

Original Research Paper

Wi-Fi Network Quality Assessment Towards a Smart University: A Case Study of Maharakham University

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Abstract: A Smart University serves as a crucial component in enabling the implementation of intelligent systems and driving innovation. Many international universities have taken the lead in initiating Smart University projects to align with the ever-changing educational landscape. Thailand is actively dedicated to pursuing a transformative agenda that is consistent with the 20-year national strategy (2018-2037) with the aim of promoting sustainable development. This study aims to examine the performance of the Wi-Fi network at Maharakham University in Thailand, with the objective of identifying factors that influence the delivery of network services, user satisfaction and network coverage. The findings will provide valuable information to enhance the system. The study focuses on assessing user behaviors related to network usage and evaluating user satisfaction across three dimensions. Wi-Fi network service, security system and service venue/facilities. In addition, the NetSpot software tool is used to measure the extent of Wi-Fi signal coverage. The research seeks to evaluate the effectiveness of the university's Wi-Fi network in supporting the transition towards a Smart University. The study's target population consists of students, professors and staff members at Maharakham University during the academic year 2022, which is a total of 45,426 individuals. The findings will provide valuable guidance to university management, enabling them to plan, analyze and design an efficient and effective smart IT infrastructure to facilitate the development of students, faculty and university staff toward a Smart University.

Keywords: Wi-Fi Signal, Smart University, Smart City, Quality Assessment, Network Quality

Introduction

In today's technologically advanced world, the concept of a Smart University and smart city has gained significant attention. A Smart University refers to an educational institution that integrates cutting-edge technology to improve teaching and learning experiences, while a smart city is an urban area that employs technology to improve the quality of life of its residents (Janpla and Nilsook, 2019; Imbar *et al.*, 2020). Both concepts share a common goal of using technology to create more efficient and sustainable environments. The smart city objective is to reduce the costs and use of resources for the municipality and its residents. This initiative highlights the importance of effective design principles and active participation of

businesses and the community in urban development (Albino *et al.*, 2015).

A smart city integrates transportation, energy, healthcare, public safety and governance systems to create a connected urban environment. A Smart University serves as a supportive component in this context, enabling the implementation of intelligent systems and fostering innovation. It uses advanced technologies, data analytics and connectivity on campus to improve efficiency, sustainability and innovation (Dong *et al.*, 2020; Rico-Bautista, 2019). Several international universities have initiated Smart University projects to align with the current educational landscape in Europe, particularly in the European Higher Education Area (EHEA). An example is the smart CEI moncloa project at the Moncloa campus of International Excellence in Spain, led by the

Universidad Politécnica de Madrid (UPM). This initiative uses IoT technology to monitor human movement and environmental conditions on campus. Using USB Wi-Fi devices in receiver mode, the project accurately tracks people by detecting connected devices via Wi-Fi, facilitating an efficient count of people at different locations. The resulting population density data can be easily accessed through a dedicated application (Alvarez-Campana *et al.*, 2017).

Thailand's 20-Year National Strategy (2018-2037) aims for sustainable development and good governance, with digital technology playing a crucial role. The education sector must adapt and strategically plan to effectively utilize digital technologies, including wireless internet connectivity (Wi-Fi) and integrated systems for smart universities. The objective is to create an inclusive environment that enhances the development of educational institutions. Smart universities can improve the quality of life of faculty, staff and students (Janpla and Nilsook, 2019).

In Thailand, universities are preparing to become smart universities in alignment with the national strategy. For example, Phranakhon Si Ayutthaya Rajabhat University has a comprehensive Smart University plan for 2020-2022 to drive technological advancements, particularly in information technology (Smart University, 2020). Mae Fah Luang University has strengthened its technological infrastructure to become a Smart University through partnerships with private entities. This includes integrating a digital lifestyle, improving wired and wireless networks and prioritizing cybersecurity measures for a secure cyber environment (TechTalkThai, 2023). Thammasat University is dedicated to becoming a sustainable Smart University by promoting energy reduction, alternative energy sources and environmental initiatives. This includes implementing projects such as smart energy, smart transportation and smart waste management, along with a strong commitment to reducing plastic usage (Thammasat, 2019).

Wi-Fi networks in universities offer seamless Internet access, benefiting students, faculty and staff. Fast and stable connectivity supports online learning platforms and instructional materials, expanding university services. For more than two decades, the efficiency of the Wi-Fi network has been extensively researched. Khattab (2000) undertook a research investigation concerning the efficiency analysis of Wireless Local Area Networks (WLANs), aiming to enhance the network's agility. The study provides a comprehensive examination of WLAN technologies, focusing on access control management with the

CSMA/CA protocol. It introduces the Single-Station Superposition (SSS) technique to address identified challenges and improve performance evaluation. Ibrahim and Bilal (2014) evaluated the performance of the Wi-Fi network using MATLAB simulink software, analyzing the Packet Error Rate (PER) and Signal to Noise Ratio (SNR) parameters. Frequency dropout had no impact, but AWGN and flat fading affected performance. Future research should focus on mitigating degradation and optimizing Quality of Service (QoS) in Wi-Fi networks. Junyaem (2016) evaluated the quality of the wireless network at King Mongkut's University of Technology North Bangkok. The study analyzed performance aspects and established an evaluation framework. The results showed smartphones as the primary user device, with average connection durations of 1-3 h per session. Network satisfaction was moderate. Plainbangyang (2017) evaluated the provision of information system service at Rajamangala University of Technology Rattanakosin. The study involved 232 participants from the Salaya campus, revealing a moderate overall quality of service. It identified a significant relationship between electronic service quality, acceptance of electronic service and effectiveness. The challenges included internet connectivity, virus protection and staffing. In a study by Xu *et al.* (2019), an examination of Smart University technologies was conducted in the context of a 5G network in order to mitigate data traffic on the smart campus network platform. In a study by Kaljahi (2021), the assessment of the performance of the Wi-Fi network was carried out under conditions of overlapping networks and interference. Throughput was measured with two co-channel networks operating simultaneously, causing congestion and interference. A standalone network was used for comparison. The results highlighted increased interference and congestion due to the number of active devices and the selection of random channels.

Maharakham University, Thailand, has developed a five-year digital development plan (2022-2026) to guide its transformation into a Smart University, focusing on the integration of digital technologies for increased efficiency. This study investigates the performance of the Maharakham University Wi-Fi network, focusing on factors that influence the delivery of network services, user satisfaction and network coverage. The findings will provide information on system enhancements in this context. The study aims to provide insights and recommendations for optimizing network service delivery and advancing the university's progression toward a Smart University. This study focuses on three main perspectives, as follows.

First, our focus is on studying user behaviors with respect to their use of the network. This involves examining factors such as the objectives of using Wi-Fi network services, the average daily and weekly frequency of using the Wi-Fi network system, the regular time periods when the service is used, the locations where the Wi-Fi network service is regularly accessed and the devices used for Wi-Fi network connectivity.

Second, we assess user satisfaction with network service considering three dimensions: The aspect of Wi-Fi network service, the aspect of the security system and the aspect of service locations and convenience amenities.

Third, the extent of coverage of the Wi-Fi signal is evaluated using the NetSpot software tool. Specifically, the Wi-Fi site survey is used to evaluate the efficiency of network service provision.

Theoretical Framework and Related Concepts

This section presents a comprehensive exploration of the theoretical foundations related to university network systems, Wi-Fi signal quality assessment and the concept of smart cities.

The Wi-Fi Network System in the Context of Maharakham University

Maharakham University (MSU) is actively upgrading its service-orientated facilities to align with the rapid advancement of digital technologies. This includes ensuring compatibility with the evolving technological landscape and embracing influential technologies such as 5G and the Internet of Things (IoT). These efforts are aimed at driving the university's missions while effectively implementing transformative technologies. MSU has the distinction of being the second oldest higher education institution and the fourth university in the northeastern region of Thailand. Its origins can be traced back to its establishment as the college of education on 27 March 1968. Subsequently, it achieved a higher status as Srinakharinwirot University, Maharakham campus, on 29 June 1974. Eventually, it gained autonomy as an independent university, assuming the name Maharakham University, on December 9, 1994. MSU offers wireless computer network services called MSU-Wi-Fi, providing convenient connectivity to the university network for students and faculty. The SSID @MSU-Net Plus and @eduroam allow seamless connections for laptops, tablets and smart devices. With 919 strategically deployed access points, the University computer center ensures comprehensive campus-wide coverage while managing the network effectively.

The MSU-Net at MSU caters to a significant number of devices, with a capacity of approximately 18000-20000.

This comprehensive system allows simultaneous access to wired and wireless networks. With a maximum traffic capacity of around 4.5 Gbps, the network maintains an average utilization rate of 70%, accommodating 12500-14000 concurrent users. In particular, most of the traffic and concurrent usage can be attributed to MSU Wi-Fi users. An analysis based on a previous study (Maharakham University's Digital Development Plan to Become a Smart University, 2022), highlights the top five units with the highest traffic utilization at the university. Maharakham Business School (MBS) exhibits the highest average peak traffic, ranging from 1.2-1.8 Gbps, followed closely by the faculty of informatics with an average peak traffic range of 700-1.2 Gbps. Suddhavej hospital (faculty of medicine, MSU) experiences an average peak traffic range of 500-700 Mbps, while the faculty of education and the Maharakham university demonstration school (secondary section) record average peak traffic ranging from 300-500 Mbps.

Wireless Local Area Network (WLAN)

A wireless local area network, known as Wi-Fi, represents a wireless network technology that influences the evolution of concepts and management approaches in organizational computer network infrastructures. It does not aim to substitute wired networks, but rather serves as an extension to wired networks. The wireless LAN offers the ability to expand network connectivity wirelessly, making it valuable in situations where physical cable installations pose geographical challenges or where temporary network setups are needed for rapid deployment, such as exhibitions, conferences and academic seminars. Wireless LAN presents advantages in terms of convenience and rapid deployment. Various standards exist for wireless LAN devices, including HIPERLAN established by the European Telecommunications Standards Institute (ETSI), Wireless Asynchronous Transfer Mode (ATM) introduced by the ATM forum and the widely recognized IEEE 802.11 standard developed by the Institute of Electrical and Electronics Engineers (IEEE), commonly known as Wi-Fi, which has garnered extensive global adoption.

The Quality of Wi-Fi Signal Compared to Signal Strength

In wireless communication systems, the Received Signal Strength Indicator (RSSI) is used to measure the strength or detectability of the received signal. It is typically expressed in decibel-milliwatt (dBm), which represents the signal power relative to a reference power of 1 milliwatt (*mW*). The formula for calculating dBm is as follows.

dBm is an electrical power unit in decibels, (dB) referenced to 1 milliwatt (mW). The power in decibel-milliwatts P_{dBm} is equal to 10 times base 10 logarithm of the power in milliwatts P_{mW} and can be obtained by:

$$P_{(dBm)} = 10 \cdot \log_{10} \left(\frac{P_{(mW)}}{1 \text{ mW}} \right) \quad (1)$$

where, the power in milliwatts P_{mW} is equal to 1 mW multiplied by 10 raised by the power in decibel-milliwatts P_{dBm} and divided by 10. This can be calculated by:

$$P_{(mW)} = 1 \text{ mW} \cdot 10^{\left(\frac{P_{(dBm)}}{10} \right)} \quad (2)$$

where, 1 milliwatt is equal to 0 dBm and the relationship can be stated as follows: $1mW = 0 \text{ dBm}$. Consequently, 1 watt is equal to 30 dBm , or $1 \text{ W} = 1000 \text{ mW} = 30 \text{ dBm}$.

Converting dBm to milliwatts is crucial for signal analysis. Signal strengths below 65 dBm are considered weak, indicating a significant distance from the Access Point (AP). Although it may still be possible to connect to the AP, the connection is likely to be slow and unstable. Details on signal levels are presented in Table 1.

Concepts and Theoretical Perspectives on Smart University

A smart city is a city that uses technology and data to improve the quality of life of its citizens. Integrates various systems and services to optimize operations, improve sustainability and improve the overall efficiency of the city. Some common features of a smart city include smart transportation, smart mobility, smart living and smart governance (Fiske, 2020).

A Smart University, on the other hand, uses technology and data to enhance the learning experience for students and improve the overall efficiency of the institution. It involves the integration of various digital tools and platforms to support teaching, learning, research and administrative processes.

Smart University

During the past two decades, previous studies have offered comprehensive definitions of the Smart University concept Bueno-Delgado *et al.* (2012) defined a Smart University as an institution that establishes a technologically advanced environment where students, instructors, staff and university resources harmoniously interact. This interaction is facilitated within a ubiquitous computing environment, indicating the integration of cutting-edge technologies throughout the entire campus. The objective of a Smart University is to enhance convenience and accessibility for all stakeholders by leveraging state-of-the-art technological advancements in various university spaces.

Table 1: The quality of Wi-Fi signal in comparison to signal strength

Power (dBm)	Power (mW)	Quality
-30	0.001	Very strong
-40	0.0001	
-50	0.00001	
-60	0.000001	Strong
-70	0.0000001	Fair
-80	0.00000001	Weak
-95	Noise floor	Very weak

Coccoli *et al.* (2014) define a Smart University as a platform that collects and disseminates crucial data to enhance the teaching and learning environment. This is achieved through the retrieval of sensor data, the integration with open data and the utilization of formal instruction knowledge. Although technology plays a crucial role in enabling a Smart University, other variables such as legal and policy changes, economic and market analysis, social issues and emerging technologies also influence learning patterns. The learning environment involves fostering learner-instructor relationships, reducing classroom lecture time and promoting self-directed learning through Internet resources. Social networks are increasingly used for collaborative learning and work. A Smart University requires diverse services that continuously transform the learning environment, leveraging the technologies and services of the internet.

Zainuddin (2017) defines a Smart University as an advancement of digital universities, enhancing the educational environment for teachers and students. It uses advanced Information and Communication Technology (ICT) to enhance education, research and curriculum design, promoting organizational growth and innovation. A Smart University prioritizes stability, environmental friendliness and energy conservation. It involves the extensive use of intelligent devices, collaborative spaces and service centers that provide access to diverse resources. Smart universities promote community integration, blending physical and digital spaces. This requires the establishment of a large-scale data network framework and the implementation of intelligent solutions to address web-related challenges and support application systems.

Hamza *et al.* (2022) present the Software Engineering Competence Centre (SECC) vision for smart universities. The authors outline the proposed capabilities that constitute the Smart University vision, as well as the suggested reference architecture. The Smart Universities Reference Architecture (SURA) aims to serve as a roadmap for digitally transforming universities in Egypt, but its principles can be applied to any university worldwide. The authors define six

dimensions that serve as the main pillars for universities to qualify as "Smart Universities." These dimensions encompass various aspects that contribute to the overall transformation and effectiveness of the institution. By focusing on these dimensions, universities can enhance their operations, improve student experiences and adapt to the ever-evolving digital landscape.

In summary, a Smart University undergoes a technological transformation, evolving from electronic or digital universities into intelligent institutions. This transformation involves integrating advanced technologies to improve the educational environment for faculty and students. It involves the convergence of university administration, management and lifestyle, which requires high-speed Internet services and connectivity. Smart universities take advantage of intelligent devices, collaborative spaces, service centers and supportive applications to efficiently manage and use resources.

Materials and Methods

This section provides an overview of the conceptual framework, assumptions, performance measurement tools and software tools used in this study, which will be described in detail in the following.

Conceptual Framework

In this study, the conceptual framework is divided into three parts. The first part focuses on studying user behaviors related to network usage. It applies the concept of internet usage behavior and includes factors such as (1) Objectives of Wi-Fi network service usage, (2) Average frequency of Wi-Fi network system usage per day, (3) Average frequency of Wi-Fi network system usage per week, (4) Regular service usage time period, (5) Regularly utilized Wi-Fi network service locations and (6) Devices for Wi-Fi network connectivity.

The second part examines user satisfaction with the network service, considering three dimensions: (1) Wi-Fi network service aspect, (2) Security system aspect and (3) Service locations/convenience amenities aspect.

In the third part, the NetSpot software tool is used to measure the coverage of the Wi-Fi signal. Specifically, Wi-Fi is the wireless network.

The NetSpot Wi-Fi site survey software is used to assess the effectiveness of network service provision. Due to the limitations of the paper, the study focusses on three faculties: Humanities and social sciences, public health and tahe faculty of architecture, urban design and creative arts. Each faculty area is examined separately, with software assisting in evaluating the strength of the Wi-Fi signal.

By incorporating these three components, the research establishes a comprehensive framework to analyze user behavior, satisfaction and network performance within the context of the provided network services. The conceptual framework of the research can be illustrated in Fig. 1.

Hypothesis Development

User satisfaction plays a vital role in service delivery efficiency. It can be categorized into two types. First, there is satisfaction expressed through positive emotions and feelings towards a specific entity, influenced by perceptions of service types, quality and experiences. When these align with expectations and desired outcomes, it generates positive emotions and satisfaction. Second, satisfaction arises from the evaluation of the disparities between the expected and received outcomes in a service context. Pre-service knowledge and expectations significantly influence perception and when received service meets expected outcomes, it confirms accuracy, leading to user satisfaction (Rujiworachot, 2020; Wimolmuang, 2019). In this study, a study on satisfaction with the use of Wi-Fi network services, which are associated with user behaviors, focused on three main aspects: The Wi-Fi network service aspect, the security system aspect and the service venue/facilities aspect. Therefore, the associations hypothesized in this study are as follows.

Hypothesis 1: There is a relationship between the users' network usage behavior and their satisfaction with university Wi-Fi services (Wi-Fi network service aspect).

Hypothesis 2: There is a relationship between the users' network usage behavior and their satisfaction with university Wi-Fi services (security system aspect).

Hypothesis 3: There is a relationship between users' network usage behavior and their satisfaction with university Wi-Fi services (service venue/facilities aspect).

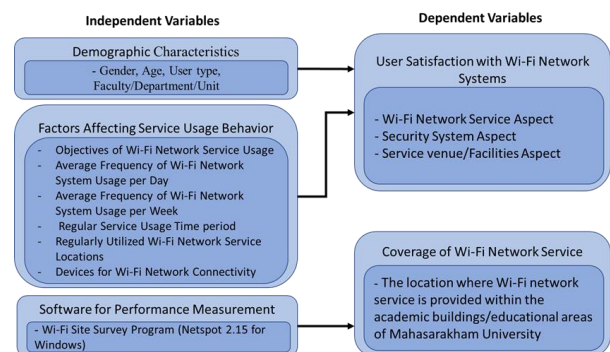


Fig. 1: The conceptual framework

This study is based on three assumptions, each consisting of six sub-perspectives, in order to address the question of user satisfaction. By analyzing these three assumptions and their corresponding sub- perspectives, this study aims to provide a comprehensive understanding of user satisfaction. The findings of this study contributed to the existing body of knowledge in the field and provided valuable insights for businesses and organizations seeking to improve user satisfaction.

Sample Selection and Data Collection Procedure

The population for this study comprises students, professors and staff members at MSU during the academic year 2022, totaling 45,426 individuals (Number of Students of Maharakham University, 2022). The sample size estimation in this study adheres to the widely accepted approach proposed by Krejcie and Morgan (1970). The method of Krejcie and Morgan offers a formula for determining the suitable sample size:

$$s = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)} \quad (3)$$

where, s represents the required sample size, X^2 is the Chi-square table value for one degree of freedom at the desired confidence level, N stands for the population size, P denotes the assumed population proportion of 0.50 and d represents the degree of precision expressed as 0.05.

Consequently, an appropriate sample size is 1,050 under the 95% confidentiality rule. The researcher has sought the cooperation of the computer center, the main unit responsible for providing computer and network services at MSU, to collect data through questionnaires. The questionnaire was attached as a google form link, accompanied by an authentication system to access the university's internet. Therefore, the questionnaire surveys were directly seen by the sample prospects, who are the key informants. Data were collected from December 2022 to February 2023. A collection of 6,558 responses was received. Since the university's authentication system to access university internet services requires all users to complete a questionnaire before proceeding with the identity verification process, it can be argued that all responses were obtained from completed questionnaires and are usable for further analysis. Therefore, it can be stated that the effective response rate was approximately 100%.

Software and Statistical Analysis

In this section, this study will discuss the software and statistics used in the research. The details are as follows.

The Wi-Fi Site Survey Software

The technical effectiveness assessment examines the service coverage and distribution of Wi-Fi network

systems at MSU by observing the signal propagation of Access Point (AP) devices. Due to limitations, the study focusses on three faculties: Humanities and social sciences, public health and the faculty of architecture, urban design and creative arts, based on the behavior of a large number of Wi-Fi network users.

For this study, NetSpot Wi-Fi site survey software was used to collect data on the university's Wi-Fi service. Developed by Etwok, LLC, NetSpot generates accurate and visually appealing coverage maps of Wi-Fi signals. Provides information on signal names, router details and signal quality levels. The software helps plan the network infrastructure, determine the location of the signal and analyze the precise strength of the signal. It includes features to upload floor plans, perform Wi-Fi signal searches and speed and signal strength performance tests.

Statistical Methods

The statistics used in this study include inferential statistics, descriptive statistics, percentage distribution and nonparametric statistics. In addition, statistics are used to assess the quality of research tools.

Assessment of the Tool's Reliability

Cronbach's alpha is a measure of internal consistency, indicating the degree of relationship among a group of items. It can be expressed as a function of the number of test items and the average intercorrelation among the items, as shown below:

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N - 1)\bar{c}} \quad (4)$$

where, N is equal to the number of items, \bar{c} is \bar{v} the average inter-item covariance among the items and equals the average variance.

Test for Independence Chi-Square

The test statistic for the chi-square test of Independence is denoted X^2 and is computed as:

$$X^2 = \sum_{i=1}^R \sum_{j=1}^C \frac{(o_{ij} - e_{ij})^2}{e_{ij}} \quad (5)$$

where, o_{ij} is the observed cell count in the i^{th} row and j^{th} column of the table. e_{ij} is the expected cell count in i^{th} row and j^{th} column of the table, computed as:

$$e_{ij} = \frac{\text{row } i \text{ total} \times \text{col } j \text{ total}}{\text{grand total}} \quad (6)$$

The quantity $(o_{ij} - e_{ij})$ is often referred to as the residual of cell (i, j) , denoted as r_{ji} . To determine the significance

of the observed data, the calculated X^2 The value is compared to the critical value obtained from the X^2 distribution table. The degrees of freedom (df) are calculated as $df = (R-1) (C-1)$ where R represents the number of rows and C represents the number of columns in the data table. The choice of confidence level is also taken into consideration. If the calculated X^2 value exceeds the critical X^2 Value, the study rejects the null hypothesis.

Results

In this section, the authors present and test hypotheses and provide an explanation of the survey results obtained from the site survey. The results of the analysis are presented as follows.

Statistical Analysis

Data are collected from a questionnaire, with responses obtained from 1,050 participants from a total of 6,588 participants, which is selected based on the method of Krejcie and Morgan (1970) as mentioned above.

Reliability and Validity

In this study, a questionnaire was used for data collection. The questionnaire was content validated by three experts to ensure its relevance and precision. The objective congruence index of items (IOC) serves as a measure of validity, indicating the extent to which the items accurately reflect the intended construct. In this study, IOC values ranging from 0.95-1.00 were calculated, suggesting a high level of validity. To further evaluate the reliability of the questionnaire. A pilot study was conducted with 30 participants and the study selected 1,050 participants to test the three main aspects of the hypotheses. This large sample size increased the generalizability and statistical power of the study. This allows clearer conclusions to be drawn.

Cronbach's alpha was used to test the reliability of the measurement, while the coefficient alpha indicates the degree of internal consistency between items that should be greater than 0.70 (Hair *et al.*, 2010). Cronbach's alpha coefficients were measured at 0.831, which exceeds 0.70 to indicate that the construct validity is present.

Overview of Survey Respondents

In this section, the authors collected general information about the survey respondents, including gender, age and user category, as shown in Table 2.

The analysis of Table 2 reveals that the majority of the survey respondents were female (67.8%), while males (32.2%). Regarding age, the largest proportion fell within the 21-30 age range (32.8%), followed by 41-50 years (30.5%). In terms of user category, the respondents were predominantly students (38.1%), followed by personnel (33.3%) and lecturers (28.6%).

Table 2: Comprehensive overview of survey respondents' characteristics and demographics

		Frequency	Percent (%)
Gender	Male	338	32.2
	Female	712	67.8
	Total	1050	100.0
Age	under 20 years old	139	13.2
	21-30 years old	344	32.8
	31-40 years old	196	18.7
	41-50 years	320	30.5
	51-60 years old	45	4.3
	60 years or older	6	0.6
Total		1050	100.0
User type	Student	400	38.1
	Lecturer	300	28.6
	Personnel	350	33.3
	Total	1050	100.0

Table 3: Relationship between independent variables and dependent variables

Demographic characteristics	χ^2	p-value
N_V1(Gender)	6.338	0.175
N_V1(Gender)	6.686	0.154
N_V1(Gender)	3.427	0.489
N_V1(Age)	64.046	0.000***
N_V2(Age)	44.157	0.001***
N_V3(Age)	44.612	0.001***
N_V1(User type)	67.077	0.000***
N_V2(User type)	53.698	0.000***
N_V3(User TYPE)	36.238	0.000***
N_V1(Faculty)	117.335	0.346
N_V2(Faculty)	148.424	0.012**
N_V3(Faculty)	108.683	0.571

*** p<0.01, ** p<0.05, * p<0.10

The Relationship Between Variables

In this section, the relationship between independent variables, demographic characteristics and dependent variables was analyzed, namely user satisfaction in three aspects: Wi-Fi network service aspect, security system aspect and service venue/facilities aspect. The statistical analysis was carried out using the chi-square test, as presented in Table 3, where χ^2 represents the chi-square value, the p-value indicates statistical significance, N_V1 represents the satisfaction of the user with the aspect of the Wi-Fi network service, N_V2 represents the satisfaction of the user with the aspect of the security system and N_V3 represents the satisfaction of the user with the aspect of the venue / facilities of the service.

Table 3, the chi-square test analysis revealed that gender was not significantly associated with user satisfaction in all three aspects. However, age demonstrated a significant relationship with user satisfaction in all aspects (p<0.01). The user category also

showed a significant relationship with user satisfaction in all aspects ($p < 0.01$). faculty/department/unit exhibited a significant relationship only with satisfaction with respect to the security system aspect ($p < 0.05$). No statistically significant relationship was found for the remaining aspects (N_V1 and N_V3).

Results of Hypothesis Testing

In this study, three main aspects were considered: The Wi-Fi network service aspect, the security system aspect and the service venue/facilities aspect. Hypotheses were formulated to explore the associations between these aspects and user satisfaction. The results of hypothesis testing are revealed as follows.

Hypothesis 1: There is a relationship between the users' network usage behavior and their satisfaction with university Wi-Fi services (Wi-Fi network service aspect). This hypothesis consists of six aspects as follows:

- H₁ : The objectives of Wi-Fi network service usage are not associated with user satisfaction in the Wi-Fi network service aspect
- H₂ : The average frequency of Wi-Fi network system usage per day is not associated with user satisfaction in the Wi-Fi network service aspect
- H₃ : The average frequency of Wi-Fi network system usage per week is correlated with user satisfaction in the Wi-Fi network service aspect
- H₄ : The period of regular service usage time is correlated with user satisfaction in the aspect of Wi-Fi network service
- H₅ : Regularly used Wi-Fi network service locations are correlated with user satisfaction in the Wi-Fi network service aspect
- H₆ : Devices for Wi-Fi network connectivity is correlated with user satisfaction in the Wi-Fi network service aspect

Hypothesis 2: There is a relationship between users' network usage behavior and their satisfaction with university Wi-Fi services (security system aspect). This hypothesis consists of six aspects as follows:

- H₇ : The objectives of Wi-Fi network service usage are not associated with user satisfaction in the security system aspect
- H₈ : The average frequency of Wi-Fi network system usage per day is not associated with user satisfaction in the security system aspect
- H₉ : The average frequency of Wi-Fi network system usage per week is correlated with user satisfaction in the security system aspect
- H₁₀ : The period of regular service usage time is correlated with user satisfaction in the aspect of the security system

- H₁₁ : Regularly used Wi-Fi network service locations are correlated with user satisfaction in the security system aspect
- H₁₂ : Devices for Wi-Fi network connectivity is correlated with user satisfaction in the security system aspect

Hypothesis 3: There is a relationship between users' network usage behavior and their satisfaction with university Wi-Fi services (service venue/facilities aspect). This hypothesis consists of six aspects as follows:

- H₁₃ : The objectives of Wi-Fi network service usage are not associated with user satisfaction in the service venue/facilities aspect
- H₁₄ : The average frequency of Wi-Fi network system usage per day is not associated with user satisfaction in the service venue/facilities aspect
- H₁₅ : The average frequency of Wi-Fi network system usage per week is correlated with user satisfaction in the service venue/facilities aspect
- H₁₆ : The period of regular service usage time is correlated with user satisfaction in the service venue/facilities aspect
- H₁₇ : Regularly used Wi-Fi network service locations are correlated with user satisfaction in the service venue/facilities aspect
- H₁₈ : Devices for Wi-Fi network connectivity is correlated with user satisfaction in the service venue/facilities aspect

Measurement of Wi-Fi Signal Coverage

In this section, a study and presentation of the measurement of the Wi-Fi signal strength was conducted using the net spot. The aim was to assess the overall effectiveness of Wi-Fi network coverage in three faculties within the university campus. Three faculties included in the study were the faculty of humanities and social sciences, the faculty of public health and the faculty of architecture, urban design and creative arts.

An example of measuring the quality of signals obtained from service points within the university campus, using different client devices, is illustrated in Fig. 2. It can be observed that the signal strength of the Wi-Fi transmitted from the SSID named '@MSU-Net' provides signals in the weak and very weak range, within the signal strength levels of -95 dBm to -80 dB.

The Results of the Faculty of the Humanities and Social Sciences Building

Based on the site survey conducted in the faculty of humanities and social sciences building, specifically on the second floor, Wi-Fi service provision and frequency band coverage were evaluated by measuring signal strength levels, expressed in dBm. The summarized data can be found in Table 4, shown in Fig. 3.

Table 4: Survey results of the number of access points in the faculty of humanities and social sciences

SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
HUSOC_1-ZONE1	C2:9F:DB:F1:BE:59	6	n	-45.7	27.30
HUSOC_1-ZONE2	C6:9F:DB:F1:BE:59	6	n	-47.3	25.70
HUSOC_1-ZONE3	CA:9F:DB:F1:BE:59	6	n	46.7	26.30
AIS SMART Login	74:3E:2B:0E:E6:69	1	ac	-49.0	11.17
.@ AIS SUPER Wi-Fi	74: 3E:2B:0E:8E:18	1	ac	-61.0	4.00
@MSU-Net via AIS	74:3E:2B:BF:6A:AC	149	ac	-77.0	2.00
@MSU-Net Plus	74:3E:2B:7F:6A:AC	149	ax	-78.0	3.00
@MSU-Net	D8:84:66:5A:67:00	100	ax	-66.7	17.70
Eduroam	74:3E:2B:CE:E6:68	1	ax	-49.7	14.18

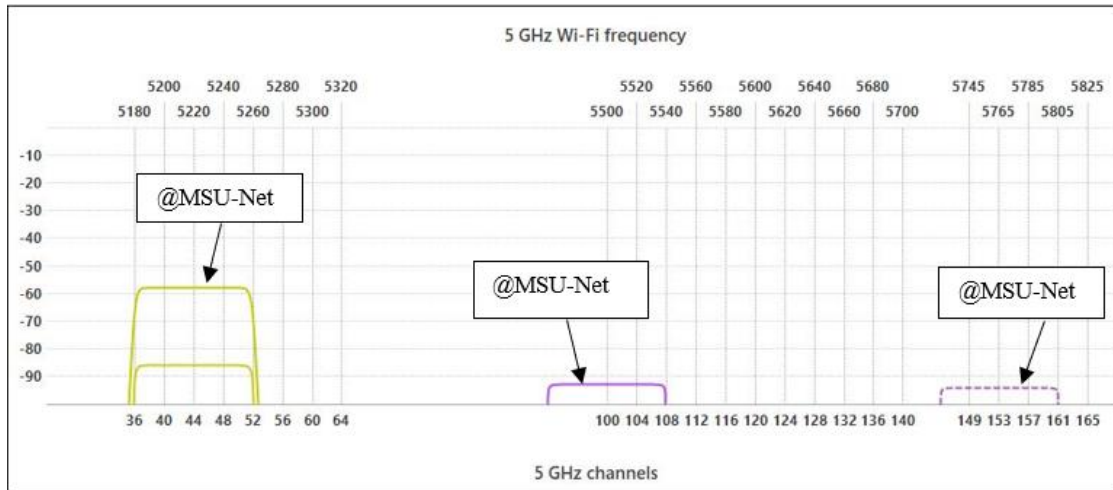
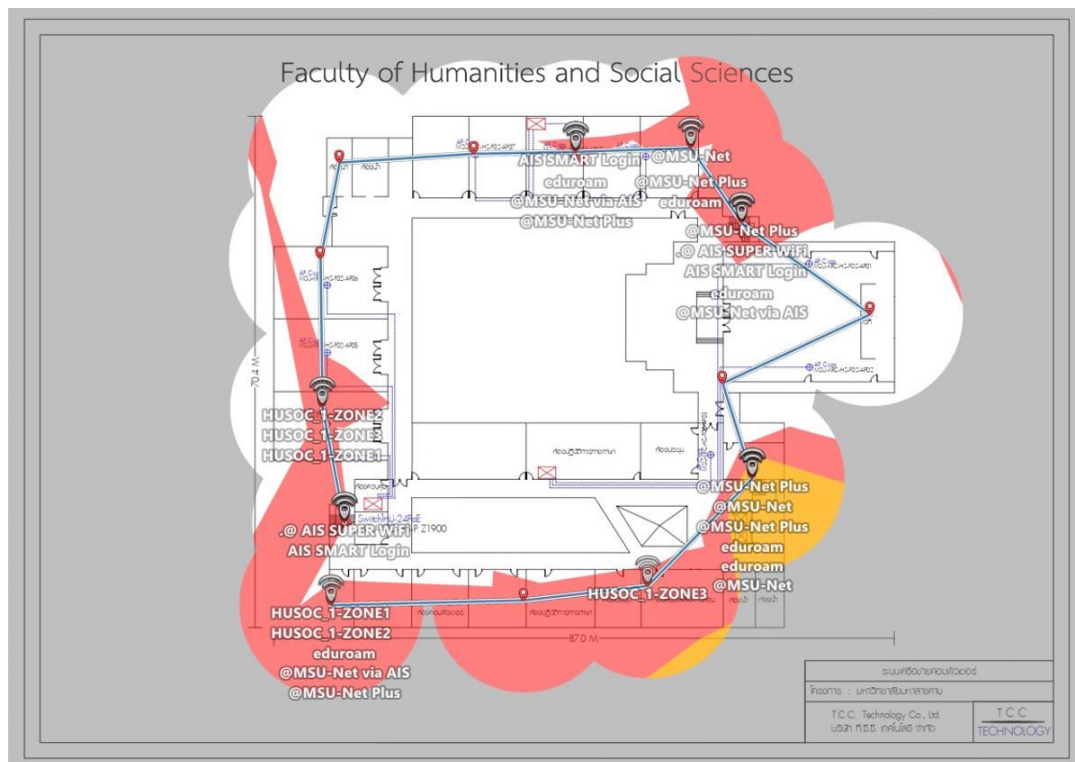
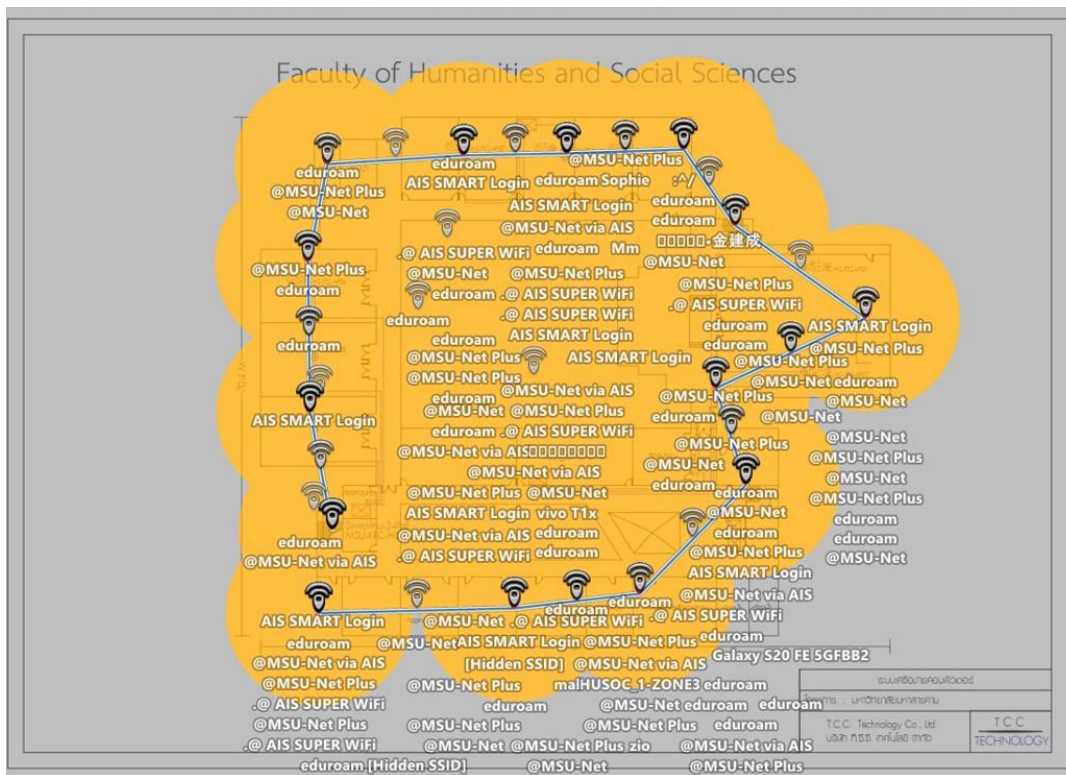


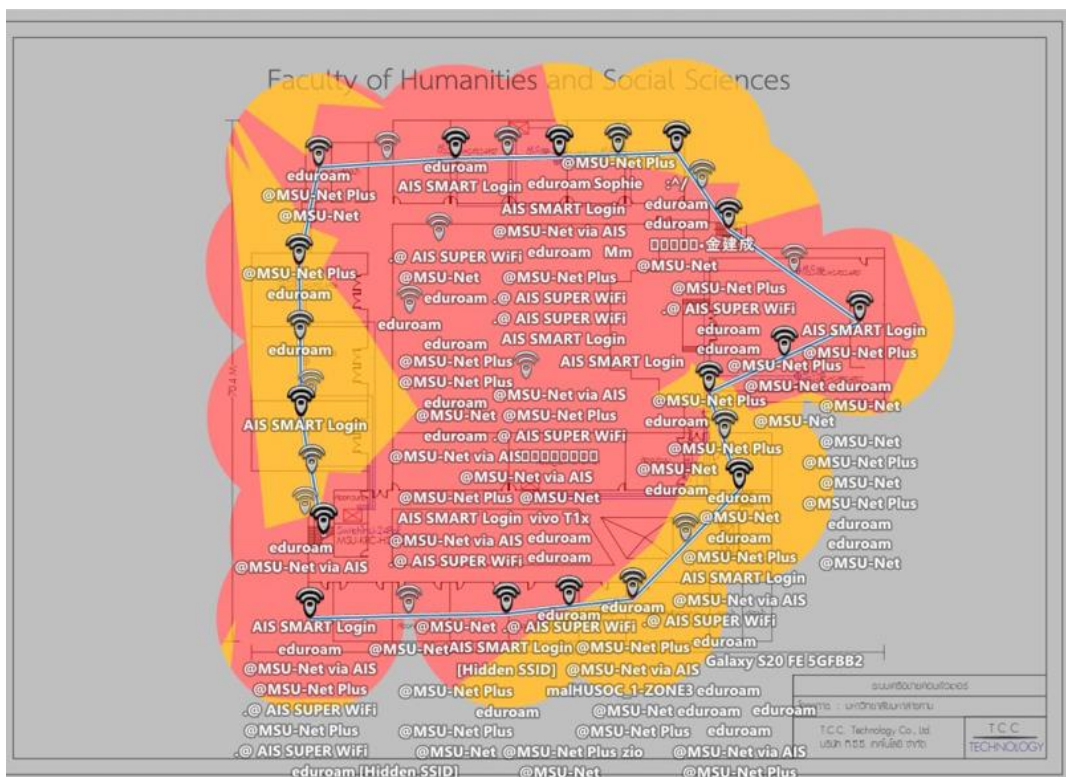
Fig. 2: Measurement of @MSU-Net SSID signal quality within the university campus



(a)



(b)



(c)

Fig. 3: Power levels decibel-milliwatts (dBm) in the faculty of humanities and social sciences; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

From Table 4 and Fig. 3, it can be observed that the Service Set Identifiers (SSIDs) named HUSOC_1-ZONE1, HUSOC_1-ZONE2, HUSOC_1-ZONE3, AIS SMART Login and eduroam are Wi-Fi names provided in the Faculty of Humanities and Social Sciences building. These Wi-Fi services are available from Access Points (APs) that provide a very strong signal strength. Additionally, there are APs that exhibit weak signal strength, such as SSIDs named @MSU-Net via AIS and @MSU-Net Plus.

The Results of the Faculty of the Public Health Building

Based on the site survey conducted at the faculty of public health, specifically on the third floor, the provision of Wi-Fi service and frequency band coverage were evaluated by measuring signal strength levels, expressed in dBm. The summarized data can be found in Table 5, shown in Fig. 4.

Table 5 and Fig. 4, it can be observed that Service Set Identifiers (SSIDs) named AP3 and AP4 are Wi-Fi names provided in the Faculty of Public Health building. These Wi-Fi services are available under

Access Points (APs) that provide a very strong signal strength. Furthermore, there are APs that exhibit weak signal strength, such as SSIDs named AP1, AP7, AP8, AP9, @PH-Wi-Fi, AIS SMART Login and @MSU-Net via AIS.

The Results of the Faculty of the Architecture, Urban Design and Creative Arts

Based on the site survey conducted at the faculty of architecture, urban design & creative arts, specifically on the third floor, the Wi-Fi service provision and frequency band coverage were evaluated by measuring the signal strength levels, expressed in dBm. The summarized data can be found in Table 6, shown in Fig. 5.

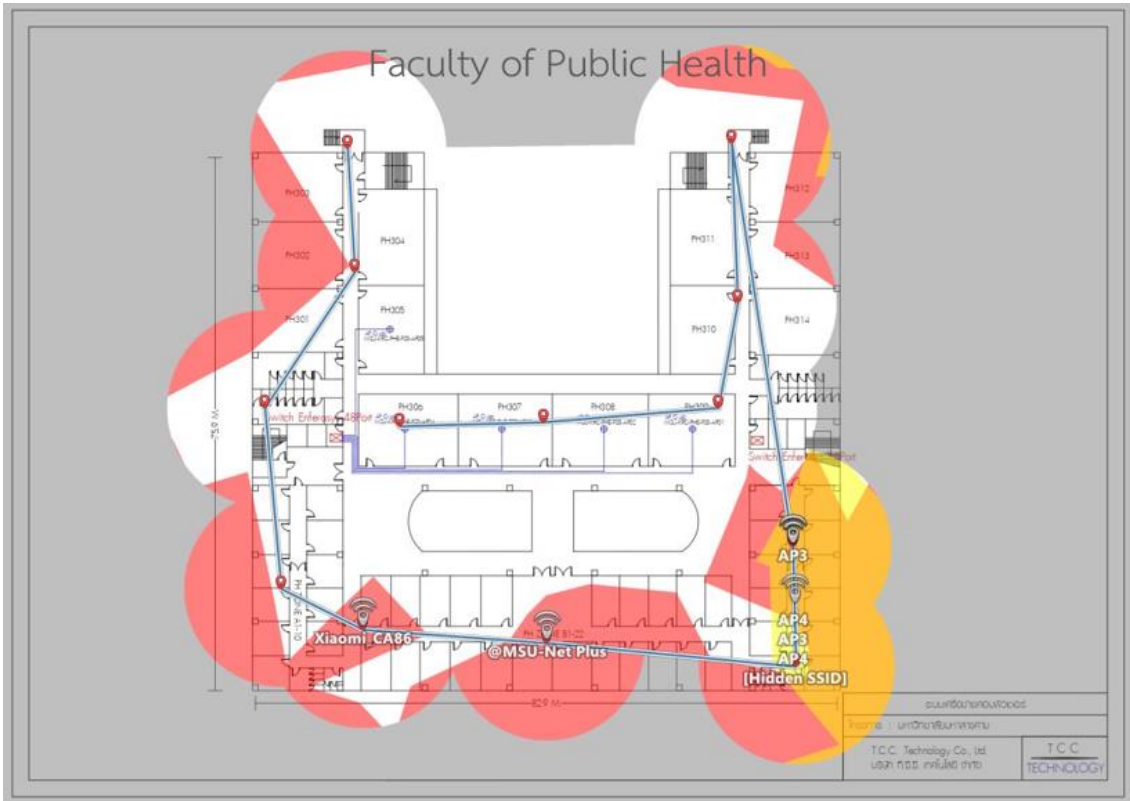
Table 6 and Fig. 5, it can be observed that the Service Set Identifier (SSID) named Edu roam is a Wi-Fi service provided in the faculty of architecture, urban design and fine arts building. This service is available under the Access Point (AP) that provides a very strong signal strength. Additionally, there are APs that exhibit weak signal strength, such as the SSID named @MSU-Net via.

Table 5: Survey results of the number of access points in the faculty of public health

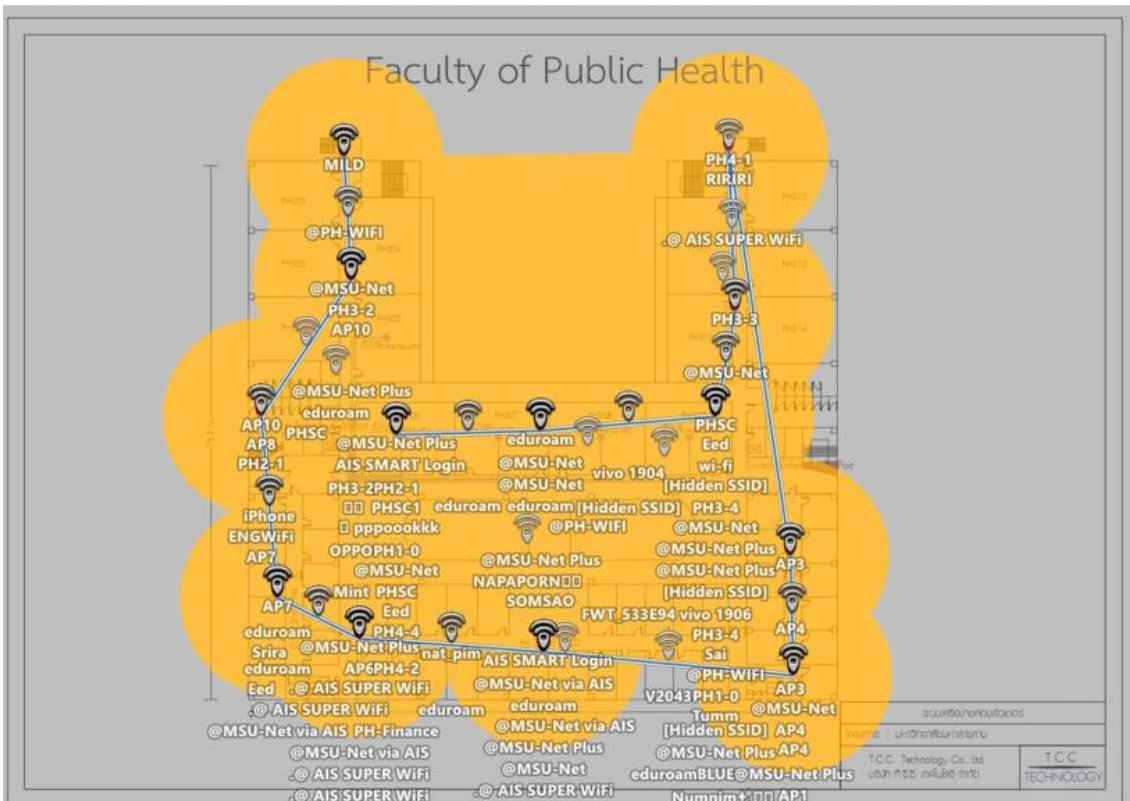
SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR (dB)
AP1	68:D7:9A:0D:1A:EA	157	ac	-77.0	9.0
AP2	68:D7:9A:0D:17:47	36	ac	-69.0	11.3
AP3	68:D7:9A:0C:17:16	1	ac	-42.3	32.7
AP4	6A:D7:9A:0D:17:16	36	ac	-44.3	44.7
A P7	68:D7:9A:0D:1B:74	149	ac	-78.0	18.0
AP8	68:D7:9A:0D:19:EC	149	ac	-75.0	9.7
AP9	68:D7:9A:0D:18:FB	149	ac	-78.7	1.3
AP10	68:D7:9A:0D:1A:A5	44	ac	-67.0	20.0
@PH-WI-FI	A8:5B:F7:8F:B8:C0	11	ax	-85.0	-3.0
AIS SMART Login	74:3E:2B:3F:0F:0D	161	ac	-73.0	13.0
.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:0C	161	ac	-70.0	18.3
@MSU-Net via AIS	74:3E:2B:BF:0F:0C	161	ac	-71.3	14.7
@MSU-Net Plus	2C:1A:05:6D:67:8D	100	ax	-65.7	22.3
@MSU-Net	D8:84:66:5A:54:B9	1	ax	-66.0	5.0
Eduroam	D8:84:66:5A:5C:FA	1	ax	-51.7	16.3

Table 6: Survey results of the number of access points in the faculty of architecture, urban design and creative arts

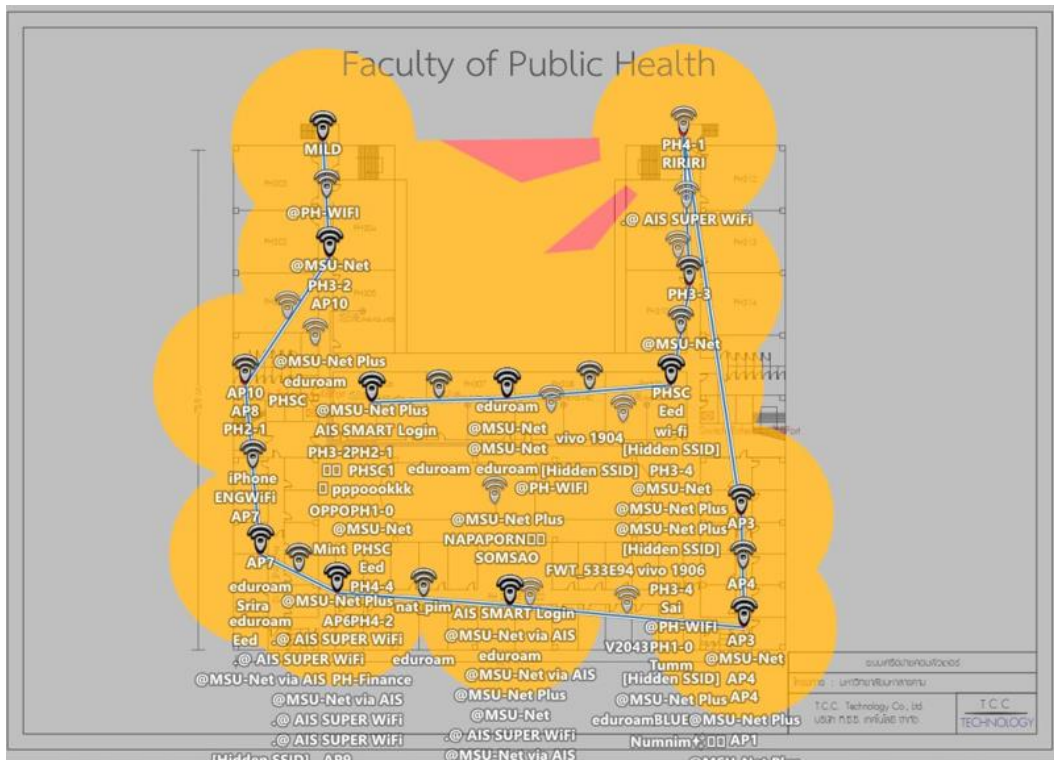
SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR (dB)
.@ AIS SUPER Wi-Fi	74:3E:2B:3E:B8:C8	11	ac	-66.0	9.7
AIS SMART Login	74:3E:2B:3E:C8:09	6	ac	-70.0	6.0
@MSU-Net via AIS	74:3E:2B:BE:C8:08	6	ac	-71.3	5.7
@MSU-Net Plus	D8:84:66:5A:59:C1	104	ax	-57.0	36.0
@MSU-Net	D8:84:66:5A:54:38	1	ax	-62.0	15.0
Eduroam	D8:84:66:5A:59:CA	1	ax	-45.7	27.7



(a)

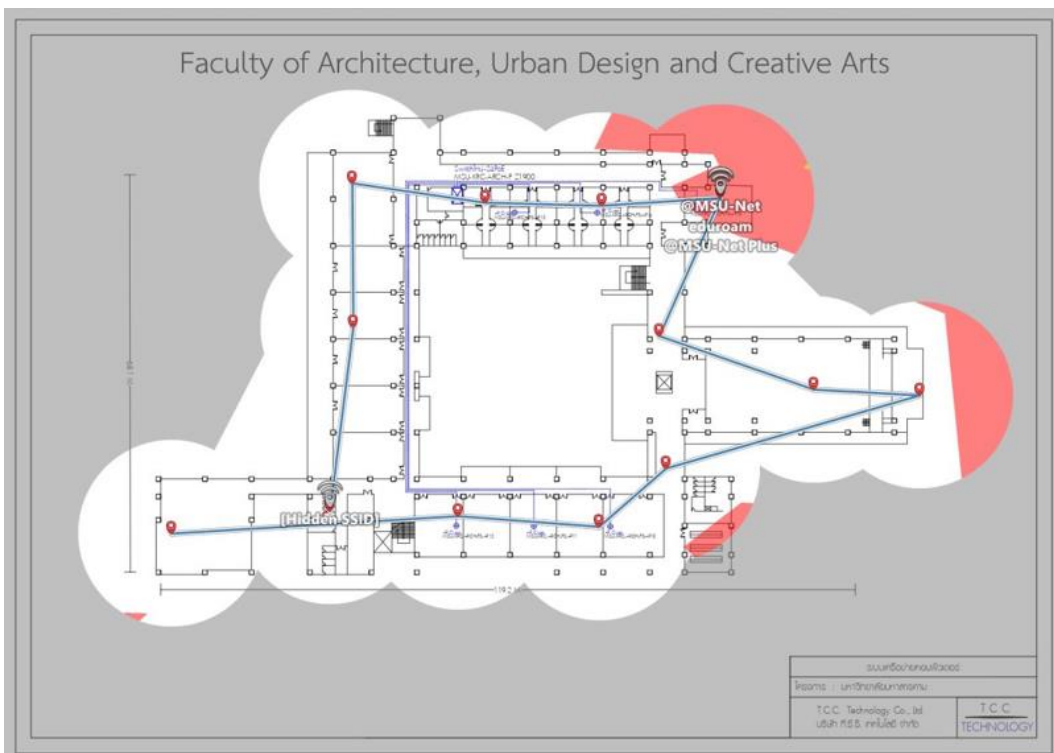


(b)

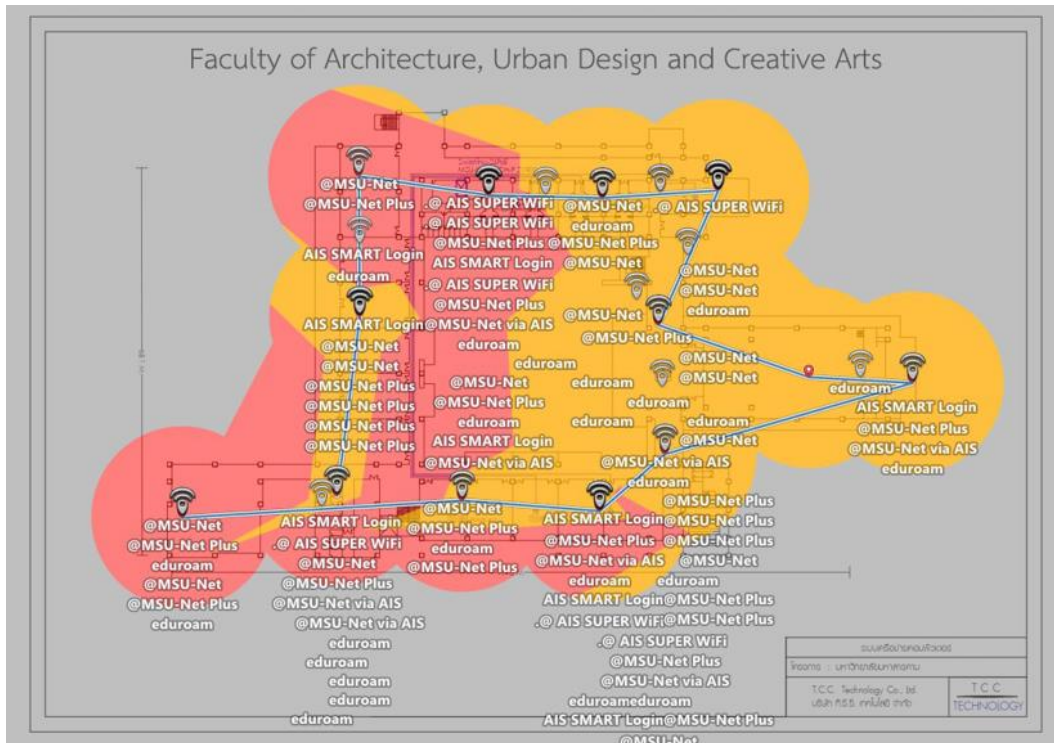


(c)

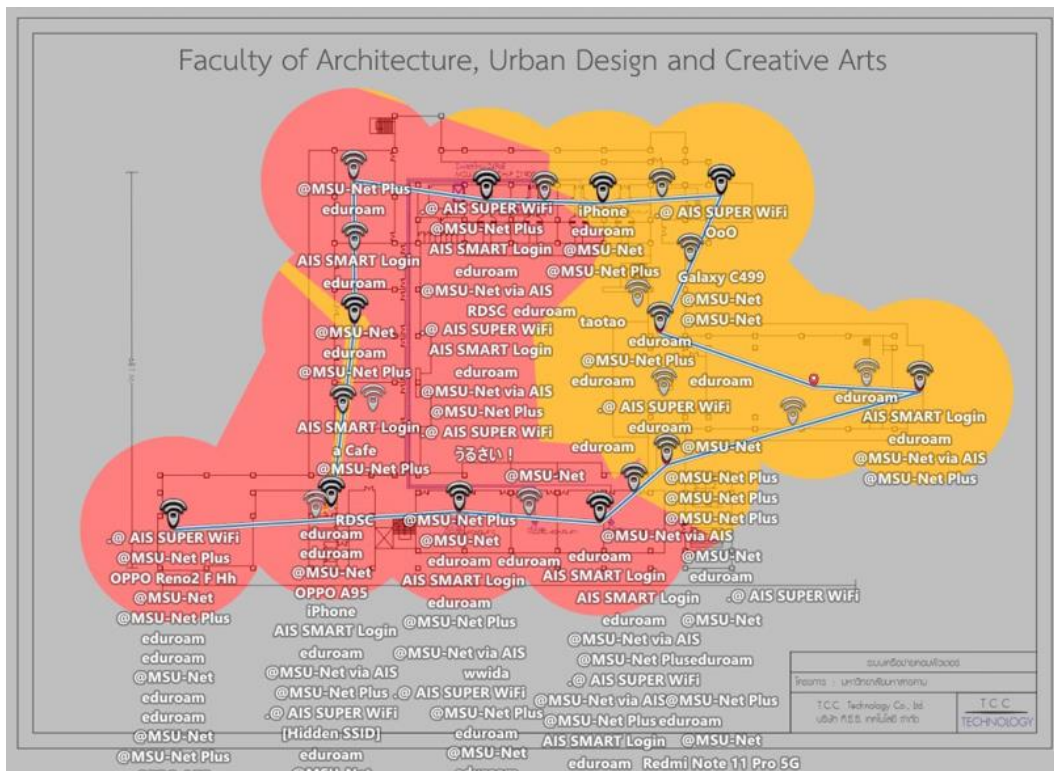
Fig. 4: Power levels decibel-milliwatts (dBm) in the faculty of public health; (a) The very strong power at -50 dBm; (b) The weak power at -80 dBm; (c) The signal quality in dBm encompassing all the measurements



(a)



(b)



(c)

Fig. 5: Power levels decibel-milliwatts (dBm) in the faculty of architecture, urban design and creative Arts (continued); (a) Very strong power at -50 dBm; (b) Weak power at -80 dBm; (c) The signal quality in dBm encompassing all the measurements

Discussion

In this section, the authors present an inclusive analysis and discussion of the research findings, along with their related aspects, as outlined below.

Quantitative Analysis of Research Results

From the questionnaire survey conducted among a sample population of 1,050 participants composed of students, faculty members and staff of Mahasarakham University, the sample population consisted of women with ages ranging from 21-30 years.

The analysis of the relationship between demographic characteristics, namely gender and user satisfaction was carried out using the chi-square test. The results indicated that gender was not significantly associated with user satisfaction in the three faculties. On the other hand, age was found to be significantly associated with user satisfaction in all three faculties. Furthermore, it was found that the type of user had a significant relationship with user satisfaction in the three faculties. Furthermore, the aspect of service venue/facilities was found to have a significant relationship with user satisfaction in terms of the aspect of security system (refer to Table S-2 in the supplementary files).

Quality Analysis of Research Findings

This study carried out the coverage of the Wi-Fi network within the university campus. There are a total of seven areas available for network access. Due to the limitations of the paper, the authors focused on three selected faculties as case studies and reported the findings (additional results from the remaining four areas can be found in the supplementary file). The efficiency of Wi-Fi network coverage was analyzed using NetSpot. The study was conducted at Mahasarakham University, specifically in the faculty of humanities and social sciences, public health, architecture, urban design and creative arts. The Wi-Fi usage survey revealed that the most commonly used SSIDs from the selected faculties were AIS SMART Login, eduroam, @ AIS SUPER Wi-Fi, @MSU-Net Plus, @ MSU-Net and MSU-Net via AIS. Further discussions of the aforementioned SSID names are presented below.

The majority of areas supported the 2.4 GHz signal, which covers a greater distance than 5 and 6 GHz. However, 2.4 GHz has fewer channels (11), limiting device connections and causing unstable connectivity, slower speeds and frequency interference. The penetration of obstacles is better with low-frequency connections. The 2.4 GHz range suffers from interference and congestion due to its popularity and dense device usage. The 5 GHz range receives signals over long distances, but with a signal quality lower than that of 2.4 GHz. Devices

using 5 GHz should be placed closer to maintain speed. With more channels (23), it supports more devices, offers faster downloads and reduces signal interference. However, obstacle penetration may be weaker and fewer devices support 5 GHz, resulting in faster data transmission.

The Wi-Fi network service coverage provided by Mahasarakham University varies in efficiency and area coverage between different faculties and departments. Due to the historical context, the network service is provided by both faculties and departments, resulting in varying numbers of Access Points (APs) depending on the budget allocation of each faculty/department. Consequently, the Wi-Fi service within the university exhibits different data transmission capabilities, directly impacting user satisfaction with inconsistent Wi-Fi service provision.

The Hypothesis Testing Analysis

Based on the research hypotheses stated earlier, the study's findings can be summarized as follows.

Hypothesis 1: There is a relationship between the users' network usage behavior and their satisfaction with university Wi-Fi services (Wi-Fi network service aspect). It was revealed that:

1. The objectives of using Wi-Fi network services and the frequency of accessing the Wi-Fi network on average per day were not correlated with satisfaction with the provision of network services
2. The frequency of accessing the Wi-Fi network on average per week, consistent time periods of accessing the service, regular locations of service usage and devices used for network connectivity were found to be associated with satisfaction with network service provision

Hypothesis 2: There is a relationship between the users' network usage behavior and their satisfaction with university Wi-Fi services (security system aspect). It was revealed that:

1. The objectives of using Wi-Fi network services, the frequency of accessing the Wi-Fi network system per day, the regular time intervals of service usage and the specific locations where Wi-Fi network services are used were not significantly correlated with satisfaction with the security system
2. However, the frequency of accessing the Wi-Fi network system per week and the devices used to connect to the Wi-Fi network showed a significant relationship with satisfaction with the security system

Hypothesis 3: There is a relationship between users' network usage behavior and their satisfaction with university Wi-Fi services (service venue/facilities aspect). It was revealed that:

1. The objectives of using Wi-Fi network services, the regular time intervals of service usage and the devices used to connect to the Wi-Fi network were not significantly correlated with satisfaction with the locations/services and amenities provided
2. However, the frequency of accessing the Wi-Fi network system per day, the frequency of accessing the Wi-Fi network system per week and the specific locations where the Wi-Fi network services are used showed a significant relationship with satisfaction with the locations/services and amenities provided

Based on the analysis of factors that influence user satisfaction, the following conclusions can be drawn.

Regarding Hypothesis 1, which states that user behavior in using Wi-Fi network services is correlated with satisfaction in using university Wi-Fi services (in terms of the aspect of Wi-Fi network service aspect), it was found that four factors (H_3 , H_4 , H_5 and H_6) significantly influence satisfaction, as discussed in the preceding subsection.

Regarding Hypothesis 2, which suggests that user behavior when using Wi-Fi network services is correlated with satisfaction when using university Wi-Fi services (in terms of security system aspect), it was found that two factors (H_9 and H_{12}) significantly impact satisfaction, as discussed in the previous subsection.

Regarding Hypothesis 3, which states that user behavior when using Wi-Fi network services is correlated with satisfaction when using university Wi-Fi services (in terms of the service venue/facilities aspect), it was found that three factors (H_{14} , H_{15} and H_{17}) significantly influence satisfaction, as previously discussed in the subsection.

Based on the results of hypothesis testing, it can be concluded that user satisfaction with the service depends on the following factors: Users who frequently use the service for five to seven days per week, primarily during daytime hours and predominantly in the area of the Mahasarakham business school. Furthermore, the use of highly efficient devices for network connectivity significantly influences user satisfaction with the efficiency of Wi-Fi service provision in the university.

Research Contributions

This study offers several potential areas of research contributions as follows. First, research can focus on

developing algorithms and techniques to optimize the allocation of network resources, such as bandwidth and computing power, to ensure smooth and efficient delivery of services within a Smart University environment. Second, with the increasing complexity and connectivity of Smart University networks, research can contribute to enhancing network security measures, preventing cyber threats and protecting user privacy. Third, smart universities heavily rely on IoT devices for various applications. Research can focus on integrating and managing these devices effectively, ensuring seamless communication, data collection and analysis. Fourth, research can address issues related to the Quality of Service (QoS) in network service delivery, aiming to provide high-speed, reliable and uninterrupted connectivity for various Smart University services, such as e-learning platforms and campus-wide communication systems. In addition, research can explore the use of data analytics techniques to analyze network traffic patterns, user behavior and resource utilization. This can help in making informed decisions regarding network optimization, capacity planning and resource allocation.

Conclusion

A smart city is characterized by the utilization of modern technologies and innovations to enhance service delivery and city management. Similarly, the concept of a Smart University involves the incorporation of advanced technologies, data analytics and connectivity within the university campus. Many universities around the world, including those in Europe, have been implementing Smart University initiatives. In recent years, universities in Thailand, such as MSU, have also begun to transition to become Smart Universities.

MSU, for example, has developed a digital development plan to transform into a Smart University in a 5-year period (2022-2026). This study focusses on the efficiency of the provision of Wi-Fi network services at MSU as a case study. The research framework consists of three main components: Studying user behavior, investigating user satisfaction and using the NetSpot software tool to measure the coverage of Wi-Fi signals.

The objective of employing the NetSpot software tool, specifically the Wi-Fi site survey, is to examine factors related to user behavior that impact the use of the Wi-Fi network service. This study aims to achieve a comprehensive understanding of the strength of the Wi-Fi signal using the aforementioned software tool.

Based on the study of factors that affect the Wi-Fi network service and the evaluation of user satisfaction, as well as the tests of the effectiveness of the Wi-Fi network service coverage provided by the university, three key factors have been identified that influence the service and user satisfaction. These factors include: (1) Factors related to the aspect of Wi-Fi network service, (2) Factors related

to maintenance of the security system and (3) Factors related to the location and amenities of the service. Furthermore, demographic factors such as age, user types and faculties/departments were found to affect service and user satisfaction in all three faculties.

The survey conducted using the Wi-Fi site survey software and selecting a sample from faculties including social sciences, public health and the faculty of architecture, urban design and creative arts revealed variations in the service coverage of the Wi-Fi network across different faculties/departments. This discrepancy is attributed to signal propagation, as the signal strength decreases with increasing distance from the access point installation points. Obstructions, such as walls and windows, also influence signal strength. Furthermore, the university's Wi-Fi network service delivery models, funded individually by each faculty/department or by the central university administration, contribute to variations in data transmission capabilities in different areas, directly impacting user satisfaction.

User satisfaction is influenced by factors such as the frequency of service usage, which is typically five to seven days a week, with most users accessing the service during the day. The specific location where the Wi-Fi network service is used regularly is mainly concentrated in the area of the Mahasarakham Business School. Additionally, user satisfaction is affected by the high-performance connectivity devices used for Wi-Fi network access.

In conclusion, the transition towards becoming a Smart University involves various factors that impact the efficiency of Wi-Fi network service provision. By studying user behavior, investigating user satisfaction and measuring Wi-Fi signal coverage, universities can identify areas for improvement and enhance the overall Smart University experience.

Acknowledgment

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Author's Contributions

Khanittha Klangburam: Assumed primary responsibility for ideated and developed the concept, devised a research plan, formulated the methodology, gathered and analyzed data, evaluated performance, and authored the paper.

Charuay Savithi: Made significant contributions by provided critical support, shaped the article and thoroughly reviewed the final manuscript. Additionally, assumed a supervisory role throughout the project.

Ethics

The presented research study represents an original contribution and has not been previously submitted or published. The authors have thoroughly reviewed and complied with the submission requirements for this original paper, as well as adhered to the research ethics code. The Research Institutional Ethics Review (IRB) issued its ethical approval by Mahasarakham University.

Data Availability

Data are available via e-mail at charuay.s@msu.ac.th

Conflicts of Interest

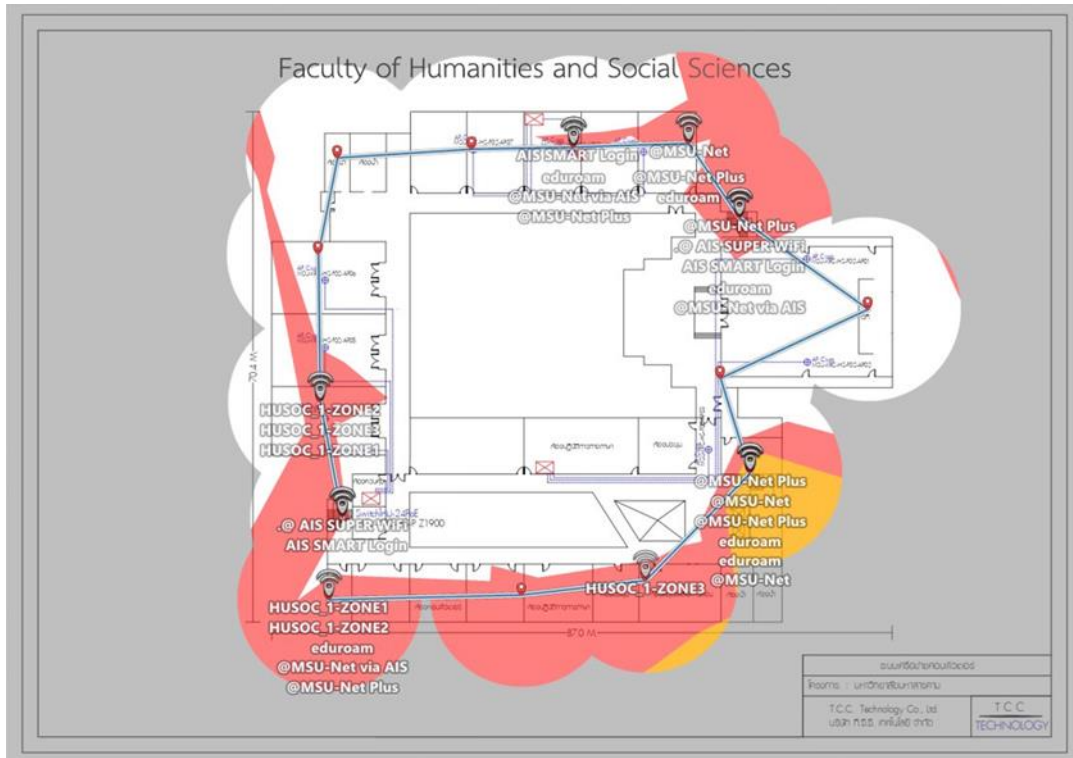
The authors declare that there is no conflict of interest with respect to the publication of this study.

References

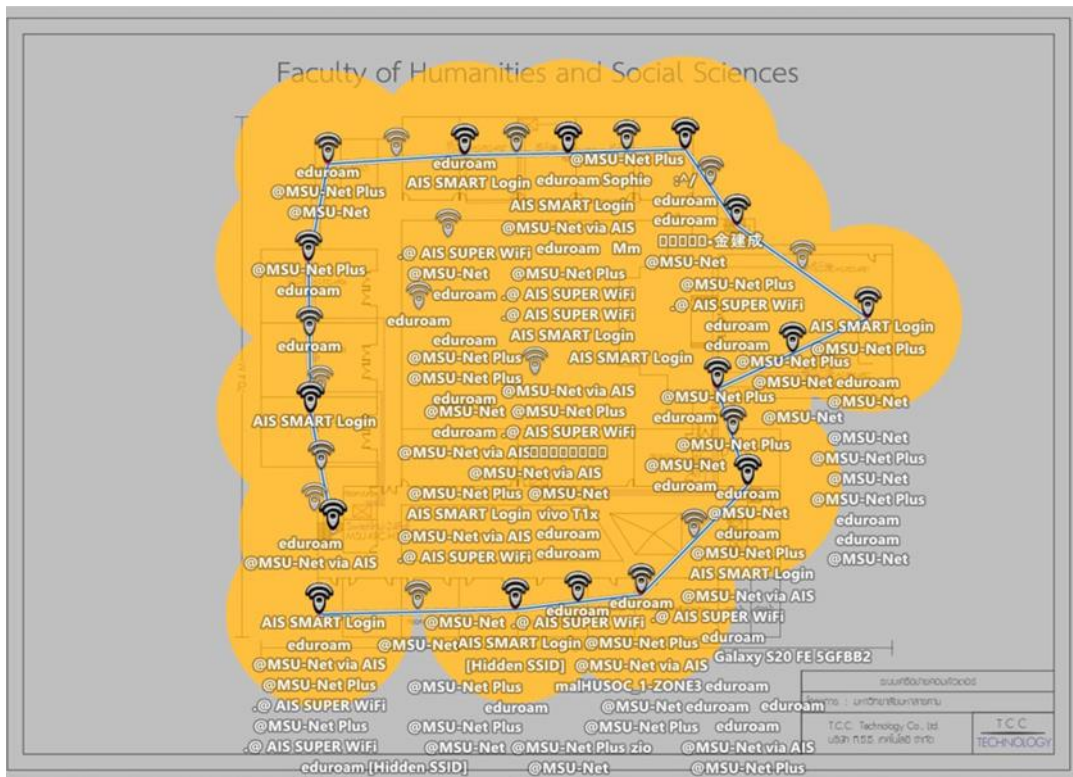
- Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance and initiatives. *Journal of Urban Technology*, 22(1), 3-21. <https://doi.org/10.1080/10630732.2014.942092>
- Alvarez-Campana, M., López, G., Vázquez, E., Villagrà, V. A., & Berrocal, J. (2017). Smart CEI moncloa: An IOT-based platform for people flow and environmental monitoring on a Smart University Campus. *Sensors*, 17(12), 2856. <https://doi.org/10.3390/s17122856>
- Bueno-Delgado, M. V., Pavón-Marino, P., De-Gea-Garcia, A., & Dolon-Garcia, A. (2012, July). The Smart University experience: An NFC-based ubiquitous environment. In *2012 Sixth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing* (pp. 799-804). IEEE. <https://doi.org/10.1109/IMIS.2012.110>
- Coccoli, M., Guercio, A., Maresca, P., & Stanganelli, L. (2014). Smarter universities: A vision for the fast-changing digital era. *Journal of Visual Languages & Computing*, 25(6), 1003-1011. <https://doi.org/10.1016/j.jvlc.2014.09.007>
- Dong, Z. Y., Zhang, Y., Yip, C., Swift, S., & Beswick, K. (2020). Smart campus: Definition, framework, technologies and services. *IET Smart Cities*, 2(1), 43-54. <https://doi.org/10.1049/iet-smc.2019.0072>
- Fiske, D. H., (2020). Pongpisit Tirapas, Chamnarn Lilaonitkul, Thanan. *Smart City Handbook Thailand*. [https://www.depa.or.th/storage/app/media/file/Smart city%20Handbook_Thai%20Version_Book.pdf](https://www.depa.or.th/storage/app/media/file/Smart%20Handbook_Thai%20Version_Book.pdf)

- Hair, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis: A Global Perspective*. Pearson.
<https://books.google.co.th/books?id=SLRPLgAA CAAJ>
- Hamza, H. S., Ghanim, Y., Nabih, A. K., Elsheikh, A. S., & Ibrahim, S. S. (2022, June). SECC Smart University Reference Architecture. In *Proceedings of the Federated Africa and Middle East Conference on Software Engineering* (pp. 46-50).
<https://doi.org/10.1145/3531056.3542771>
- Ibrahim, E. S., & Bilal, H. K. (2014). Performance Evaluation of Wi-Fi Network. *International Journal of Science and Research (IJSR)*, 3, 2290-2294.
https://www.researchgate.net/publication/317032915_Performance_Evaluation_of_Wi-Fi_Network
- Imbar, R. V., Supangkat, S. H., & Langi, A. Z. (2020, November). Smart campus model: A literature review. In *2020 International Conference on ICT for Smart Society (ICISS)* (pp. 1-7). IEEE.
<https://doi.org/10.1109/ICISS50791.2020.9307570>
- Janpla, S., & Nilsook, P. (2019). SMART UNIVERSITY: Guidelines to implementation Smart University. *Journal of Technology Management Rajabhat Maha Sarakham University, Year, 6*.
- Junyaem, K. (2016). *Wireless Network Quality Assessment: Case Study King Mongkut's University of Technology North Bangkok* [Unpublished master's thesis]. King Mongkut's University of Technology North Bangkok.
https://tdc.thailis.or.th/tdc/browse.php?option=show&browse_type=title&titleid=493447
- Kaljahi, N. E. (2021). *Performance Evaluation of Wi-Fi Networks* (Master's thesis, OsloMet-storbyuniversitetet).
<https://hdl.handle.net/11250/2774525>
- Khattab, M. S. T. (2000). *Performance Analysis of Wireless Local Area Networks (WLANs)*. Cairo University.
- Krejcie, R. V., & Morgan. (1970). *Determining Sample Size for Research Activities Psychological Measurement*. In (pp. 607-610).
<https://psycnet.apa.org/record/1971-03263-001>
- Mahasarakham University's Digital Development Plan to Become a Smart University. (2022). *Computer Center*.
<https://cc.msu.ac.th/th/syscc/docf/ufiles/digitalplan65-1.pdf>
- Number of Students of Mahasarakham University. (2022). *Devision of Registration*.
<http://regpr.msu.ac.th/eng/>
- Plainbanyang, S. (2017). Effectiveness of information system service of Rajamangala University of Technology Rattanakosin. *Veridian E-Journal, Silpakorn University. 10(1)*, 1351-1365.
<https://he02.tci-thaijo.org/index.php/Veridian-E-Journal/article/view/89181>
- Rico-Bautista, D. W. (2019, November). Conceptual framework for Smart University. In *Journal of Physics: Conference Series* (Vol. 1409, No. 1, p. 012009). IOP Publishing.
<https://doi.org/10.1088/1742-6596/1409/1/012009>
- Rujiworachot, K. (2020). *A Study of Customer Satisfaction and Confidence at the One-Stop Service Center Department of Health Service Support*. Ministry of Public Health.
http://ossc.hss.moph.go.th/fileupload_doc/2020-09-09-7-20-3526447.pdf
- Smart University. (2020). Rajabhat University. Center for learning and development based on effective information technology. *Developing the University as a Smart University*.
<https://www.aru.ac.th/arit/PDF/smartuniversity-2564.pdf>
- TechTalkThai. (2023). Mae Fah Luang University Strengthen your technology foundation and become a Smart University with services from AIS Business and Cisco [Guest Post].
<https://www.techtalkthai.com/ais-business-cisco-mfu-smart-university-guest-post/>
- Thammasat. (2019). Thammasat Aims to be a Smart University, A Model University of Sustainability in Every Dimension.
<https://tu.ac.th/thammasat-go-smart-university>
- Wimolmuang, A. (2019). *Satisfaction of Service Recipients Towards the Service of Personel Work in Faculty of Architecture* [Unpublished master's thesis]. Rajamangala University of Technology Thanyaburi.
<http://www.repository.rmutt.ac.th/dspace/bitstream/123456789/3906/3/20221121-Research-Atittaya%20W..pdf>
- Xu, X., Li, D., Sun, M., Yang, S., Yu, S., Manogaran, G., ... & Mavromoustakis, C. X. (2019). Research on key technologies of smart campus teaching platform based on 5G network. *IEEE Access*, (7), 20664-20675.
<https://doi.org/10.1109/ACCESS.2019.2894129>
- Zainuddin, N. (2017). Smart Universities Offer Innovative Resources Close at Hand.
<http://103.18.93.160/handle/123456789/15611>

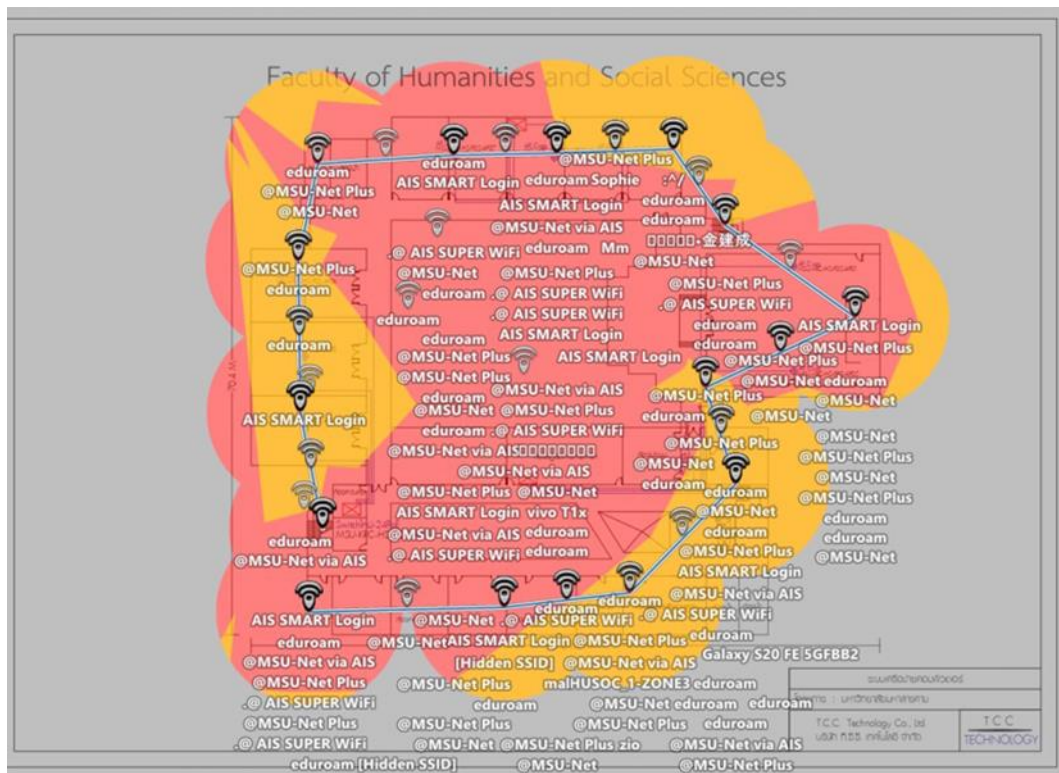
Supplementary Figures and Tables



(a)



(b)



(c)

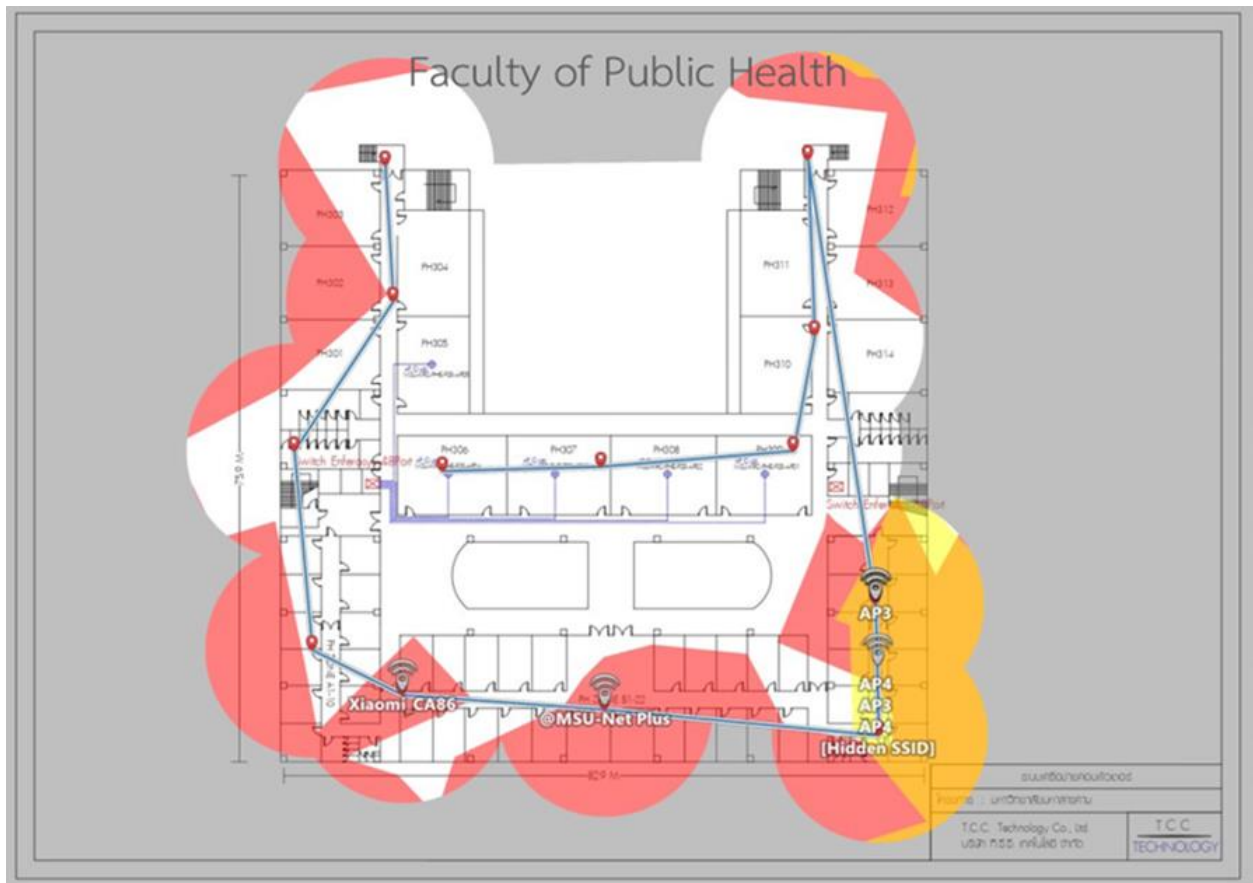
Fig. S1: Power levels decibel-milliwatts (dBm) in the faculty of humanities and social sciences; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S1: Comprehensive overview of survey respondents’ characteristics and demographics

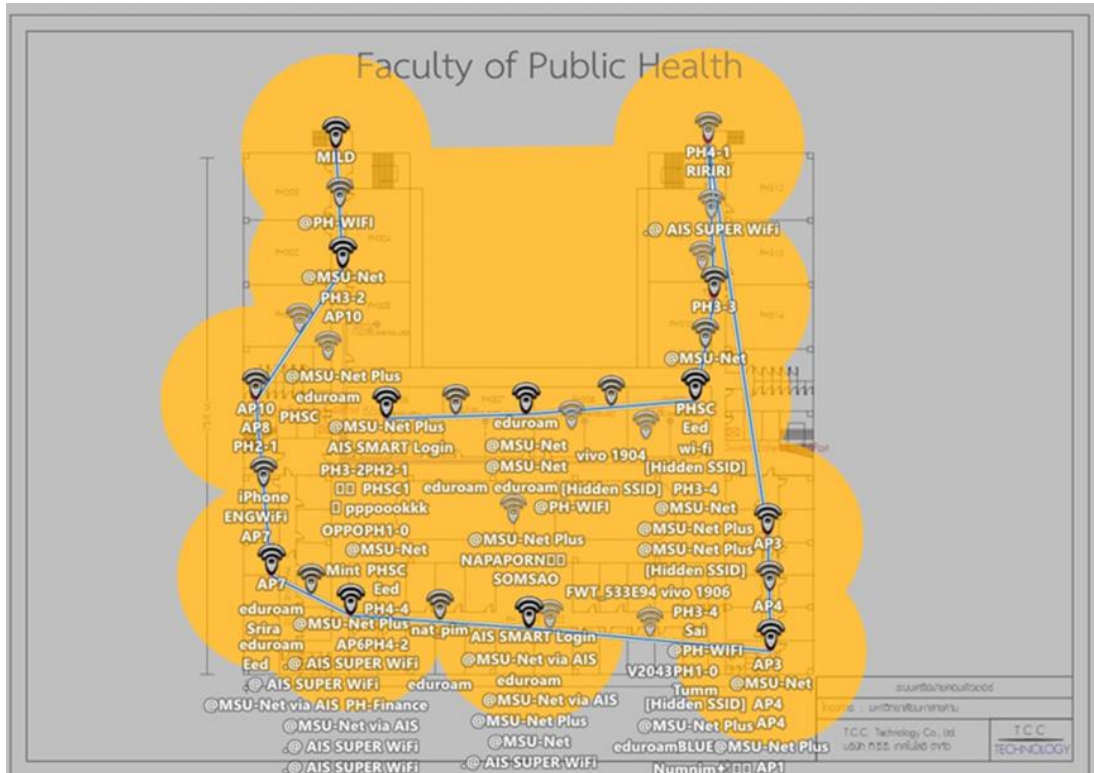
		Frequency	Percent
Gender	Male	338	32.2
	female	712	67.8
	total	1050	100.0
Age	under 20 years old	139	13.2
	21-30 years old	344	32.8
	31-40 years old	196	18.7
	41-50 years	320	30.5
	51-60 years old	45	4.3
	60 years or older	6	0.6
	total	1050	100.0
User Type	student	400	38.1
	lecturer	300	28.6
	personnel	350	33.3
	total	1050	100.0
	Faculty/Department/ Unit		
	Faculty of medicine	32	3.0
	Faculty of law	28	2.7
	Faculty of pharmacy	25	2.4
	Faculty of education	51	4.9
	Faculty of public health	45	4.3
	Faculty of medicine	113	10.8
	Faculty of technology	50	4.8
	Faculty of engineering	56	5.3
	Faculty of science	106	10.1
	Faculty of humanities and social sciences	48	4.6
	Maharakham business school	160	15.2

Table S1: Comprehensive overview of survey respondents' characteristics and demographics

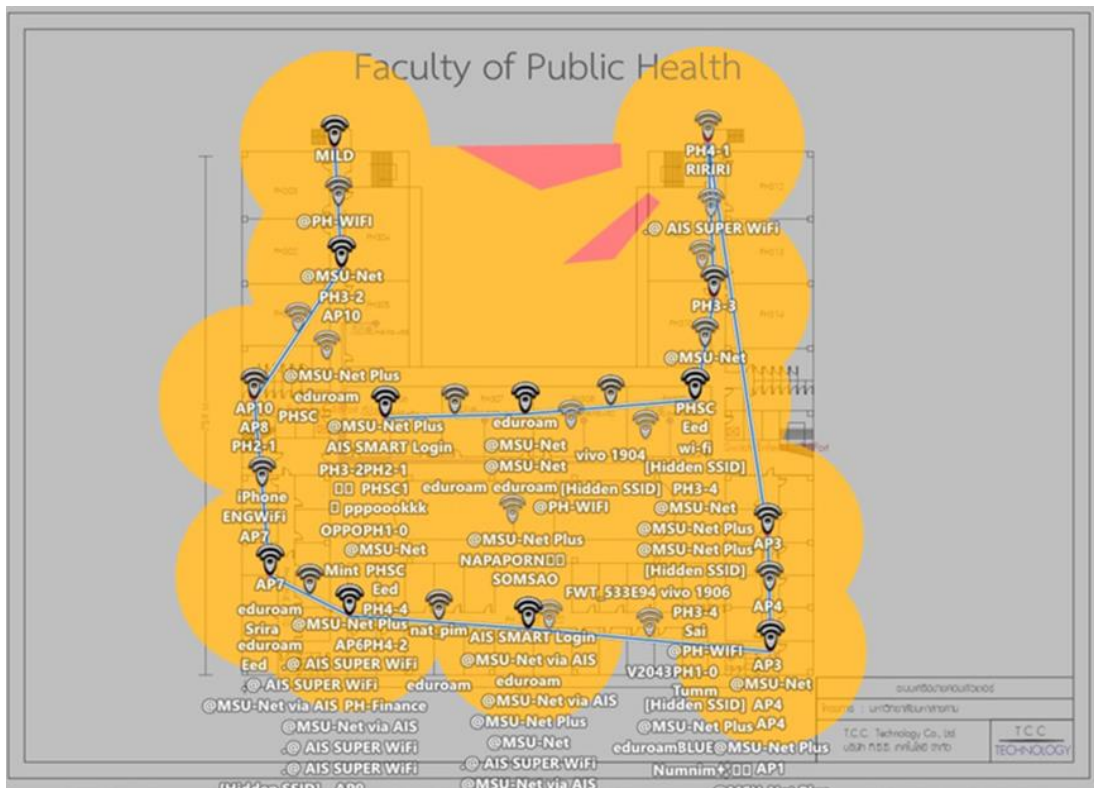
Faculty/Department/ Unit	Frequency	Percent
Faculty of fine-applied arts and cultural science	11	1.0
Faculty of veterinary sciences	18	1.7
Faculty of tourism and hotel management	25	2.4
Faculty of Informatics	47	4.5
Faculty of environment and resource studies	15	1.4
Faculty of architecture, urban design and creative arts	24	2.3
College of music	13	1.2
College of politics governance	32	3.0
Graduate school MSU	2	.2
General education msu	11	1.0
uniquet msu	2	0.2
msu computer center	10	1.0
Academic resource center	16	1.5
Division of public and international affairs walai rukhavej	3	0.3
Botanical research institute		
Palaeontological research and education centre	2	0.2
The research institute of northeastern art and culture	8	0.8
Division of general affairs, office of the president	85	8.1
Total	1050	100.0



(a)



(b)



(c)

Fig. S2: Power levels decibel-milliwatts (dBm) in the faculty of public health area; (a) The very strong power at -50 dBm; (b) The weak power at -80 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S2: Relationship between independent variables and dependent variables

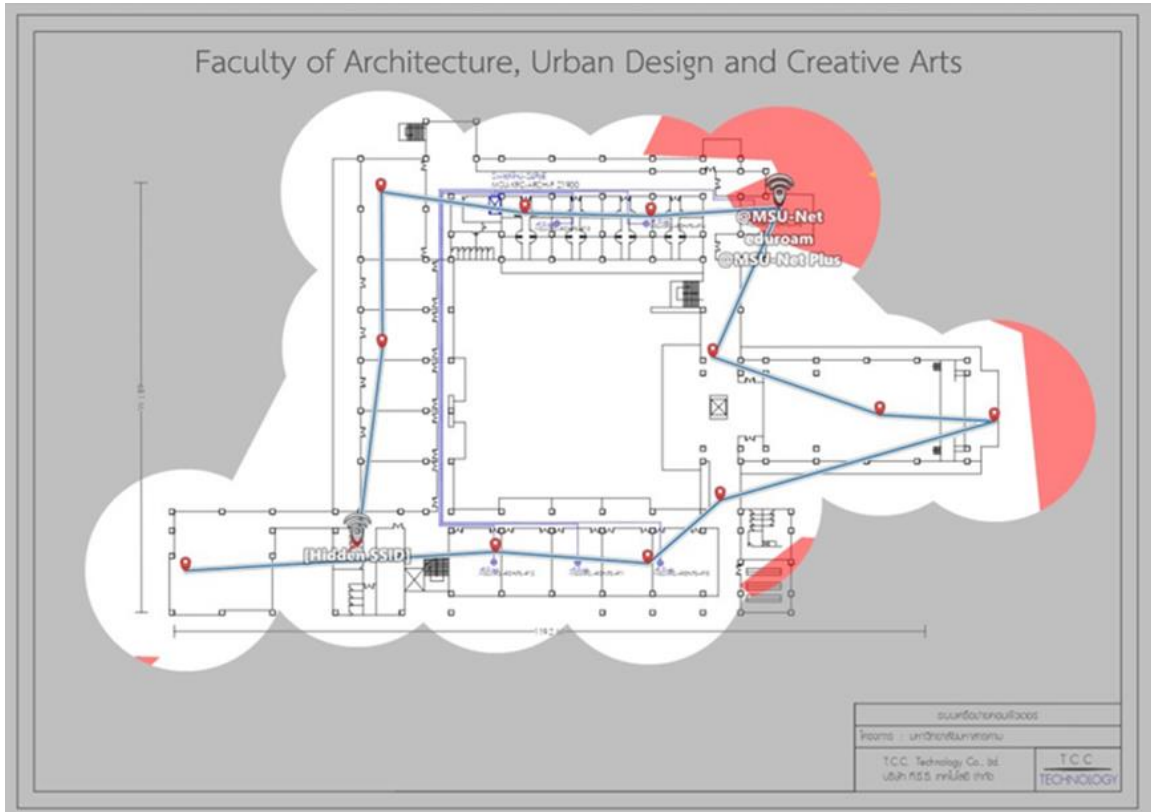
Demographic Characteristics	User satisfaction with Wi-Fi network systems					x ²	p-value
	1	2	3	4	5		
NV_1						6.338	0.175
male	10(3.0)	23(6.8)	118(34.9)	151(4.7)	36(10.7)		
female	19(2.7)	62(8.7)	260(36.5)	420(37.8)	102(14.3)		
NV_2						6.686	0.154
male	5(1.5)	8(2.4)	79(23.4)	178(52.7)	68(20.1)		
female	10(1.4)	20(2.8)	199(27.9)	315(44.2)	168(23.6)		
NV_3						3.427	0.489
male	10(3.0)	22(6.5)	107(31.7)	153(45.3)	46(13.6)		
female	23(3.2)	47(6.6)	243(34.1)	282(39.6)	163(16.4)		
Age							
N_V1						64.046	0.000*
under 20 years old	2(1.4)	15(10.8)	64(46.0)	42(30.2)	16(11.5)		
21-30 years old	9(2.6)	38(11.0)	150(43.6)	104(30.2)	43(12.5)		
31-40 years old	10(5.1)	12(6.1)	63(32.1)	91(46.4)	20(10.2)		
41-50 years	7(2.2)	15(4.7)	89(27.8)	156(48.8)	53(16.6)		
51-60 years old	1(2.2)	5(11.1)	11(24.4)	22(48.9)	6(13.3)		
N_V2						44.157	0.001*
under 20 years old	2(1.4)	1(0.7)	49(35.3)	60(43.2)	27(19.4)		
21-30 years old	4(1.2)	12(3.5)	119(34.6)	143(41.6)	66(19.2)		
31-40 years old	5(2.6)	7(3.6)	36(18.4)	102(52.0)	46(23.5)		
41-50 years	3(0.9)	8(2.5)	66(20.6)	159(49.7)	84(26.3)		
51-60 years old	1(2.2)	0(0)	7(15.6)	24(53.3)	13(28.9)		
60 years or older	0(0)	0(0)	1(16.7)	5(83.3)	0(0)		
N_V3						44.612	0.001*
under 20 years old	3(2.2)	3(2.2)	61(43.9)	54(38.8)	18(12.9)		
21-30 years old	10(2.9)	28(8.1)	137(39.8)	119(34.6)	50(14.5)		
31-40 years old	9(4.6)	16(8.2)	58(29.6)	83(42.3)	30(15.3)		
41-50 years	10(3.1)	20(6.3)	86(26.9)	147(45.9)	57(17.8)		
51-60 years old	1(2.2)	1(2.2)	8(17.8)	27(60.0)	8(17.8)		
60 years or older	0(0)	1(16.7)	0(0)	5(83.3)	0(0)		
N_V1						67.077	0.000*
student	9(2.3)	48(12.0)	184(46.0)	108(27.0)	51(12.8)		
lecturer	4(1.3)	15(5.0)	86(28.7)	156(52.0)	39(13.0)		
personnel	16(4.6)	22(6.3)	108(30.9)	156(44.6)	48(13.7)		
N_V2						53.698	0.000*
student	4(1.0)	11(2.8)	152(38.0)	153(38.3)	80(20.0)		
lecturer	2(0.7)	4(1.3)	57(19.0)	164(54.7)	73(24.3)		
personnel	9(2.6)	13(3.7)	69(19.7)	176(50.3)	83(23.7)		
N_V3						36.238	0.000*
student	11(2.8)	24(6.0)	166(41.5)	140(35.0)	59(14.8)		
lecturer	6(2.0)	14(4.7)	74(24.7)	156(52.0)	50(16.7)		
personnel	16(4.6)	31(8.9)	110(31.4)	139(39.7)	54(15.4)		
N_V1						117.335	0.346
Faculty of medicine	0(0)	2(6.3)	10(31.3)	12(37.5)	8(25.0)		
Faculty of law	1(3.6)	2(7.1)	11(39.3)	11(39.3)	3(10.7)		
Faculty of pharmacy	0(0)	1(4.0)	6(24.0)	14(56.0)	4(16.0)		
Faculty of education	1(2.0)	3(5.9)	20(39.2)	21(41.2)	6(11.8)		
Faculty of public health	1(2.2)	4(8.9)	22(48.9)	11(24.4)	7(15.6)		
Faculty of medicine	5(4.4)	16(14.2)	32(28.3)	48(42.5)	12(10.6)		
Faculty of technology	2(4.0)	2(4.0)	17(34.0)	22(44.0)	7(14.0)		
Faculty of engineering	1(1.8)	6(10.7)	30(53.6)	15(26.8)	4(7.1)		
Faculty of science	4(3.8)	5(4.7)	34(32.1)	45(42.5)	18(17.0)		
Faculty of humanities and social sciences	0(0)	5(10.4)	22(45.8)	15(31.3)	6(12.5)		
Maharakham business school	3(1.9)	15(9.4)	56(35.0)	63(39.4)	23(14.4)		
faculty of fine-applied arts and cultural science	0(0)	3(27.3)	5(45.5)	2(18.2)	1(9.1)		
Faculty of veterinary	0(0)	0(0)	5(27.8)	11(61.1)	2(11.1)		

Table S2: Continue

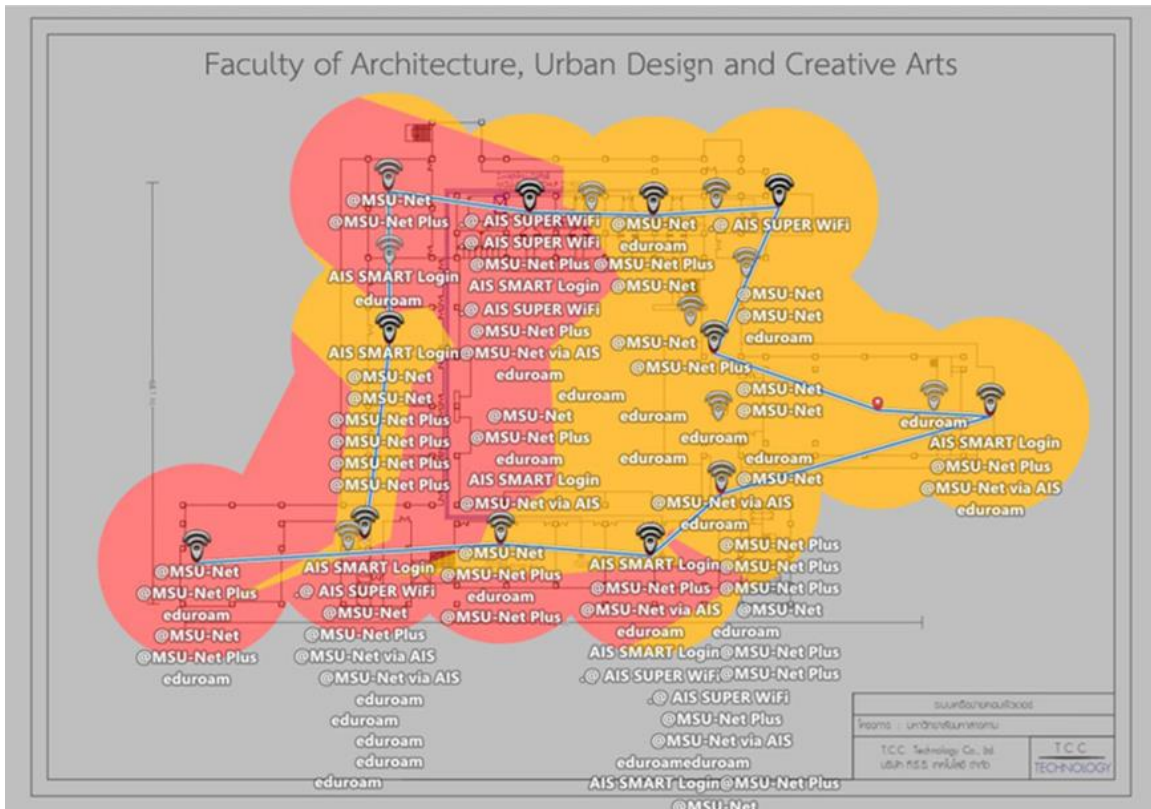
Sciences							
Faculty of tourism and hotel management	0(0)	2(8.0)	12(48.0)	8(32.0)	3(12.0)		
Faculty of informatics	1(2.1)	4(8.5)	18(38.3)	20(42.6)	4(8.5)		
Faculty of environment and resource studies	1(6.7)	0(0)	3(20.0)	9(60.0)	2(13.3)		
Faculty of architecture, urban design and creative arts	1(4.2)	2(8.3)	7(29.2)	12(50.0)	2(8.3)		
College of Music	0(0)	1(7.7)	5(38.5)	7(53.8)	0(0)		
College of Politics	0(0)	3(9.4)	15(46.9)	13(40.6)	1(3.1)		
Governance							
Graduate school MSU	0(0)	0(0)	1(50.0)	0(0)	1(50.0)		
General education MSU	0(0)	2(18.2)	4(36.4)	3(27.3)	2(18.2)		
Uniquet MSU	0(0)	0(0)	0(0)	0(0)	2(100.0)		
MSU computer center	1(10.0)	1(10.0)	2(20.0)	6(60.0)	0(0)		
Academic resource center	0(0)	0(0)	4(25.0)	9(56.3)	3(18.8)		
Division of public and International affairs	1(8.3)	1(8.3)	5(41.7)	3(25.0)	2(16.7)		
Walai Rukhavej botanical Research institute	1(8.3)	1(8.3)	5(41.7)	3(25.0)	2(16.7)		
Palaeontological Research and Education Centre	0(0)	0(0)	0(0)	3(100.0)	0(0)		
The Research Institute of North-eastern Art and Culture	0(0)	0(0)	2(100.0)	0(0)	0(0)		
Division of General Affairs, Office of the President	0(0)	0(0)	3(37.5)	3(37.5)	2(25.0)		
N_V2						148.424	0.012*
Faculty of medicine	0(0)	1(3.1)	5(15.6)	15(46.9)	11(34.4)		
Faculty of law	0(0)	0(0)	9(32.1)	12(42.9)	7(25.0)		
Faculty of pharmacy	0(0)	0(0)	5(20.0)	14(56.0)	6(24.0)		
Faculty of education	0(0)	1(2.0)	14(27.5)	22(43.1)	14(27.5)		
Faculty of public health	1(2.2)	1(2.2)	20(44.4)	13(28.9)	10(22.2)		
Faculty of medicine	4(3.5)	5(4.4)	22(19.5)	58(51.3)	24(21.2)		
Faculty of technology	0(0)	0(0)	11(22.0)	28(56.0)	11(22.2)		
Faculty of engineering	0(0)	3(5.4)	23(41.1)	24(42.9)	6(10.7)		
Faculty of science	3(2.8)	3(2.8)	23(21.7)	53(50.0)	24(22.6)		
Faculty of humanities and Social Sciences	0(0)	3(6.3)	16(33.3)	20(41.7)	9(19.8)		
Mahasarakham business School	0(0)	2(1.3)	42(26.3)	78(48.8)	38(23.8)		
Faculty of fine-applied Arts and cultural science	0(0)	7(63.6)	2(18.2)	2(18.2)			
Faculty of veterinary Sciences	0(0)	0(0)	2(11.1)	9(50.0)	7(39.9)		
Faculty of tourism and Hotel management	0(0)	0(0)	12(48.0)	9(36.0)	4(16.0)		
Faculty of informatics	0(0)	1(2.1)	14(29.8)	23(48.9)	9(19.1)		
Faculty of environment and resource studies	1(6.7)	2(13.3)	2(13.3)	8(53.3)	2(13.3)		
Faculty of architecture, urban design and creative arts	2(8.3)	0(0)	4(16.7)	14(58.3)	4(16.7)		
College of music	0(0)	0(0)	4(30.8)	7(53.8)	2(15.4)		
College of politics	0(0)	0(0)	13(40.6)	13(40.6)	6(18.8)		
Governance							
Graduate school MSU	0(0)	0(0)	0(0)	1(50.0)	1(50.0)		
General education MSU	1(9.1)	0(0)	2(18.2)	6(54.5)	2(18.2)		

Table S2: Continue

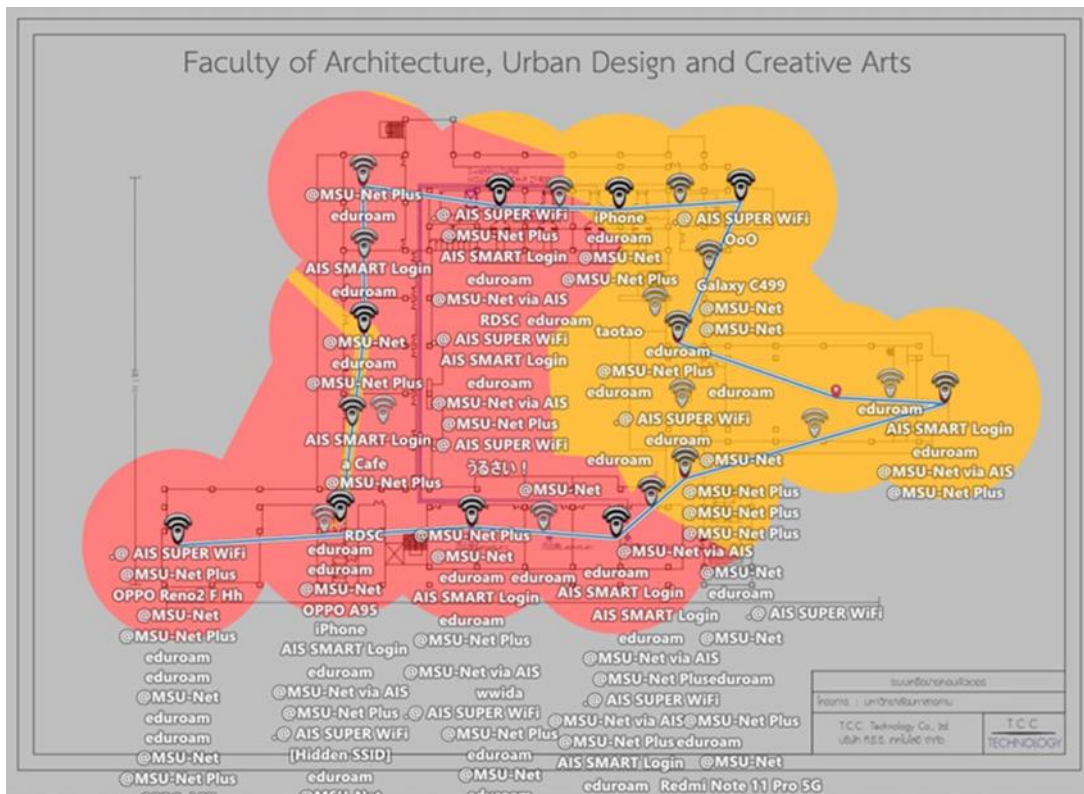
Uniquet MSU	0(0)	0(0)	0(0)	0(0)	2(100.0)		
MSU computer center	1(10.0)	0(0)	2(20.0)	6(60.0)	1(10.0)		
Academic resource center	0(0)	0(0)	4(25.0)	8(50.0)	4(25.0)		
Division of Public and international affairs	0(0)	2(16.7)	2(16.7)	6(50.0)	2(16.7)		
Walai Rukhavej	0(0)	2(16.7)	2(16.7)	6(50.0)	2(16.7)		
Botanical Research Institute							
Palaeontological Research and Education Centre	0(0)	0(0)	0(0)	3(100.0)	0(0)		
The research institute of North-Eastern art and culture	0(0)	0(0)	2(100.0)	0(0)	0(0)		
Division of general Affairs, office of the President	0(0)	0(0)	0(0)	3(37.5)	5(62.5)		
N_V3						108.683	0.571
Faculty of medicine	1(31.1)	2(6.3)	6(18.8)	16(50.0)	7(21.9)		
Faculty of law	1(3.6)	2(7.1)	12(42.9)	10(35.7)	3(10.7)		
Faculty of pharmacy	0(0)	1(4.0)	6(24.0)	16(64.0)	2(8.0)		
Faculty of education	1(2.0)	3(5.9)	14(27.5)	25(49.0)	8(15.7)		
Faculty of public health	1(2.2)	2(4.4)	23(51.1)	11(24.4)	8(17.8)		
Faculty of medicine	6(5.3)	12(10.6)	34(30.1)	46(40.7)	15(13.3)		
Faculty of technology	2(4.0)	3(6.0)	13(26.0)	24(48.0)	8(16.0)		
Faculty of engineering	2(3.6)	4(7.1)	29(51.8)	15(26.8)	6(10.7)		
Faculty of Science	4(3.8)	6(5.7)	33(31.1)	43(40.6)	20(18.9)		
Faculty of humanities and social sciences	2(4.2)	3(6.3)	21(43.8)	18(37.5)	4(8.3)		
Maharakham business school	2(1.3)	5(3.1)	53(33.1)	68(42.5)	32(20.0)		
faculty of fine-applied arts and Cultural science	1(9.1)	1(9.1)	5(45.5)	2(18.2)	2(18.2)		
faculty of veterinary sciences	0(0)	1(5.6)	4(22.2)	9(50.0)	4(22.2)		
Faculty of tourism and hotel management	0(0)	1(4.0)	13(52.0)	8(32.0)	3(12.0)		
Faculty of informatics	0(0)	3(6.4)	17(36.2)	20(42.6)	7(14.9)		
Faculty of environment and resource studies	1(6.7)	2(13.3)	4(26.7)	6(40.0)	2(13.3)		
Faculty of architecture, urban design and Creative Arts	2(8.3)	0(0)	9(37.5)	9(37.5)	4(16.7)		
College of music	0(0)	1(7.7)	3(23.1)	8(61.5)	1(7.7)		
College of politics	0(0)	2(6.3)	12(37.5)	16(50.0)	2(6.3)		
Governance							
Graduate school MSU	0(0)	0(0)	0(0)	1(50.0)	1(50.0)		
General education	1(9.1)	1(9.1)	2(18.2)	5(45.5)	2(18.2)		
MSU							
Uniquet MSU	0(0)	0(0)	0(0)	1(50.0)	1(50.0)		
MSU computer center	1(10.0)	1(10.0)	2(20.0)	6(60.0)	0(0)		
Academic Resource Center	0(0)	0(0)	4(25.0)	9(56.3)	3(18.8)		
Division of Public and International affairs	1(8.3)	3(25.0)	3(25.0)	3(25.0)	2(16.7)		
Walai Rukhavej botanical Research institute	0(0)	0(0)	0(0)	3(100.0)	0(0)		
Palaeontological Research and Education centre	0(0)	0(0)	2(100.0)	0(0)	0(0)		
The research institute of North-Eastern art and culture	0(0)	0(0)	2(25.0)	4(50.0)	2(25.0)		
Division of general Affairs, office of the president	4(4.7)	10(11.8)	24(28.2)	33(38.8)	14(16.5)		



(a)



(b)



(c)

Fig. S3: Power levels decibel-milliwatts (dBm) in the faculty of architecture, urban design and creative arts; (a) The very strong power at -50 dBm; (b) The weak power at -80 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S3: Survey results of the number of access points (faculty of humanities and social sciences)

	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	AIS SMART Login	74:3E:2B:0E:73:1D	153	ac	-76.0	4.0
2	eduroam	74:3E:2B:CE:73:1C	153	ax	-76.0	4.0
3	@MSU-Net via AIS	74:3E:2B:8E:73:1C	153	ac	-76.0	4.0
4	@MSU-Net Plus	74:3E:2B:4E:73:1C	153	ax	-75.7	4.3
5	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:73:1C	153	ac	-75.7	7.0
6	AIS SMART Login	74:3E:2B:3F:6A:AD	149	ac	-78.0	2.0
7	eduroam	74:3E:2B:FF:6A:AC	149	ax	-78.0	2.0
8	@MSU-Net via AIS	74:3E:2B:BF:6A:AC	149	ac	-77.0	3.0
9	@MSU-Net Plus	74:3E:2B:7F:6A:AC	149	ax	-78.0	2.0
10	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:6A:AC	149	ac	-78.0	3.3
11	eduroam	24:1F:BD:74:6B:D2	116	ax	-73.0	-1.0
12	@MSU-Net	24:1F:BD:74:6B:D1	116	ax	-73.0	-1.0
13	@MSU-Net Plus	24:1F:BD:74:6B:D0	116	ax	-72.7	4.0
14	AIS SMART Login	74:3E:2B:0E:E6:6D	48	ac	-72.0	10.7
15	eduroam	74:3E:2B:CE:E6:6C	48	ax	-72.7	10.0
16	@MSU-Net via AIS	74:3E:2B:8E:E6:6C	48	ac	-72.7	10.0
17	AIS SMART Login	74:3E:2B:0E:8E:1D	48	ac	-74.0	8.7
18	@MSU-Net Plus	74:3E:2B:4E:E6:6C	48	ax	-72.7	10.0
19	eduroam	74:3E:2B:CE:8E:1C	48	ax	-74.0	8.7
20	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:E6:6C	48	ac	-72.7	10.0
21	@MSU-Net via AIS	74:3E:2B:8E:8E:1C	48	ac	-74.0	8.7
22	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8E:1C	48	ac	-73.0	9.7
23	AIS SMART Login	74:3E:2B:3F:0F:3D	40	ac	-76.7	6.0
24	eduroam	74:3E:2B:FF:0F:3C	40	ax	-76.7	6.3
25	@MSU-Net via AIS	74:3E:2B:BF:0F:3C	40	ac	-77.0	6.0
26	@MSU-Net Plus	74:3E:2B:7F:0F:3C	40	ax	-77.3	5.7

Table S3: Continue

27	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:3C	40	ac	-77.0	6.7
28	eduroam	24:1F:BD:74:6B:C2	11	ax	-68.3	-5.3
29	@MSU-Net	24:1F:BD:74:6B:C1	11	ax	-68.3	-5.3
30	@MSU-Net Plus	24:1F:BD:74:6B:C0	11	ax	-68.3	-5.3
31	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:6A:A8	11	ac	-60.7	3.3
32	AIS SMART Login	74:3E:2B:3F:6A:A9	11	ac	-62.3	0.7
33	@MSU-Net via AIS	74:3E:2B:BF:6A:A8	11	ac	-61.0	3.0
34	@MSU-Net Plus	74:3E:2B:7F:6A:A8	11	ax	-61.0	3.0
35	eduroam	74:3E:2B:FF:6A:A8	11	ax	-60.7	6.3
36	HUSOC_1-ZONE1	C2:9F:DB:2F:20:D9	11	n	-42.3	25.2
37	HUSOC_1-ZONE3	CA:9F:DB:2F:20:D9	11	n	-45.7	26.7
38	HUSOC_1-ZONE2	C6:9F:DB:2F:20:D9	11	n	-42.3	25.2
39	AIS SMART Login	74:3E:2B:3F:0F:39	6	ac	-54.3	16.7
40	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:38	6	ac	-58.7	12.7
41	@MSU-Net Plus	74:3E:2B:4E:73:18	6	ax	-54.3	16.7
42	eduroam	24:1F:BD:74:6D:62	6	ax	-80.0	-31.0
43	@MSU-Net	24:1F:BD:74:6D:61	6	ax	-80.0	-31.0
44	@MSU-Net Plus	24:1F:BD:74:6D:60	6	ax	-80.0	-31.0
45	@MSU-Net	24:1F:BD:73:F6:81	1	ax	-78.0	-17.3
46	@MSU-Net Plus	24:1F:BD:73:F6:80	1	ax	-78.0	-17.3
47	eduroam	24:1F:BD:73:F8:E2	1	ax	-73.0	-12.3
48	@MSU-Net	24:1F:BD:73:F8:E1	1	ax	-73.0	-14.5
49	@MSU-Net Plus	24:1F:BD:73:F8:E0	1	ax	-73.0	-12.3
50	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:E6:68	1	ac	-50.0	14.5
51	AIS SMART Login	74:3E:2B:0E:E6:69	1	ac	-49.0	11.7
52	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8E:18	1	ac	-61.0	4.0
53	AIS SMART Login	74:3E:2B:0E:8E:19	1	ac	-62.3	2.7
54	eduroam	74:3E:2B:CE:E6:68	1	ax	-49.7	14.8
55	eduroam	74:3E:2B:CE:8E:18	1	ax	-61.0	4.0
56	@MSU-Net via AIS	74:3E:2B:8E:8E:18	1	ac	-61.3	-0.7
57	@MSU-Net via AIS	74:3E:2B:8E:E6:68	1	ac	-49.7	14.8
58	@MSU-Net Plus	74:3E:2B:4E:8E:18	1	ax	-63.0	1.5
59	@MSU-Net Plus	74:3E:2B:4E:E6:68	1	ax	-49.0	15.5
60	eduroam	2C:1A:05:6C:FF:2E	112	ax	-66.3	6.3
61	eduroam	24:1F:BD:74:6D:B2	52	ax	-75.0	1.7
62	@MSU-Net	24:1F:BD:74:6D:B1	52	ax	-75.0	1.7
63	@MSU-Net Plus	24:1F:BD:74:6D:B0	52	ax	-75.0	1.7
64	@MSU-Net Plus	74:3E:2B:4E:8E:1C	48	ax	-73.0	9.7
65	@MSU-Net Plus	2C:1A:05:6D:F3:E2	11	ax	-62.7	11.3
66	eduroam	2C:1A:05:6D:F3:E1	11	ax	-63.0	11.0
67	eduroam	24:1F:BD:74:6D:A2	11	ax	-72.0	-9.0
68	eduroam	74:3E:2B:FF:0F:38	6	ax	-60.0	11.3
69	@MSU-Net via AIS	74:3E:2B:BF:0F:38	6	ac	-56.3	15.0
70	HUSOC_1-ZONE2	C6:9F:DB:F1:BE:59	6	n	-47.3	25.7
71	.@ AIS SUPER Wi-Fi	F8:E7:1E:2B:CA:78	6	ac	-66.7	10.3
72	eduroam	74:3E:2B:CE:8C:38	6	ax	-55.3	16.0
73	AIS SMART Login	74:3E:2B:0E:8C:39	6	ac	-58.3	13.0
74	@MSU-Net Plus	2C:1A:05:6D:F2:42	6	ax	-58.0	9.0
75	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8C:38	6	ac	-56.0	15.3
76	@MSU-Net Plus	74:3E:2B:7F:1C:08	1	ax	-41.7	23.3
77	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:1C:08	1	ac	-42.3	27.7
78	AIS SMART Login	74:3E:2B:0D:2E:0D	161	ac	-79.0	6.7
79	eduroam	74:3E:2B:CD:2E:0C	161	ax	-79.0	6.7
80	@MSU-Net via AIS	74:3E:2B:8D:2E:0C	161	ac	-80.0	5.7
81	@MSU-Net Plus	74:3E:2B:4D:2E:0C	161	ax	-79.0	6.7
82	.@ AIS SUPER Wi-Fi	74:3E:2B:0D:2E:0C	161	ac	-79.0	8.0
83	@MSU-Net Plus	24:1F:BD:74:70:10	161	ax	-73.0	6.0
84	AIS SMART Login	74:3E:2B:3F:1E:CD	149	ac	-75.0	12.0
85	eduroam	74:3E:2B:FF:1E:CC	149	ax	-76.0	12.0
86	@MSU-Net via AIS	74:3E:2B:BF:1E:CC	149	ac	-76.0	12.0

Table S3: Continue

87	@MSU-Net Plus	74:3E:2B:7F:1E:CC	149	ax	-75.7	12.3
88	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:1E:CC	149	ac	-76.3	12.7
89	@MSU-Net Plus	2C:1A:05:6D:F3:ED	124	ax	-65.3	9.0
90	eduroam	2C:1A:05:6D:F3:EE	124	ax	-66.0	8.3
91	@MSU-Net	2C:1A:05:6D:F3:EF	124	ax	-66.3	8.0
92	@MSU-Net	24:1F:BD:73:F8:F1	132	ax	-84.0	5.0
93	@MSU-Net Plus	24:1F:BD:73:F8:F0	132	ax	-84.0	5.0
94	@MSU-Net Plus	9C:D5:7D:05:07:8D	124	ax	-85.0	-7.0
95	eduroam	D8:84:66:5A:5C:C2	112	ax	-63.3	18.0
96	@MSU-Net Plus	2C:1A:05:6C:FF:2D	112	ax	-66.3	6.3
97	@MSU-Net Plus	D8:84:66:5A:5C:C1	112	ax	-61.0	20.3
98	@MSU-Net	2C:1A:05:6C:FF:2F	112	ax	-66.3	6.3
99	@MSU-Net	D8:84:66:5A:5C:C0	112	ax	-65.3	16.0
100	eduroam	D8:84:66:5A:5D:42	108	ax	-71.3	10.0
101	@MSU-Net Plus	D8:84:66:5A:5D:41	108	ax	-71.3	10.0
102	eduroam	D8:84:66:5A:56:B2	100	ax	-82.3	7.7
103	@MSU-Net	D8:84:66:5A:56:B0	100	ax	-83.3	6.7
104	@MSU-Net	D8:84:66:5A:5D:40	108	ax	-71.7	9.7
105	eduroam	24:1F:BD:73:FD:12	100	ax	-81.5	-9.5
106	@MSU-Net	24:1F:BD:73:FD:11	100	ax	-81.5	-9.5
107	@MSU-Net Plus	24:1F:BD:73:FD:10	100	ax	-81.0	-9.0
108	@MSU-Net	2C:1A:05:6D:F2:4F	64	ax	-73.0	2.0
109	eduroam	2C:1A:05:6D:F2:4E	64	ax	-73.0	2.0
110	@MSU-Net Plus	2C:1A:05:6D:F2:4D	64	ax	-73.0	2.0
111	eduroam	D8:84:66:5A:63:C2	52	ax	-66.0	17.0
112	@MSU-Net	D8:84:66:5A:63:C0	52	ax	-66.0	17.0
113	@MSU-Net Plus	D8:84:66:5A:63:C1	52	ax	-66.0	17.0
114	AIS SMART Login	74:3E:2B:3F:20:BD	44	ac	-81.0	2.7
115	eduroam	74:3E:2B:FF:20:BC	44	ax	-81.0	2.0
116	@MSU-Net via AIS	74:3E:2B:BF:20:BC	44	ac	-81.0	2.0
117	@MSU-Net Plus	74:3E:2B:7F:20:BC	44	ax	-79.7	3.3
118	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:20:BC	44	ac	-79.7	4.3
119	.@ AIS SUPER Wi-Fi	F8:E7:1E:2B:CA:7C	36	ac	-83.7	-0.7
120	eduroam	74:3E:2B:FF:63:D8	11	ax	-68.0	6.0
121	@MSU-Net via AIS	74:3E:2B:BF:63:D8	11	ac	-58.0	16.0
122	@MSU-Net Plus	74:3E:2B:7F:63:D8	11	ax	-57.7	16.3
123	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:63:D8	11	ac	-63.3	11.7
124	AIS SMART Login	74:3E:2B:3F:1E:C9	11	ac	-48.3	25.7
125	eduroam	74:3E:2B:FF:1E:C8	11	ax	-49.0	25.0
126	@MSU-Net via AIS	74:3E:2B:BF:1E:C8	11	ac	-48.7	25.3
127	@MSU-Net Plus	74:3E:2B:7F:1E:C8	11	ax	-48.7	25.3
128	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:1E:C8	11	ac	-51.0	23.0
129	@MSU-Net Plus	74:3E:2B:4D:2E:08	11	ax	-62.0	12.0
130	.@ AIS SUPER Wi-Fi	74:3E:2B:0D:2E:08	11	ac	-59.0	15.0
131	eduroam	24:1F:BD:73:FD:02	11	ax	-74.7	-11.7
132	@MSU-Net	24:1F:BD:73:FD:01	11	ax	-71.7	-8.7
133	@MSU-Net Plus	24:1F:BD:73:FD:00	11	ax	-74.0	-2.3
134	@MSU-Net	24:1F:BD:74:6D:A1	11	ax	-70.0	4.0
135	@MSU-Net Plus	24:1F:BD:74:6D:A0	11	ax	-76.0	-19.0
136	AIS SMART Login	74:3E:2B:0D:2E:09	11	ac	-57.0	15.3
137	eduroam	74:3E:2B:CD:2E:08	11	ax	-59.0	15.0
138	@MSU-Net via AIS	74:3E:2B:8D:2E:08	11	ac	-62.0	12.0
139	eduroam	2C:1A:05:6D:F2:41	6	ax	-56.0	-7.0
140	@MSU-Net	2C:1A:05:6D:F2:40	6	ax	-55.0	12.0
141	@MSU-Net via AIS	74:3E:2B:8E:8C:38	6	ac	-54.7	16.7
142	@MSU-Net Plus	74:3E:2B:4E:8C:38	6	ax	-56.0	15.3
143	HUSOC_1-ZONE3	CA:9F:DB:F1:BE:59	6	n	-46.7	26.3
144	eduroam	F8:E7:1E:EB:CA:78	6	ax	-69.7	3.7
145	@MSU-Net via AIS	F8:E7:1E:AB:CA:78	6	ac	-70.0	3.3
146	@MSU-Net Plus	F8:E7:1E:6B:CA:78	6	ax	-67.7	5.7

Table S3: Continue

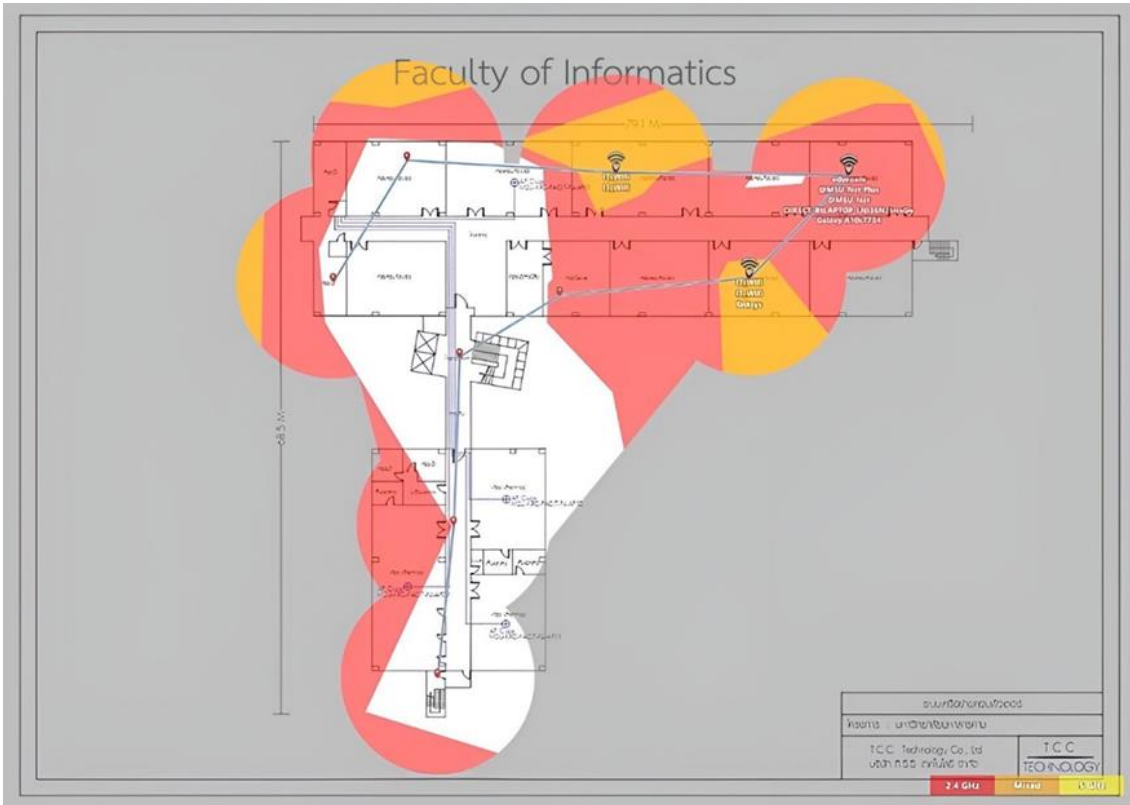
147	@MSU-Net via AIS	74:3E:2B:8E:73:18	6	ac	-54.3	16.7
148	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:73:18	6	ac	-55.3	15.7
149	HUSOC_1-ZONE1	C2:9F:DB:F1:BE:59	6	n	-45.7	27.3
150	AIS SMART Login	74:3E:2B:3F:20:B9	1	ac	-60.7	5.0
151	eduroam	74:3E:2B:FF:20:B8	1	ax	-57.0	8.0
152	@MSU-Net via AIS	74:3E:2B:BF:20:B8	1	ac	-56.0	9.0
153	@MSU-Net Plus	74:3E:2B:7F:20:B8	1	ax	-57.0	8.0
154	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:20:B8	1	ac	-55.0	15.5
155	AIS SMART Login	74:3E:2B:3F:1C:09	1	ac	-43.3	21.7
156	eduroam	74:3E:2B:FF:1C:08	1	ax	-41.7	23.3
157	@MSU-Net via AIS	74:3E:2B:BF:1C:08	1	ac	-41.7	23.3
158	eduroam	D8:84:66:5A:63:CA	1	ax	-74.0	-9.3
159	eduroam	D8:84:66:5A:5C:CA	1	ax	-57.3	7.3
160	@MSU-Net	D8:84:66:5A:67:08	1	ax	-59.0	6.0
161	@MSU-Net	D8:84:66:5A:63:C8	1	ax	-71.5	-6.8
162	@MSU-Net Plus	D8:84:66:5A:5C:C9	1	ax	-55.7	8.8
163	@MSU-Net	D8:84:66:5A:5C:C8	1	ax	-53.0	12.0
164	eduroam	24:1F:BD:73:F8:F2	132	ax	-84.0	5.0
165	AIS SMART Login	74:3E:2B:0E:73:19	6	ac	-55.7	15.3
166	eduroam	74:3E:2B:CE:73:18	6	ax	-54.7	16.3
167	@MSU-Net Plus	74:3E:2B:7F:0F:38	6	ax	-58.3	12.7
168	eduroam	24:1F:BD:74:70:02	1	ax	-63.3	1.7
169	@MSU-Net	24:1F:BD:74:70:01	1	ax	-66.7	-1.7
170	eduroam	9C:D5:7D:05:07:8E	124	ax	-83.0	-5.0
171	AIS SMART Login	74:3E:2B:3F:1C:0D	44	ac	-71.0	12.0
172	eduroam	74:3E:2B:FF:1C:0C	44	ax	-71.0	12.0
173	@MSU-Net via AIS	74:3E:2B:BF:1C:0C	44	ac	-71.0	12.0
174	@MSU-Net Plus	74:3E:2B:7F:1C:0C	44	ax	-70.7	12.3
175	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:1C:0C	44	ac	-71.0	15.0
176	AIS SMART Login	74:3E:2B:0E:8C:3D	36	ac	-75.7	6.3
177	eduroam	74:3E:2B:CE:8C:3C	36	ax	-76.0	6.0
178	@MSU-Net via AIS	74:3E:2B:8E:8C:3C	36	ac	-76.0	6.0
179	@MSU-Net Plus	74:3E:2B:4E:8C:3C	36	ax	-76.0	6.0
180	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8C:3C	36	ac	-76.0	11.0
181	AIS SMART Login	74:3E:2B:3F:63:D9	11	ac	-60.0	15.0
182	@MSU-Net	2C:1A:05:6D:F3:E0	11	ax	-69.0	5.0
183	@MSU-Net Plus	D8:84:66:5A:55:8A	1	ax	-74.0	-9.3
184	@MSU-Net Plus	2C:1A:05:6C:FF:22	1	ax	-58.0	-5.0
185	eduroam	2C:1A:05:6C:FF:21	1	ax	-58.0	-5.0
186	@MSU-Net	2C:1A:05:6C:FF:20	1	ax	-56.0	8.5
187	@MSU-Net Plus	2C:1A:05:6D:F7:AD	124	ax	-80.0	-5.7
188	eduroam	D8:84:66:5A:67:31	64	ax	-80.7	15.3
189	@MSU-Net Plus	D8:84:66:5A:67:32	64	ax	-81.0	15.0
190	AIS SMART Login	F8:E7:1E:2B:CA:7D	36	ac	-84.0	-1.0
191	eduroam	F8:E7:1E:EB:CA:7C	36	ax	-82.0	1.0
192	@MSU-Net via AIS	F8:E7:1E:AB:CA:7C	36	ac	-82.0	1.0
193	AIS SMART Login	74:3E:2B:3F:63:DD	153	ac	-80.0	7.0
194	eduroam	74:3E:2B:FF:63:DC	153	ax	-80.0	7.0
195	@MSU-Net via AIS	74:3E:2B:BF:63:DC	153	ac	-80.0	7.0
196	@MSU-Net Plus	74:3E:2B:7F:63:DC	153	ax	-82.0	5.0
197	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:63:DC	153	ac	-80.0	7.0
198	@MSU-Net	D8:84:66:5A:67:30	64	ax	-80.3	15.7
199	@MSU-Net Plus	F8:E7:1E:6B:CA:7C	36	ax	-83.3	-0.3
200	@MSU-Net	D8:84:66:5A:67:38	1	ax	-72.0	-7.0
201	@MSU-Net	D8:84:66:5A:5D:48	1	ax	-65.0	3.0
202	@MSU-Net Plus	D8:84:66:5A:67:3A	1	ax	-71.0	-6.0
203	@MSU-Net	2C:1A:05:6D:F7:A0	11	ax	-63.0	11.0
204	AIS SMART Login	F8:E7:1E:2B:CA:79	6	ac	-70.7	-0.7
205	eduroam	D8:84:66:5A:5D:4A	1	ax	-65.0	3.0
206	@MSU-Net Plus	D8:84:66:5A:67:02	100	ax	-67.0	23.0

Table S3: Continue

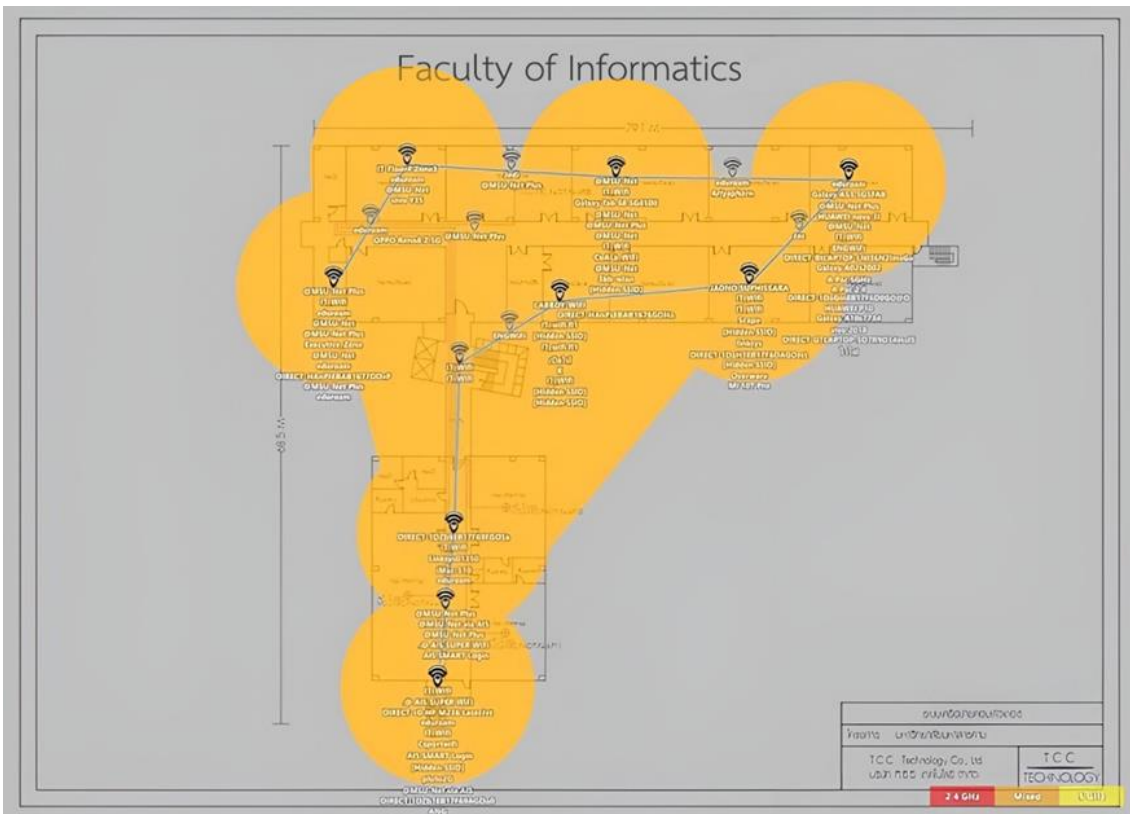
207	eduroam	D8:84:66:5A:67:01	100	ax	-66.7	17.7
208	@MSU-Net	D8:84:66:5A:67:00	100	ax	-66.7	17.7
209	@MSU-Net Plus	D8:84:66:5A:5D:49	1	ax	-64.5	3.5
210	@MSU-Net Plus	2C:1A:05:6D:F7:A2	11	ax	-65.7	8.3
211	eduroam	2C:1A:05:6D:F7:AE	124	ax	-79.3	-5.0
212	@MSU-Net	2C:1A:05:6D:F7:AF	124	ax	-79.0	-4.7
213	eduroam	2C:1A:05:6D:F7:A1	11	ax	-64.3	0.7
214	eduroam	D8:84:66:5A:67:09	1	ax	-60.0	5.0
215	eduroam	D8:84:66:5A:67:39	1	ax	-70.0	-5.0
216	eduroam	D8:84:66:5A:5B:D9	1	ax	-82.0	-17.0
217	@MSU-Net Plus	2C:1A:05:6D:F5:4D	52	ax	-76.3	1.7
218	eduroam	2C:1A:05:6D:F5:4E	52	ax	-74.0	4.0
219	@MSU-Net	2C:1A:05:6D:F5:4F	52	ax	-74.0	4.0
220	@MSU-Net Plus	D8:84:66:5A:5B:D2	112	ax	-91.0	-13.0
221	@MSU-Net	D8:84:66:5A:5B:D0	112	ax	-90.0	-12.0
222	@MSU-Net Plus	D8:84:66:5A:56:B1	100	ax	-82.3	7.7
223	@MSU-Net Plus	9C:D5:7D:03:45:AD	52	ax	-94.0	-20.0
224	eduroam	24:1F:BD:73:F5:92	52	ax	-74.3	3.7
225	@MSU-Net	24:1F:BD:73:F5:91	52	ax	-79.7	-1.7
226	@MSU-Net Plus	24:1F:BD:73:F5:90	52	ax	-75.0	3.0
227	@MSU-Net	2C:1A:05:6D:F5:40	11	ax	-50.0	5.0
228	@MSU-Net Plus	2C:1A:05:6D:F5:42	11	ax	-50.0	5.0
229	eduroam	2C:1A:05:6D:F5:41	11	ax	-49.0	6.0
230	@MSU-Net Plus	D8:84:66:5A:67:0A	1	ax	-63.3	1.3
231	eduroam	24:1F:BD:74:70:12	161	ax	-73.0	5.3
232	@MSU-Net	24:1F:BD:74:70:11	161	ax	-73.0	5.3
233	@MSU-Net Plus	2C:1A:05:6C:FF:6D	124	ax	-63.3	24.7
234	eduroam	2C:1A:05:6C:FF:6E	124	ax	-64.3	23.7
235	@MSU-Net	2C:1A:05:6C:FF:6F	124	ax	-64.3	23.7
236	@MSU-Net	9C:D5:7D:05:07:8F	124	ax	-83.0	-5.0
237	@MSU-Net	2C:1A:05:6D:B9:0F	100	ax	-93.0	-21.7
238	eduroam	24:1F:BD:73:FB:F2	52	ax	-79.0	-1.0
239	@MSU-Net Plus	24:1F:BD:74:70:00	1	ax	-63.3	1.3
240	@MSU-Net	2C:1A:05:6C:FF:60	11	ax	-61.7	10.7
241	@MSU-Net Plus	2C:1A:05:6C:FF:62	11	ax	-61.3	11.0
242	eduroam	2C:1A:05:6C:FF:61	11	ax	-61.7	10.7
243	@MSU-Net Plus	D8:84:66:5A:63:C9	1	ax	-71.0	-18.3
244	eduroam	D8:84:66:5A:56:BA	1	ax	-60.0	4.7
245	@MSU-Net Plus	D8:84:66:5A:56:B9	1	ax	-61.0	-8.3
246	@MSU-Net	D8:84:66:5A:56:B8	1	ax	-58.0	6.7
247	@MSU-Net Plus	2C:1A:05:6D:68:0D	120	ax	-45.0	44.0
248	@MSU-Net Plus	9C:D5:7D:03:89:ED	100	ax	-79.0	5.0
249	AIS SMART Login	74:3E:2B:3E:71:49	11	ac	-83.0	-10.7
250	@MSU-Net Plus	9C:D5:7D:03:95:42	11	ax	-74.0	-1.7
251	eduroam	9C:D5:7D:03:95:41	11	ax	-76.0	-3.7
252	@MSU-Net	2C:1A:05:6D:68:00	1	ax	-41.7	25.0
253	@MSU-Net Plus	9C:D5:7D:05:79:E2	1	ax	-68.0	-7.3
254	eduroam	9C:D5:7D:05:79:E1	1	ax	-68.0	-7.3
255	@MSU-Net	9C:D5:7D:03:86:EF	64	ax	-89.0	0.0
256	@MSU-Net Plus	2C:1A:05:6D:68:02	1	ax	-39.0	27.7
257	eduroam	2C:1A:05:6D:68:01	1	ax	-41.7	25.0
258	@MSU-Net Plus	9C:D5:7D:05:79:ED	40	ax	-90.3	-7.3
259	eduroam	9C:D5:7D:05:79:EE	40	ax	-90.7	-7.7
260	@MSU-Net	9C:D5:7D:05:79:EF	40	ax	-90.7	-7.7
261	@MSU-Net	9C:D5:7D:03:95:40	11	ax	-81.0	-8.7
262	@MSU-Net	9C:D5:7D:05:79:E0	1	ax	-68.0	-7.3
263	@MSU-Net Plus	9C:D5:7D:03:95:4D	100	ax	-85.0	5.0
264	@MSU-Net	9C:D5:7D:03:95:4F	100	ax	-84.0	6.0
265	@MSU-Net Plus	9C:D5:7D:03:86:ED	64	ax	-88.0	-4.0
266	eduroam	9C:D5:7D:03:86:EE	64	ax	-88.0	-4.0

Table S3: Continue

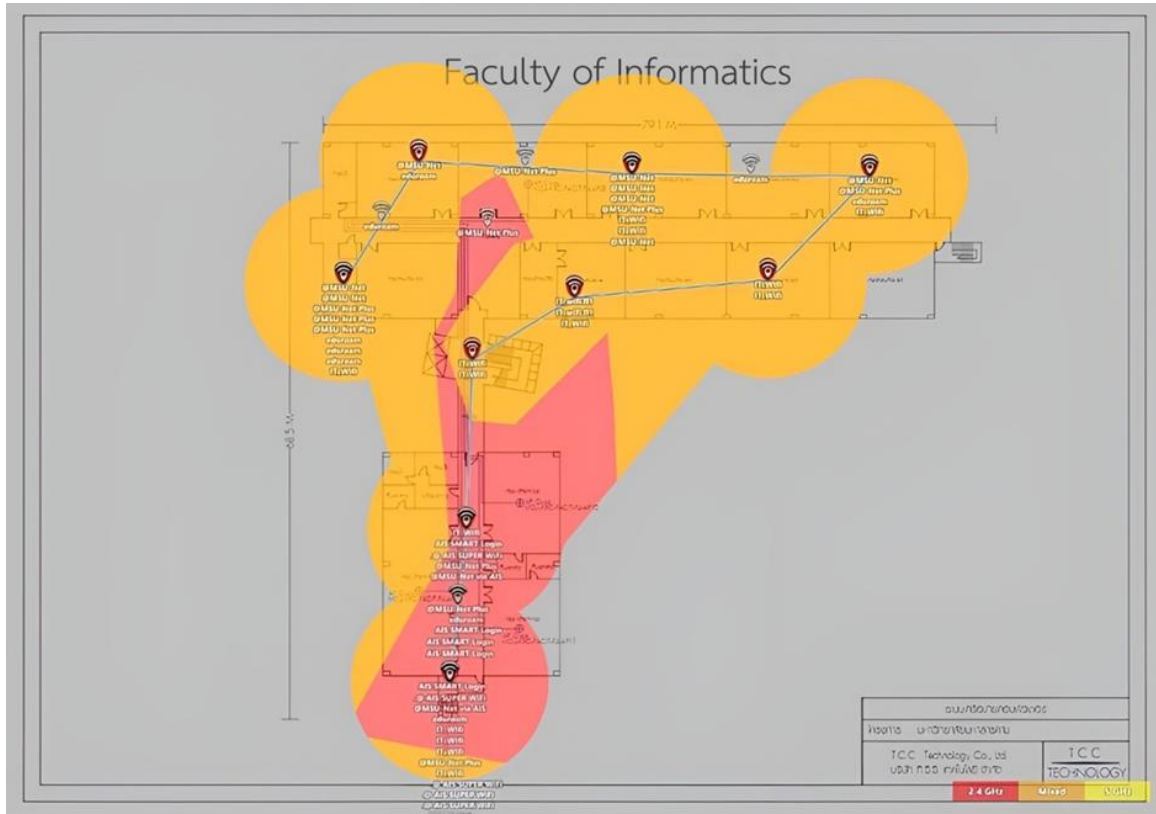
267	eduroam	D8:84:66:5A:55:89	1	ax	-74.0	-9.3
268	@MSU-Net Plus	9C:D5:7D:05:07:ED	124	ax	-83.0	-5.0
269	@MSU-Net	9C:D5:7D:05:07:EF	124	ax	-82.0	-4.0
270	@MSU-Net	9C:D5:7D:06:89:0F	124	ax	-79.0	3.0
271	eduroam	2C:1A:05:6D:68:0E	120	ax	-44.7	44.3
272	@MSU-Net	2C:1A:05:6D:68:0F	120	ax	-44.7	44.3
273	eduroam	9C:D5:7D:03:95:4E	100	ax	-86.0	4.0
274	eduroam	9C:D5:7D:03:89:EE	100	ax	-80.0	4.0
275	@MSU-Net	9C:D5:7D:03:89:EF	100	ax	-80.5	3.5
276	@MSU-Net via AIS	74:3E:2B:BE:70:B8	1	ac	-87.0	-22.3
277	@MSU-Net Plus	74:3E:2B:7E:70:B8	1	ax	-85.0	-20.3
278	@MSU-Net	24:1F:BD:73:FD:C1	1	ax	-62.0	2.7
279	@MSU-Net Plus	24:1F:BD:73:FD:C0	1	ax	-61.3	3.3
280	@MSU-Net	24:1F:BD:74:6A:61	1	ax	-64.0	0.7
281	@MSU-Net Plus	9C:D5:7D:06:89:0D	124	ax	-78.0	4.0
282	eduroam	9C:D5:7D:05:07:EE	124	ax	-86.3	-8.3
283	@MSU-Net	9C:D5:7D:03:C2:2F	100	ax	-84.0	7.0
284	@MSU-Net Plus	D8:84:66:5A:55:82	64	ax	-90.0	-6.0
285	eduroam	D8:84:66:5A:55:81	64	ax	-89.0	4.0
286	@MSU-Net	D8:84:66:5A:55:80	64	ax	-88.0	-5.0
287	@MSU-Net Plus	9C:D5:7D:06:4E:6D	52	ax	-90.0	-4.0
288	eduroam	9C:D5:7D:03:45:AE	52	ax	-92.0	-7.0
289	@MSU-Net	9C:D5:7D:03:45:AF	52	ax	-90.0	-23.0
290	AIS SMART Login	74:3E:2B:3E:7C:69	6	ac	-82.0	-21.0
291	eduroam	24:1F:BD:73:FD:C2	1	ax	-62.7	-10.7
292	eduroam	24:1F:BD:73:FB:E2	1	ax	-62.3	2.0
293	@MSU-Net	24:1F:BD:73:FB:E1	1	ax	-62.0	2.3
294	@MSU-Net	24:1F:BD:73:FB:F1	52	ax	-79.0	2.7
295	@MSU-Net Plus	24:1F:BD:73:FB:F0	52	ax	-79.7	-2.3
296	@MSU-Net Plus	24:1F:BD:73:FB:E0	1	ax	-61.7	-3.0
297	eduroam	24:1F:BD:74:6A:62	1	ax	-64.0	3.0
298	@MSU-Net Plus	24:1F:BD:74:6A:60	1	ax	-64.0	0.7
299	@MSU-Net	9C:D5:7D:06:4E:6F	52	ax	-93.0	-3.3
300	eduroam	9C:D5:7D:06:4E:6E	52	ax	-92.0	-10.3
301	eduroam	24:1F:BD:73:FC:A2	1	ax	-9.3	-9.3
302	@MSU-Net Plus	24:1F:BD:73:FC:A0	1	ax	-11.3	-11.3
303	@MSU-Net Plus	9C:D5:7D:03:C2:2D	100	ax	-70.0	2.0
304	eduroam	9C:D5:7D:03:C2:2E	100	ax	-72.0	3.0
305	eduroam	74:3E:2B:FE:7C:6C	153	ax	-89.0	-8.3
306	@MSU-Net via AIS	74:3E:2B:BE:7C:6C	153	ac	-88.0	-7.3
307	@MSU-Net Plus	74:3E:2B:7E:7C:6C	153	ax	-88.0	-8.3
308	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:7C:6C	153	ac	-87.0	-8.3
309	@MSU-Net Plus	24:1F:BD:73:FA:C0	11	ax	-88.0	-35.0
310	@MSU-Net Plus	74:3E:2B:7E:7C:68	6	ax	-88.0	-19.0
311	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:7C:68	6	ac	-81.0	-19.0
312	AIS SMART Login	74:3E:2B:3E:7C:6D	153	ac	-83.0	-8.3
313	eduroam	24:1F:BD:73:F5:82	11	ax	-83.0	-35.0
314	@MSU-Net Plus	24:1F:BD:73:F5:80	11	ax	-88.0	-32.0
315	@MSU-Net	24:1F:BD:73:F5:81	11	ax	-81.0	-30.0
316	eduroam	24:1F:BD:73:FC:B2	100	ax	-78.0	12.0
317	@MSU-Net	24:1F:BD:73:FC:B1	100	ax	-84.0	13.0
318	@MSU-Net Plus	24:1F:BD:73:FC:B0	100	ax	-83.0	-14.5
319	@MSU-Net	24:1F:BD:73:FC:A1	1	ax	-71.5	-23.0
320	eduroam	24:1F:BD:74:66:42	1	ax	-80.0	1.0
321	eduroam	24:1F:BD:74:6A:72	52	ax	-83.0	-26.0
322	@MSU-Net	24:1F:BD:74:66:41	1	ax	-83.0	1.0
323	@MSU-Net	24:1F:BD:74:6A:71	52	ax	-83.0	1.5
324	@MSU-Net Plus	24:1F:BD:74:6A:70	52	ax	-82.5	-22.0
325	@MSU-Net Plus	24:1F:BD:74:66:40	1	ax	-79.0	12.0



(a)



(b)



(c)

Fig. S4: Power levels decibel-milliwatts (dBm) in the faculty of informatics; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S4: Survey results of the number of access points (faculty of public health)

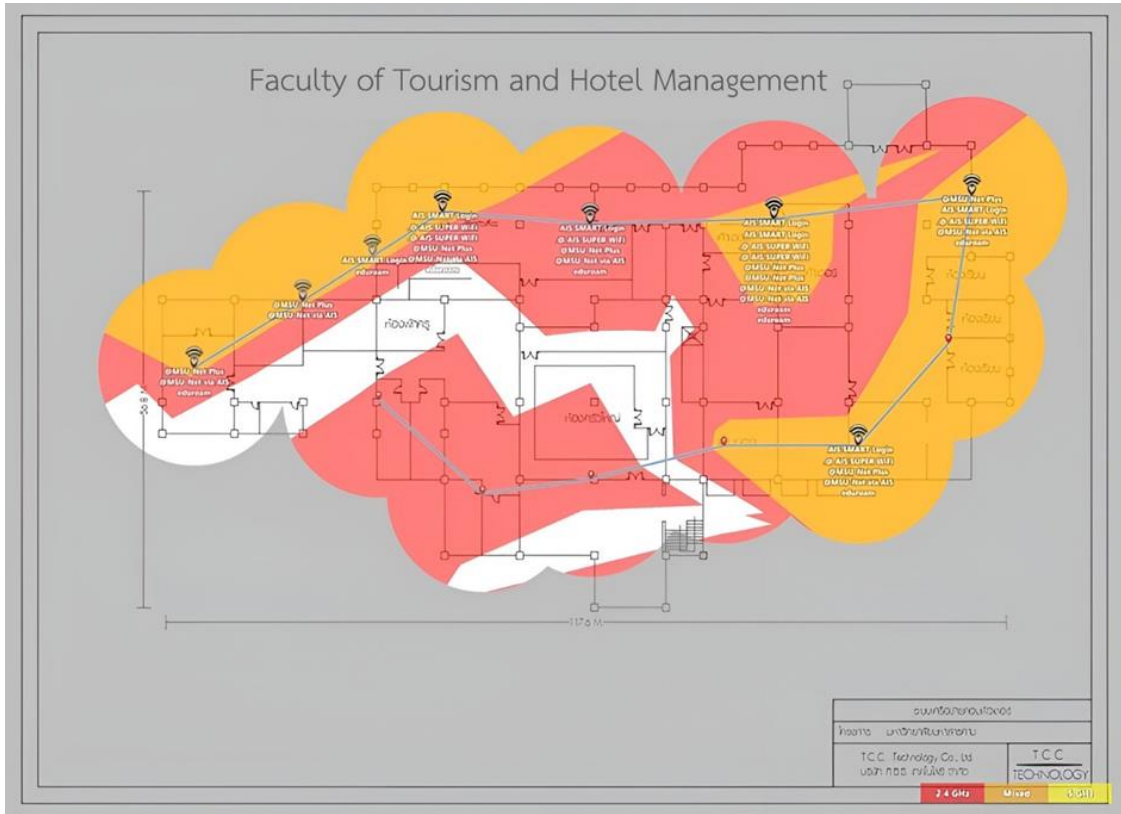
	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	eduroam	74:3E:2B:FF:0F:7C	153	ax	-80.0	3.0
2	@MSU-Net Plus	2C:1A:05:6D:67:8D	100	ax	-65.7	22.3
3	AIS SMART Login	74:3E:2B:3F:0F:0D	161	ac	-73.0	13.0
4	@MSU-Net Plus	74:3E:2B:7E:B9:48	11	ax	-68.0	-4.0
5	AP6	68:D7:9A:0D:1A:7E	44	ac	-74.3	12.7
6	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:0C	161	ac	-70.0	18.3
7	AIS SMART Login	74:3E:2B:3E:B9:4D	44	ac	-84.7	-5.7
8	AP3	68:D7:9A:0D:17:16	36	ac	-44.3	44.7
9	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:7C	153	ac	-80.0	3.0
10	AP4	6A:D7:9A:0D:17:16	36	ac	-44.3	44.7
11	AP3	68:D7:9A:0C:17:16	1	ac	-42.3	32.7
12	@MSU-Net via AIS	74:3E:2B:BF:0F:7C	153	ac	-81.0	2.0
13	@MSU-Net via AIS	74:3E:2B:BF:0F:78	11	ac	-59.3	8.7
14	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:78	11	ac	-60.0	8.0
15	eduroam	74:3E:2B:FF:69:48	6	ax	-74.0	-10.3
16	@MSU-Net	2C:1A:05:6D:67:80	1	ax	-52.0	12.7
17	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:B9:48	11	ac	-64.7	-0.7
18	eduroam	D8:84:66:5A:5C:FA	1	ax	-51.7	16.3
19	@MSU-Net Plus	74:3E:2B:7F:0F:78	11	ax	-59.0	9.0
20	@MSU-Net	D8:84:66:5A:65:D1	112	ax	-53.0	43.0
21	eduroam	74:3E:2B:FF:0F:78	11	ax	-59.7	5.3
22	@MSU-Net via AIS	74:3E:2B:BF:0F:0C	161	ac	-71.3	14.7
23	eduroam	74:3E:2B:FF:0F:08	6	ax	-61.7	7.3
24	@MSU-Net via AIS	74:3E:2B:BF:69:28	1	ac	-72.0	-6.0
25	@MSU-Net	2C:1A:05:6D:67:8F	100	ax	-64.0	24.0

Table S4: Continue

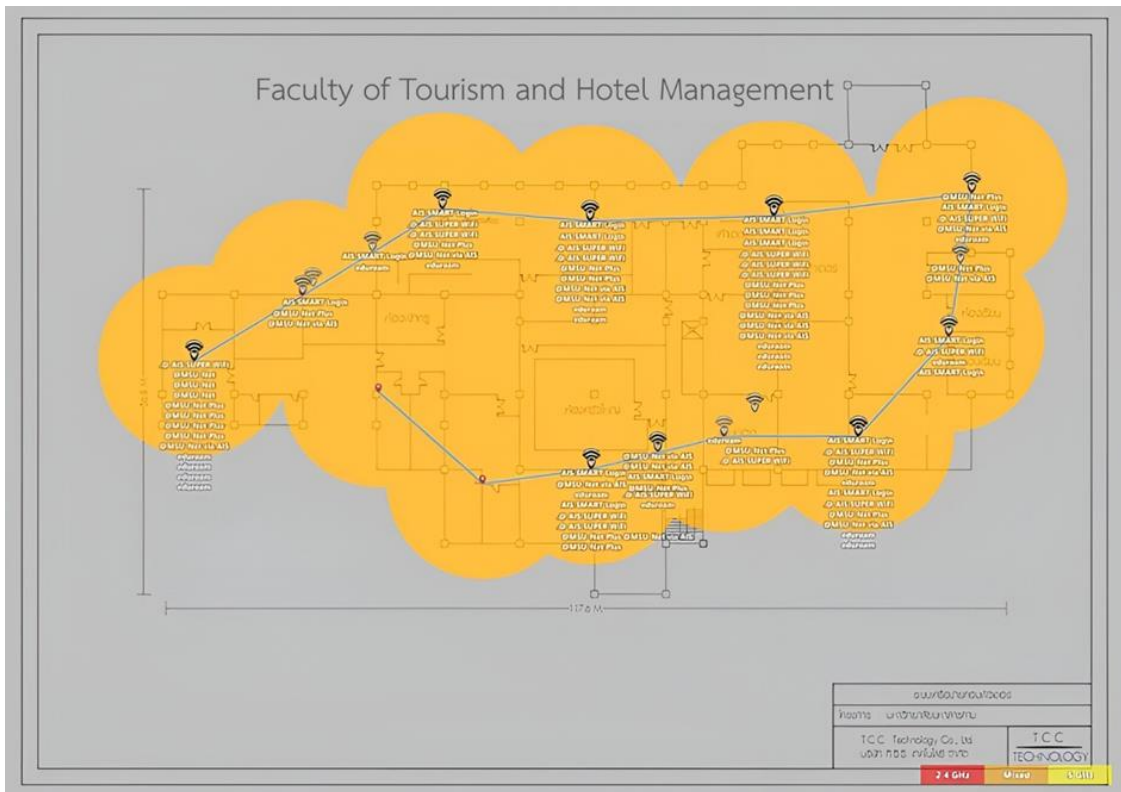
26	@MSU-Net	2C:1A:05:6D:B0:0F	64	ax	-72.3	23.7
27	@MSU-Net Plus	2C:1A:05:6D:B0:02	1	ax	-53.0	25.7
28	@MSU-Net Plus	74:3E:2B:7F:0F:7C	153	ax	-80.0	3.0
29	eduroam	74:3E:2B:FE:B9:4C	44	ax	-84.0	-5.0
30	@MSU-Net Plus	74:3E:2B:7F:0F:0C	161	ax	-71.3	14.7
31	@MSU-Net	D8:84:66:5A:67:50	100	ax	-89.3	-5.3
32	@MSU-Net	2C:1A:05:6D:66:20	1	ax	-68.0	7.0
33	@MSU-Net Plus	2C:1A:05:6D:B0:0D	64	ax	-72.7	23.3
34	AP4	6A:D7:9A:0D:17:47	36	ac	-69.0	11.3
35	@MSU-Net Plus	2C:1A:05:6D:A0:42	6	ax	-61.0	8.0
36	@MSU-Net	D8:84:66:5A:54:B9	1	ax	-66.0	5.0
37	@MSU-Net via AIS	74:3E:2B:BE:B9:4C	44	ac	-83.7	-4.7
38	eduroam	2C:1A:05:6D:A0:41	6	ax	-61.0	8.0
39	@MSU-Net via AIS	74:3E:2B:BE:B9:48	11	ac	-67.3	-3.3
40	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:08	6	ac	-64.3	4.7
41	eduroam	74:3E:2B:FF:69:28	1	ax	-73.0	-7.0
42	@PH-WI-FI	A8:5B:F7:8F:F7:C0	11	ax	-75.0	-8.3
43	@MSU-Net via AIS	74:3E:2B:BF:0F:08	6	ac	-64.3	4.7
44	@MSU-Net	2C:1A:05:6D:A6:EF	124	ax	-62.5	33.5
45	AIS SMART Login	74:3E:2B:3F:0F:79	11	ac	-60.0	8.0
46	@MSU-Net Plus	74:3E:2B:7F:0F:08	6	ax	-64.0	5.0
47	@MSU-Net Plus	D8:84:66:5A:54:BA	1	ax	-69.5	1.5
48	eduroam	2C:1A:05:6D:66:2E	124	ax	-64.3	25.0
49	@MSU-Net Plus	D8:84:66:5A:67:51	100	ax	-89.3	-5.3
50	AP4	6A:D7:9A:0C:17:16	1	ac	-43.0	32.0
51	@MSU-Net	2C:1A:05:6D:A0:40	6	ax	-61.7	7.3
52	@MSU-Net Plus	D8:84:66:5A:5C:F9	1	ax	-51.7	16.3
53	AP8	68:D7:9A:0D:19:EC	149	ac	-75.0	9.7
54	@MSU-Net Plus	74:3E:2B:7F:69:28	1	ax	-72.3	-6.3
55	@MSU-Net Plus	D8:84:66:5A:65:D2	112	ax	-53.0	43.0
56	eduroam	2C:1A:05:6D:67:8E	100	ax	-63.0	25.0
57	@PH-WI-FI	A8:5B:F7:8E:86:70	52	ax	-82.0	-2.7
58	@MSU-Net	D8:84:66:5A:5C:F0	100	ax	-64.3	26.7
59	eduroam	2C:1A:05:6D:B0:0E	64	ax	-72.0	24.0
60	eduroam	2C:1A:05:6D:B0:01	1	ax	-53.3	25.3
61	eduroam	D8:84:66:5A:5C:F2	100	ax	-64.3	26.7
62	@MSU-Net Plus	2C:1A:05:6D:A0:4D	52	ax	-79.7	9.3
63	eduroam	D8:84:66:5A:65:D0	112	ax	-52.7	43.3
64	@MSU-Net Plus	2C:1A:05:6D:66:2D	124	ax	-64.7	24.7
65	@MSU-Net Plus	74:3E:2B:7E:B9:4C	44	ax	-83.7	-4.7
66	@MSU-Net Plus	2C:1A:05:6D:A6:ED	124	ax	-62.5	33.5
67	AP4	6A:D7:9A:0C:17:47	11	ac	-55.0	13.0
68	AIS SMART Login	74:3E:2B:3E:B9:49	11	ac	-67.7	-3.7
69	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:B9:4C	44	ac	-84.0	-5.0
70	@MSU-Net Plus	D8:84:66:5A:5C:F1	100	ax	-64.7	26.3
71	@MSU-Net Plus	2C:1A:05:6D:67:82	1	ax	-52.0	12.7
72	eduroam	74:3E:2B:FE:B9:48	11	ax	-67.3	-2.3
73	eduroam	2C:1A:05:6D:A0:4E	52	ax	-78.0	11.0
74	@MSU-Net	2C:1A:05:6D:66:2F	124	ax	-64.3	25.0
75	AP10	68:D7:9A:0D:1A:A5	44	ac	-67.0	20.0
76	@MSU-Net	2C:1A:05:6D:A0:4F	52	ax	-79.3	9.7
77	AP6	68:D7:9A:0C:1A:7E	6	ac	-62.7	6.3
78	@PH-WI-FI	A8:5B:F7:90:02:B0	52	ax	-89.0	2.0
79	eduroam	2C:1A:05:6D:67:81	1	ax	-52.0	12.7
80	eduroam	2C:1A:05:6D:A6:EE	124	ax	-62.5	33.5
81	AIS SMART Login	74:3E:2B:3F:0F:7D	153	ac	-80.0	3.0
82	@MSU-Net	D8:84:66:5A:5C:F8	1	ax	-52.0	16.0
83	eduroam	2C:1A:05:6D:66:21	1	ax	-64.7	10.3
84	eduroam	D8:84:66:5A:67:52	100	ax	-91.0	-7.0
85	@MSU-Net	D8:84:66:5A:67:58	1	ax	-68.3	-7.8

Table S4: Continue

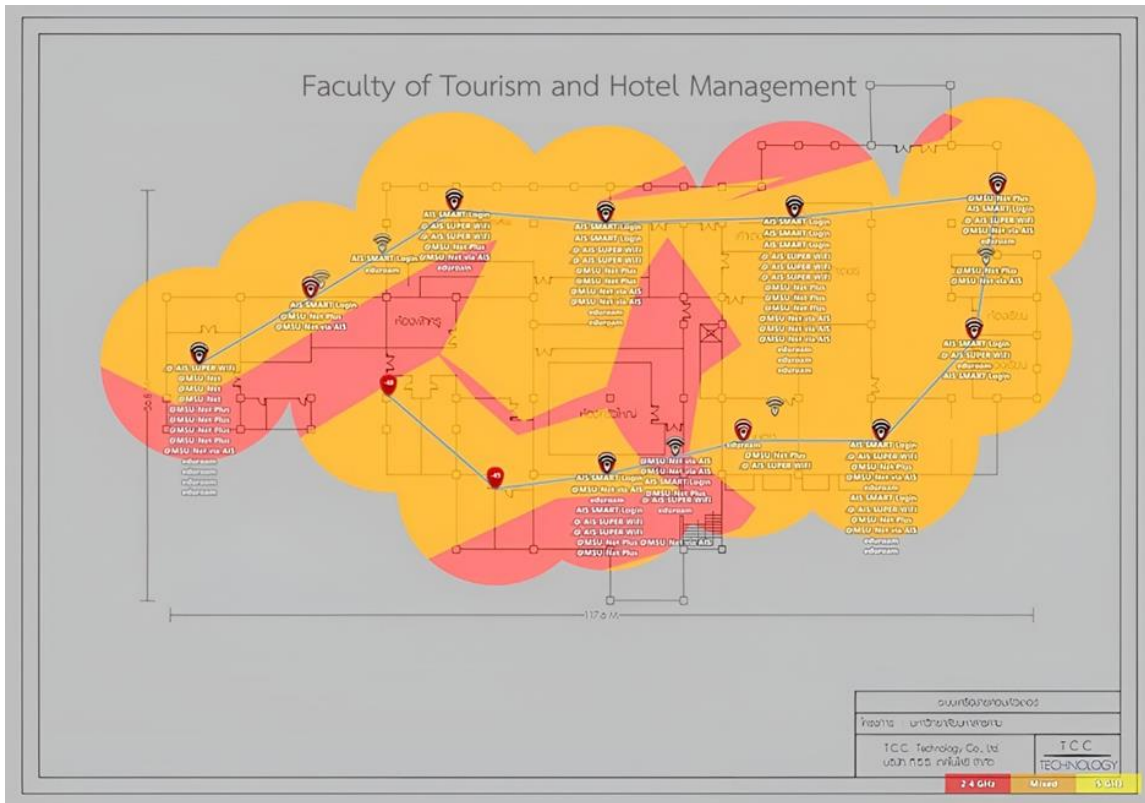
86	AP2	68:D7:9A:0D:17:47	36	ac	-69.0	11.3
87	AIS SMART Login	74:3E:2B:3F:0F:09	6	ac	-58.7	10.3
88	@MSU-Net Plus	2C:1A:05:6D:66:22	1	ax	-61.0	-0.5
89	AP4	6A:D7:9A:0C:1A:EA	6	ac	-62.3	6.7
90	AIS SMART Login	74:3E:2B:3F:10:38	1	ac	-80.0	-27.0
91	@MSU-Net	2C:1A:05:6D:A6:E0	6	ax	-53.7	24.3
92	@MSU-Net Plus	D8:84:66:5A:67:59	1	ax	-70.0	-9.5
93	AP8	68:D7:9A:0C:19:EC	11	ac	-73.0	-9.0
94	eduroam	2C:1A:05:6D:A6:E1	6	ax	-54.0	24.0
95	@MSU-Net Plus	74:3E:2B:7F:69:48	6	ax	-72.3	-17.0
96	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:48	6	ac	-73.0	-17.7
97	@MSU-Net	D8:84:66:5A:65:D9	1	ax	-58.0	8.0
98	@MSU-Net Plus	D8:84:66:5A:65:DA	1	ax	-43.0	23.0
99	@MSU-Net via AIS	74:3E:2B:BF:69:48	6	ac	-72.0	-16.7
100	@MSU-Net	D8:84:66:5A:54:B1	112	ax	-78.3	-0.3
101	eduroam	D8:84:66:5A:54:B0	112	ax	-78.3	-0.3
102	eduroam	D8:84:66:5A:67:5A	1	ax	-68.0	-7.5
103	@MSU-Net via AIS	74:3E:2B:BF:10:38	1	ac	-81.0	-28.7
104	@MSU-Net Plus	74:3E:2B:7F:10:38	1	ax	-77.0	-16.5
105	eduroam	74:3E:2B:FF:0F:0C	161	ax	-71.7	14.3
106	AIS SMART Login	74:3E:2B:3F:69:29	1	ac	-75.0	-22.7
107	@MSU-Net Plus	D8:84:66:5A:54:B2	112	ax	-78.7	-0.7
108	AIS SMART Login	74:3E:2B:3F:69:49	6	ac	-71.0	-15.7
109	AIS SMART Login	74:3E:2B:3F:69:4D	40	ac	-92.0	-14.0
110	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:2C	48	ac	-80.7	-2.7
111	@MSU-Net Plus	74:3E:2B:7F:69:4C	40	ax	-91.0	-13.0
112	eduroam	74:3E:2B:FF:69:4C	40	ax	-91.0	-13.0
113	eduroam	74:3E:2B:FF:1A:B8	1	ax	-84.0	-30.3
114	@PH-WI-FI	A8:5B:F7:8F:D5:70	100	ax	-91.0	-1.7
115	@MSU-Net via AIS	74:3E:2B:BF:69:4C	40	ac	-91.0	-13.0
116	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:4C	40	ac	-92.0	-14.0
117	@MSU-Net via AIS	74:3E:2B:BF:69:2C	48	ac	-80.3	-2.3
118	eduroam	74:3E:2B:FF:69:2C	48	ax	-80.7	-2.7
119	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:28	1	ac	-71.0	-5.0
120	AIS SMART Login	74:3E:2B:3F:69:2D	48	ac	-81.0	-3.0
121	@MSU-Net Plus	74:3E:2B:7F:69:2C	48	ax	-80.7	-2.7
122	@MSU-Net via AIS	74:3E:2B:BF:1A:B8	1	ac	-80.0	-19.5
123	@MSU-Net Plus	74:3E:2B:7F:1A:B8	1	ax	-78.0	-17.5
124	AP1	68:D7:9A:0D:1A:EA	157	ac	-77.0	9.0
125	AP4	6A:D7:9A:0D:1A:EA	157	ac	-77.0	9.0
126	@MSU-Net	2C:1A:05:6D:B0:00	1	ax	-52.3	26.3
127	eduroam	D8:84:66:5A:54:B8	1	ax	-66.3	4.7
128	eduroam	D8:84:66:5A:65:D8	1	ax	-73.0	-7.0
129	AP2	68:D7:9A:0C:17:47	11	n	-51.0	17.0
130	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:8C:58	1	ac	-84.0	-9.0
131	AP1	68:D7:9A:0C:1A:EA	6	ac	-54.0	12.3
132	@PH-WI-FI	A8:5B:F7:8F:F7:D0	116	ax	-88.0	-11.7
133	@PH-WI-FI	A8:5B:F7:90:02:A0	2	ax	-73.0	-12.5
134	AP7	68:D7:9A:0C:1B:74	6	n	-70.7	-1.7
135	AP7	68:D7:9A:0D:1B:74	149	ac	-78.0	18.0
136	AP10	68:D7:9A:0C:1A:A5	11	ac	-51.0	17.0
137	@PH-WI-FI	A8:5B:F7:90:24:E0	1	ax	-78.0	-11.3
138	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:11:48	6	n	-79.0	-25.3
139	@MSU-Net via AIS	74:3E:2B:BF:11:48	6	n	-79.0	-25.3
140	eduroam	74:3E:2B:FF:1F:18	6	ax	-80.7	-9.3
141	AIS SMART Login	74:3E:2B:3F:11:49	6	n	-83.0	-11.7
142	eduroam	74:3E:2B:FF:11:48	6	ax	-84.0	-12.7
143	@MSU-Net Plus	2C:1A:05:6D:A6:E2	6	ax	-57.0	21.0
144	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:1F:18	6	n	-80.3	-9.0
145	@MSU-Net via AIS	74:3E:2B:BF:1F:18	6	n	-78.0	-6.7
146	@MSU-Net Plus	74:3E:2B:7F:1F:18	6	ax	-79.0	-7.7
147	@PH-WI-FI	A8:5B:F7:8F:B8:C0	11	ax	-85.0	-3.0
148	AIS SMART Login	74:3E:2B:3F:1F:19	6	n	-79.0	-7.7



(a)



(b)



(c)

Fig. S5: Power levels decibel-milliwatts (dBm) in the faculty of tourism and hotel management; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S5: Survey results of the number of access points (faculty of architecture, urban design and creative arts)

	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	@MSU-Net	9C:D5:7D:03:F9:0F	161	ax	1.0	20.0
2	eduroam	9C:D5:7D:03:F9:0E	161	ax	2.0	20.0
3	@MSU-Net Plus	9C:D5:7D:03:F9:0D	161	ax	3.0	20.0
4	eduroam	9C:D5:7D:04:9B:AE	36	ax	4.0	-11.0
5	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:75:98	1	n	5.0	2.8
6	eduroam	20:9E:F7:6B:02:12	52	ax	6.0	7.0
7	@MSU-Net	20:9E:F7:6B:02:11	52	ax	7.0	7.0
8	AIS SMART Login	74:3E:2B:3E:99:89	11	ac	8.0	2.7
9	eduroam	74:3E:2B:FE:99:88	11	ax	9.0	-0.7
10	@MSU-Net via AIS	74:3E:2B:BE:99:88	11	ac	10.0	0.0
11	@MSU-Net Plus	74:3E:2B:7E:99:88	11	ax	11.0	-1.0
12	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:99:88	11	n	12.0	3.7
13	@MSU-Net Plus	74:3E:2B:7E:75:98	1	ax	-71.3	3.2
14	AIS SMART Login	74:3E:2B:3E:53:39	1	ac	-75.0	-0.5
15	eduroam	74:3E:2B:FE:53:38	1	ax	-78.7	-4.2
16	@MSU-Net via AIS	74:3E:2B:BE:53:38	1	ac	-77.7	-3.2
17	@MSU-Net Plus	74:3E:2B:7E:53:38	1	ax	-75.7	-1.2
18	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:53:38	1	n	-77.3	-2.8
19	@MSU-Net Plus	D8:84:66:5A:56:A2	104	ax	-78.0	18.0
20	AIS SMART Login	74:3E:2B:3E:B8:CD	36	ac	-88.0	1.7
21	eduroam	74:3E:2B:FE:B8:CC	36	ax	-88.0	1.7
22	@MSU-Net via AIS	74:3E:2B:BE:B8:CC	36	ac	-88.0	1.7
23	@MSU-Net Plus	74:3E:2B:7E:B8:CC	36	ax	-89.0	0.7
24	@MSU-Net	D8:84:66:5A:56:A0	104	ax	-78.0	18.0

Table S5: Continue

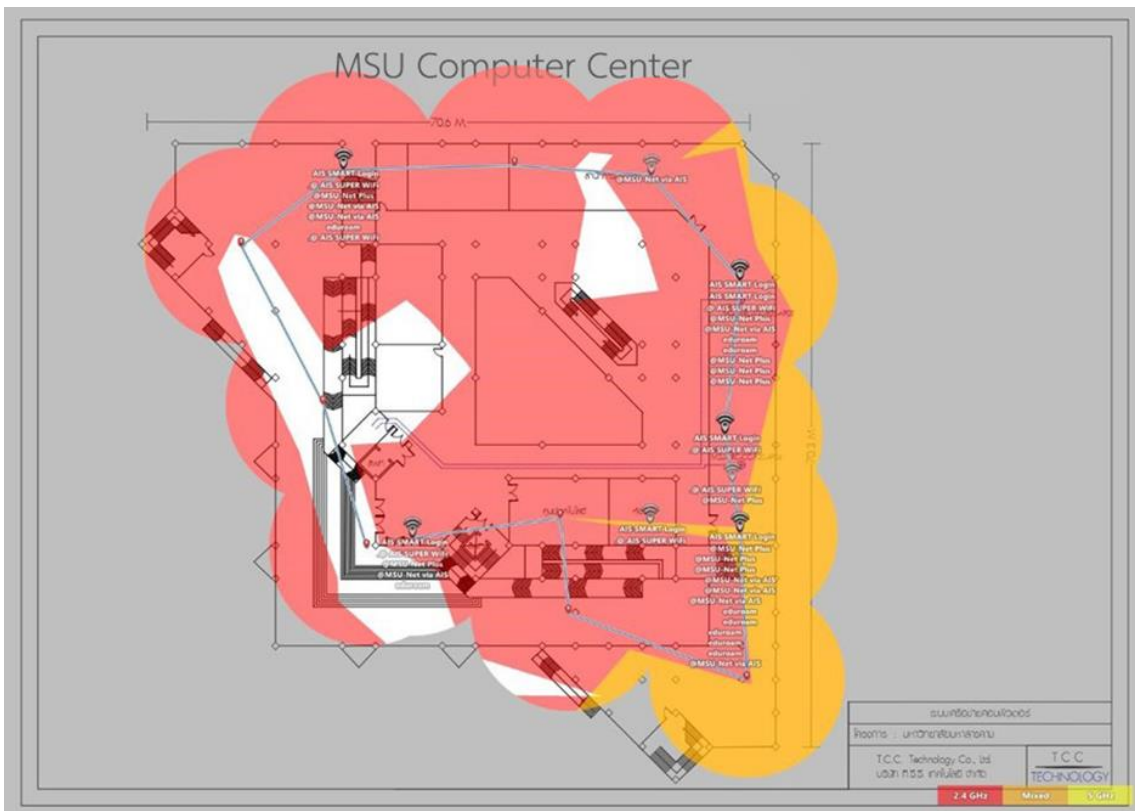
25	eduroam	74:3E:2B:FE:C8:08	6	ax	-71.0	6.0
26	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:C8:08	6	n	-72.0	5.0
27	eduroam	D8:84:66:5A:56:A1	104	ax	-78.0	18.0
28	eduroam	D8:84:66:5A:54:31	64	ax	-82.0	2.0
29	@MSU-Net	D8:84:66:5A:54:30	64	ax	-82.0	2.0
30	@MSU-Net Plus	D8:84:66:5A:54:32	64	ax	-83.0	1.0
31	@MSU-Net Plus	20:9E:F7:6B:02:10	52	ax	-84.7	6.3
32	@MSU-Net Plus	20:9E:F7:6B:02:00	6	ax	-70.0	6.0
33	AIS SMART Login	74:3E:2B:3E:C8:09	6	ac	-70.0	6.0
34	@MSU-Net via AIS	74:3E:2B:BE:C8:08	6	ac	-71.3	5.7
35	@MSU-Net Plus	74:3E:2B:7E:C8:08	6	ax	-70.3	6.7
36	eduroam	20:9E:F7:6B:02:02	6	ax	-70.0	6.0
37	@MSU-Net	20:9E:F7:6B:02:01	6	ax	-70.0	6.0
38	eduroam	D8:84:66:5A:54:39	1	ax	-73.0	4.0
39	@MSU-Net Plus	D8:84:66:5A:54:3A	1	ax	-65.0	12.0
40	@MSU-Net	D8:84:66:5A:54:38	1	ax	-62.0	15.0
41	@MSU-Net via AIS	74:3E:2B:BE:53:3C	157	ac	-88.0	-11.7
42	@MSU-Net Plus	74:3E:2B:7E:53:3C	157	ax	-90.0	-13.7
43	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:53:3C	157	ac	-90.0	-13.7
44	@MSU-Net	9C:D5:7D:03:89:AF	124	ax	-89.0	-2.0
45	@MSU-Net	9C:D5:7D:03:DC:0F	124	ax	-87.5	1.5
46	eduroam	9C:D5:7D:03:89:AE	124	ax	-89.0	-2.0
47	@MSU-Net Plus	9C:D5:7D:03:89:AD	124	ax	-89.0	-2.0
48	AIS SMART Login	74:3E:2B:3E:75:9D	40	ac	-89.0	2.0
49	eduroam	74:3E:2B:FE:75:9C	40	ax	-87.0	4.0
50	@MSU-Net via AIS	74:3E:2B:BE:75:9C	40	ac	-88.0	3.0
51	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:75:9C	40	ac	-88.0	3.0
52	AIS SMART Login	74:3E:2B:3E:53:3D	157	ac	-90.0	-13.7
53	eduroam	74:3E:2B:FE:53:3C	157	ax	-88.0	-11.7
54	@MSU-Net Plus	9C:D5:7D:03:DC:0D	124	ax	-87.0	2.0
55	@MSU-Net Plus	74:3E:2B:7E:75:9C	40	ax	-88.0	3.0
56	AIS SMART Login	74:3E:2B:3E:99:8D	36	ac	-92.0	0.0
57	eduroam	74:3E:2B:FE:99:8C	36	ax	-93.0	-1.0
58	@MSU-Net via AIS	74:3E:2B:BE:99:8C	36	ac	-92.0	0.0
59	@MSU-Net Plus	74:3E:2B:7E:99:8C	36	ax	-93.0	-1.0
60	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:99:8C	36	ac	-92.0	1.0
61	@MSU-Net via AIS	74:3E:2B:BE:4A:38	11	ac	-65.3	11.7
62	@MSU-Net Plus	74:3E:2B:7E:4A:38	11	ax	-63.3	13.7
63	AIS SMART Login	74:3E:2B:3E:B8:C9	11	ac	-63.3	10.7
64	eduroam	74:3E:2B:FE:B8:C8	11	ax	-67.0	7.0
65	@MSU-Net via AIS	74:3E:2B:BE:B8:C8	11	ac	-66.0	8.0
66	@MSU-Net Plus	74:3E:2B:7E:B8:C8	11	ax	-67.0	7.0
67	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:B8:C8	11	ac	-66.0	9.7
68	AIS SMART Login	74:3E:2B:3E:4A:39	11	ac	-67.7	10.7
69	eduroam	74:3E:2B:FE:4A:38	11	ax	-64.7	12.3
70	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:4A:38	11	ac	-63.3	15.7
71	@MSU-Net via AIS	74:3E:2B:BE:74:28	6	ac	-61.0	13.0
72	@MSU-Net Plus	74:3E:2B:7E:74:28	6	ax	-62.7	13.3
73	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:74:28	6	ac	-62.0	14.0
74	eduroam	74:3E:2B:FE:75:98	1	ax	-71.7	2.8
75	eduroam	74:3E:2B:FE:74:28	6	ax	-61.7	14.3
76	@MSU-Net Plus	2C:1A:05:6D:B1:4D	124	ax	-80.7	15.3
77	eduroam	2C:1A:05:6D:B1:4E	124	ax	-80.3	15.7
78	@MSU-Net	2C:1A:05:6D:B1:4F	124	ax	-85.3	10.7
79	AIS SMART Login	74:3E:2B:3D:A0:59	6	n	-80.0	-4.0
80	eduroam	74:3E:2B:FD:A0:58	6	ax	-81.0	-5.0

Table S5: Continue

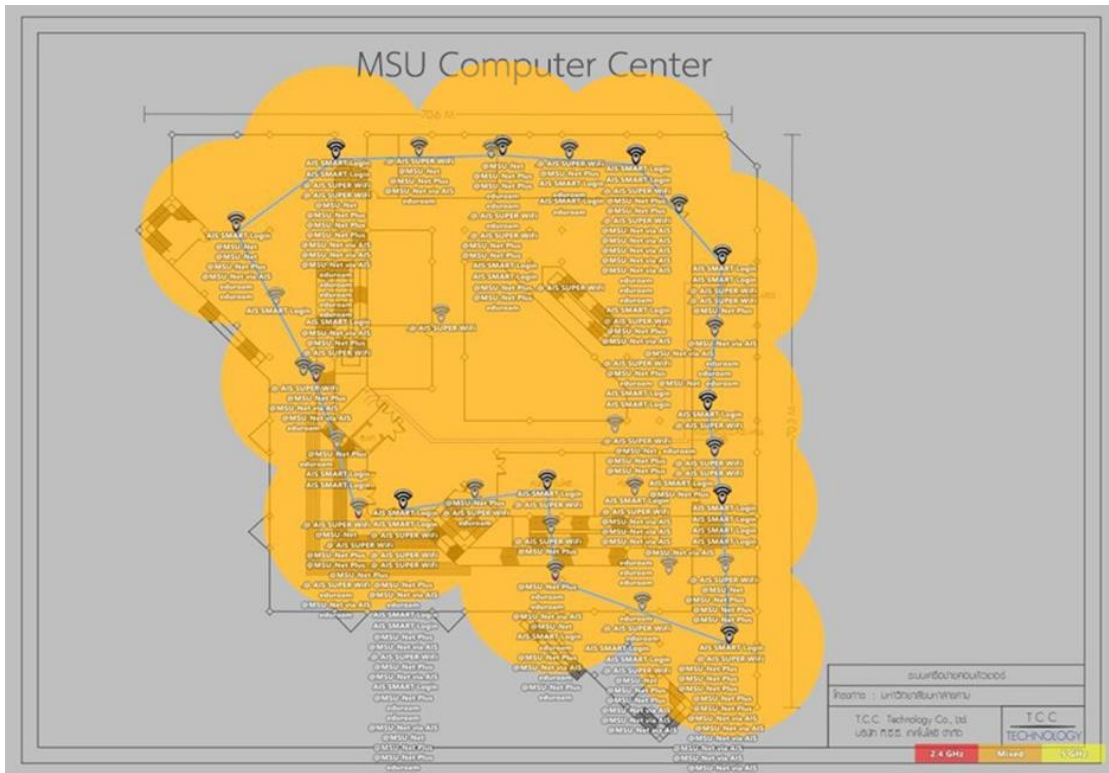
81	@MSU-Net via AIS	74:3E:2B:BD:A0:58	6	n	-82.0	-6.0
82	@MSU-Net Plus	74:3E:2B:7D:A0:58	6	ax	-81.0	-5.0
83	@MSU-Net Plus	00:DC:B2:1F:67:D0	116	ax	-88.0	2.0
84	@MSU-Net Plus	D8:84:66:5A:59:C9	1	ax	-55.0	19.5
85	@MSU-Net Plus	2C:1A:05:6D:B1:42	1	ax	-66.0	4.7
86	eduroam	2C:1A:05:6D:B1:41	1	ax	-64.3	6.3
87	@MSU-Net	2C:1A:05:6D:B1:40	1	ax	-65.3	5.3
88	@MSU-Net	D8:84:66:5A:59:C8	1	ax	-46.0	28.5
89	eduroam	00:DC:B2:1F:67:C2	1	ax	-70.3	-1.3
90	@MSU-Net	00:DC:B2:1F:67:C1	1	ax	-71.0	-2.0
91	eduroam	9C:D5:7D:03:FB:AE	64	ax	-69.7	26.3
92	@MSU-Net Plus	9C:D5:7D:03:FB:AD	64	ax	-69.0	27.0
93	@MSU-Net Plus	00:DC:B2:1F:67:C0	1	ax	-70.5	-1.5
94	@MSU-Net	9C:D5:7D:03:FB:AF	64	ax	-69.0	27.0
95	@MSU-Net	D8:84:66:5A:59:C0	104	ax	-57.0	36.0
96	eduroam	D8:84:66:5A:59:C2	104	ax	-57.0	36.0
97	AIS SMART Login	74:3E:2B:3E:C8:0D	44	ac	-87.0	3.0
98	eduroam	74:3E:2B:FE:C8:0C	44	ax	-87.0	3.7
99	@MSU-Net via AIS	74:3E:2B:BE:C8:0C	44	ac	-87.0	3.7
100	@MSU-Net Plus	74:3E:2B:7E:C8:0C	44	ax	-87.0	3.7
101	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:C8:0C	44	ac	-87.0	4.0
102	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:B8:CC	36	ac	-88.0	1.7
103	AIS SMART Login	74:3E:2B:3E:75:99	1	ac	-70.7	3.8
104	@MSU-Net via AIS	74:3E:2B:BE:75:98	1	ac	-72.3	2.2
105	@MSU-Net Plus	D8:84:66:5A:59:C1	104	ax	-57.0	36.0
106	AIS SMART Login	74:3E:2B:3E:74:29	6	ac	-64.7	9.3
107	@MSU-Net	9C:D5:7D:04:FC:AF	100	ax	-93.0	-10.0
108	@MSU-Net Plus	9C:D5:7D:04:FC:AD	100	ax	-95.0	-12.0
109	@MSU-Net Plus	9C:D5:7D:04:B3:CD	104	ax	-63.7	15.0
110	@MSU-Net	9C:D5:7D:04:B3:CF	104	ax	-62.3	16.3
111	eduroam	D8:84:66:5A:52:D2	64	ax	-78.0	18.0
112	@MSU-Net	D8:84:66:5A:52:D0	64	ax	-78.3	17.7
113	@MSU-Net Plus	9C:D5:7D:03:FB:A2	11	ax	-72.0	-1.0
114	eduroam	9C:D5:7D:03:FB:A1	11	ax	-76.0	-8.0
115	@MSU-Net	9C:D5:7D:03:FB:A0	11	ax	-74.0	-3.0
116	eduroam	D8:84:66:5A:59:CA	1	ax	-45.7	27.7
117	@MSU-Net	2C:1A:05:6D:F6:A0	1	ax	-80.0	-22.0
118	@MSU-Net	D8:84:66:5A:56:A8	1	ax	-67.3	7.2
119	@MSU-Net Plus	2C:1A:05:6D:F6:AD	124	ax	-83.0	4.0
120	eduroam	2C:1A:05:6D:F6:AE	124	ax	-82.5	4.5
121	@MSU-Net	2C:1A:05:6D:F6:AF	124	ax	-83.0	4.0
122	eduroam	9C:D5:7D:04:B3:CE	104	ax	-63.3	15.3
123	@MSU-Net Plus	D8:84:66:5A:52:D1	64	ax	-78.0	18.0
124	eduroam	D8:84:66:5A:56:A9	1	ax	-67.3	7.2
125	@MSU-Net Plus	2C:1A:05:6D:B5:8D	64	ax	-92.0	-11.7
126	@MSU-Net	2C:1A:05:6D:B5:8F	64	ax	-87.0	-6.7
127	@MSU-Net Plus	2C:1A:05:6D:F6:A2	1	ax	-75.0	-17.0
128	eduroam	2C:1A:05:6D:F6:A1	1	ax	-76.0	-18.0
129	AIS SMART Login	74:3E:2B:3E:74:2D	161	ac	-84.7	5.3
130	eduroam	74:3E:2B:FE:74:2C	161	ax	-84.3	4.7
131	@MSU-Net via AIS	74:3E:2B:BE:74:2C	161	ac	-84.3	4.7
132	@MSU-Net Plus	74:3E:2B:7E:74:2C	161	ax	-84.0	5.0
133	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:74:2C	161	ac	-84.3	11.7
134	@MSU-Net Plus	D8:84:66:5A:52:D9	1	ax	-69.0	-1.7
135	eduroam	2C:1A:05:6D:B5:81	1	ax	-71.0	-25.3

Table S5: Continue

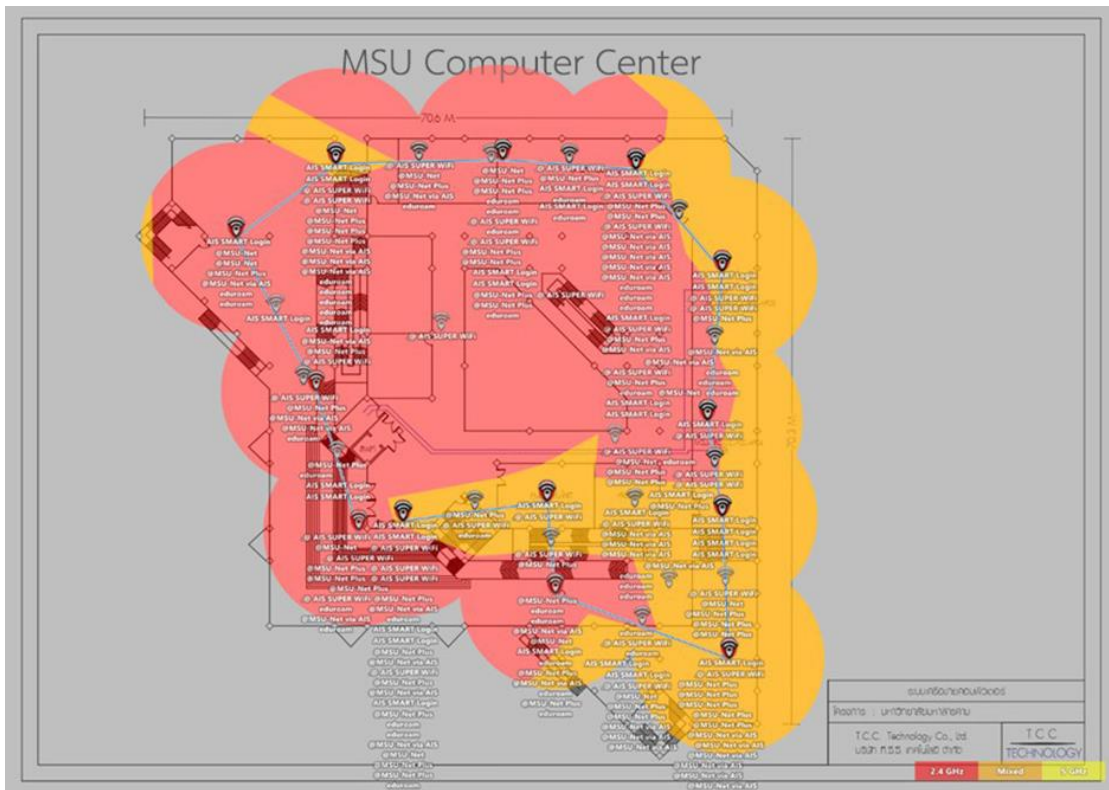
136	@MSU-Net	D8:84:66:5A:52:D8	1	ax	-66.0	-20.3
137	@MSU-Net Plus	D8:84:66:5A:56:AA	1	ax	-49.0	25.5
138	eduroam	2C:1A:05:6D:B5:8E	64	ax	-89.0	-1.3
139	@MSU-Net Plus	9C:D5:7D:04:B3:C2	6	ax	-66.0	3.3
140	eduroam	9C:D5:7D:04:B3:C1	6	ax	-61.0	8.3
141	@MSU-Net	9C:D5:7D:04:B3:C0	6	ax	-61.0	8.3
142	@MSU-Net Plus	2C:1A:05:6C:FE:A2	1	ax	-65.7	8.8
143	eduroam	2C:1A:05:6C:FE:A1	1	ax	-65.7	8.8
144	@MSU-Net	2C:1A:05:6C:FE:A0	1	ax	-65.7	8.8
145	@MSU-Net Plus	2C:1A:05:6C:FE:AD	36	ax	-89.0	3.0
146	eduroam	2C:1A:05:6C:FE:AE	36	ax	-89.0	3.0
147	@MSU-Net	2C:1A:05:6C:FE:AF	36	ax	-89.0	3.0
148	eduroam	D8:84:66:5A:52:DA	1	ax	-75.0	-8.0
149	AIS SMART Login	74:3E:2B:3E:BC:69	6	n	-75.0	-1.0
150	eduroam	74:3E:2B:FE:BC:68	6	ax	-77.3	-2.3
151	@MSU-Net via AIS	74:3E:2B:BE:BC:68	6	n	-74.0	1.0
152	@MSU-Net Plus	74:3E:2B:7E:BC:68	6	ax	-77.7	-2.7
153	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:BC:68	6	n	-83.0	-8.0
154	@MSU-Net Plus	2C:1A:05:6D:A8:CD	124	ax	-88.7	7.3
155	@MSU-Net Plus	2C:1A:05:6C:FE:E2	1	ax	-77.0	-2.5
156	@MSU-Net	2C:1A:05:6D:A8:C0	1	ax	-68.0	8.3
157	eduroam	2C:1A:05:6C:FE:E1	1	ax	-80.0	-5.5
158	@MSU-Net Plus	2C:1A:05:6D:A8:C2	1	ax	-68.7	7.7
159	eduroam	2C:1A:05:6D:A8:C1	1	ax	-68.3	8.0
160	eduroam	2C:1A:05:6D:A8:CE	124	ax	-89.0	7.0
161	@MSU-Net	2C:1A:05:6D:A8:CF	124	ax	-89.0	7.0
162	eduroam	20:9E:F7:6B:01:D2	100	ax	-92.0	4.0
163	eduroam	20:9E:F7:6B:01:C2	11	ax	-80.0	-6.0
164	@MSU-Net	20:9E:F7:6B:01:C1	11	ax	-79.0	-5.0



(a)



(b)



(c)

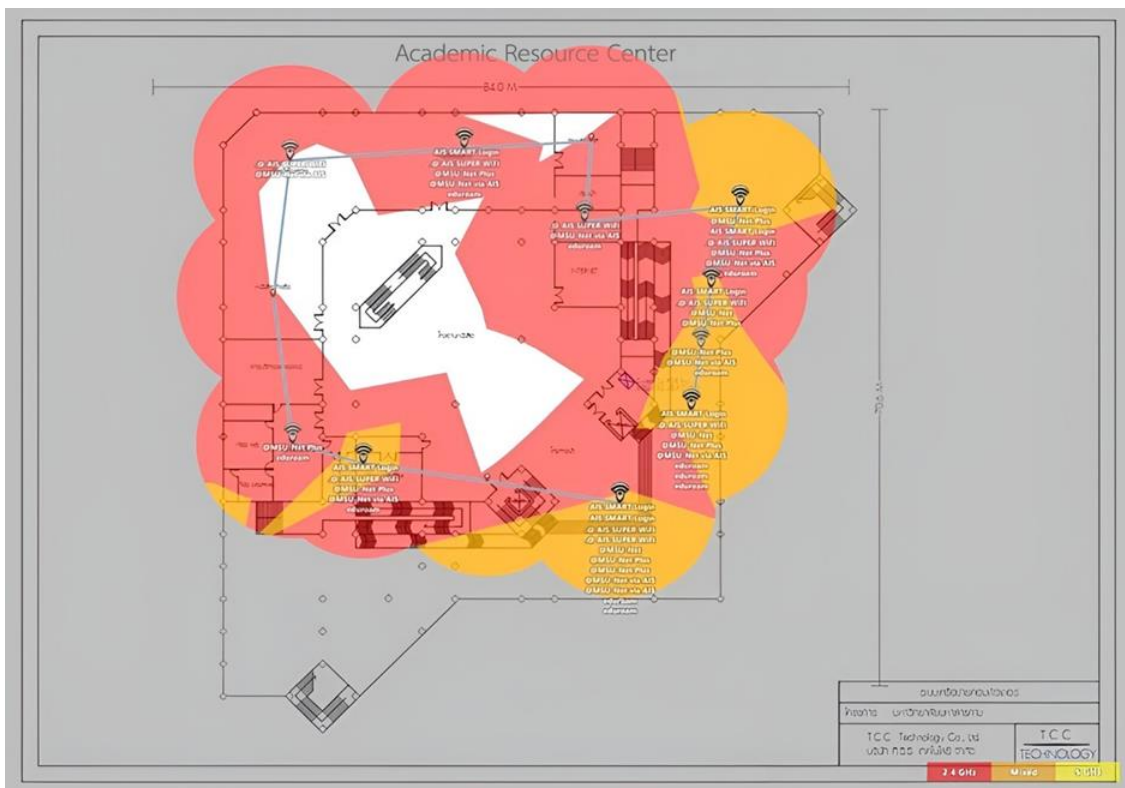
Fig. S6: Power levels decibel-milliwatts (dBm) in the MSU computer center; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S6: Survey results of the number of access points (faculty of informatics)

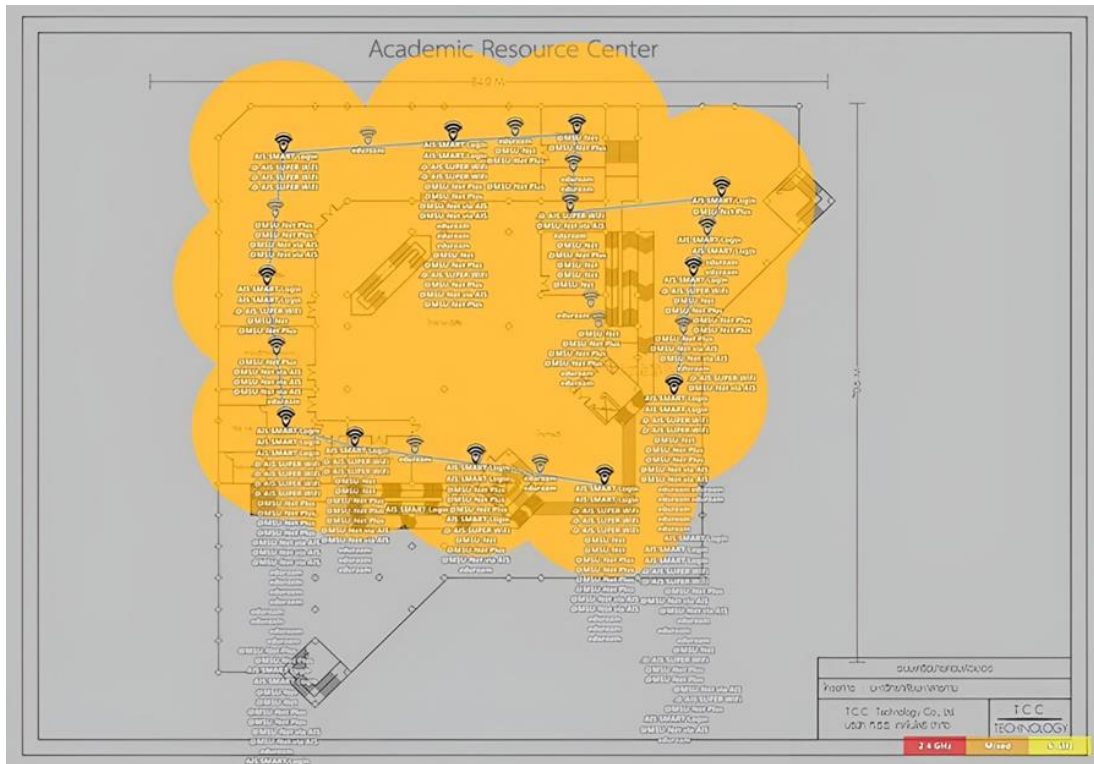
	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	eduroam	2C:1A:05:6D:AB:61	6	ax	-49.0	14.5
2	IT_Wi-Fi	9C:8C:D8:02:0E:C0	11	ac	-79.3	-9.3
3	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A0:48	6	n	-70.3	-6.8
4	@MSU-Net	2C:1A:05:6D:BD:6F	149	ax	-86.0	10.0
5	IT_Wi-Fi	9C:8C:D8:03:D1:10	36	ac	-41.0	41.5
6	@MSU-Net Plus	9C:D5:7D:04:18:C2	6	ax	-81.0	-25.0
7	IT_Wi-Fi	9C:8C:D8:04:E8:B0	100	ac	-60.7	35.3
8	eduroam	9C:D5:7D:04:18:CE	40	ax	-78.0	13.7
9	@MSU-Net	9C:D5:7D:04:18:CF	40	ax	-77.7	14.0
10	@MSU-Net Plus	9C:D5:7D:04:18:CD	40	ax	-78.0	13.7
11	eduroam	74:3E:2B:FD:A0:48	6	ax	-71.0	-7.5
12	IT_Wi-Fi	9C:8C:D8:04:7D:E0	11	ac	-76.0	-6.0
13	@MSU-Net Plus	2C:1A:05:6D:A7:CD	116	ax	-66.0	12.0
14	@MSU-Net	2C:1A:05:6D:A7:C0	1	ax	-72.0	10.0
15	eduroam	2C:1A:05:6D:AB:6E	124	ax	-66.0	30.0
16	@MSU-Net Plus	2C:1A:05:6D:AB:6D	124	ax	-67.0	29.0
17	@MSU-Net Plus	74:3E:2B:7D:A0:48	6	ax	-69.0	-5.5
18	AIS SMART Login	74:3E:2B:3D:A0:49	6	n	-70.3	-6.8
19	@MSU-Net	2C:1A:05:6D:A7:CF	116	ax	-65.7	12.3
20	@MSU-Net	2C:1A:05:6D:AB:6F	124	ax	-66.3	29.7
21	@MSU-Net via AIS	74:3E:2B:BD:A0:48	6	n	-70.3	-6.8
22	eduroam	2C:1A:05:6D:A7:CE	116	ax	-65.7	12.3
23	@MSU-Net Plus	2C:1A:05:6D:AB:62	6	ax	-50.0	13.5
24	IT_Wi-Fi	9C:8C:D8:04:E8:A0	6	ac	-50.3	30.3
25	eduroam	9C:D5:7D:04:18:C1	6	ax	-80.7	-24.7
26	@MSU-Net Plus	2C:1A:05:6D:A7:C2	1	ax	-73.0	9.0
27	eduroam	2C:1A:05:6D:A7:C1	1	ax	-72.7	9.3
28	@MSU-Net Plus	2C:1A:05:6D:BD:6D	149	ax	-85.3	10.7
29	eduroam	2C:1A:05:6D:BD:6E	149	ax	-85.7	10.3
30	@MSU-Net	9C:D5:7D:04:18:C0	6	ax	-80.7	-24.7
31	IT_Wi-Fi	9C:8C:D8:03:D1:00	11	ac	-33.0	37.0
32	@MSU-Net	2C:1A:05:6D:AB:60	6	ax	-49.0	14.5
33	IT_Wi-Fi	9C:8C:D8:05:5F:C0	1	ac	-67.0	5.7
34	IT_Wi-Fi	9C:8C:D8:03:21:20	1	ac	-69.0	-4.5
35	@MSU-Net	9C:D5:7D:07:2E:00	1	ax	-76.0	-11.0
36	IT_Wi-Fi	9C:8C:D8:02:88:80	6	ac	-25.0	38.5
37	IT_Wi-Fi	9C:8C:D8:02:88:90	52	ac	-45.0	41.3
38	IT_Wi-Fi.fl1	6C:C4:9F:28:74:D0	149	ax	-55.0	31.0
39	IT_Wi-Fi.fl1	6C:C4:9F:28:74:C0	1	ax	-52.7	13.0
40	IT_Wi-Fi	9C:8C:D8:02:7B:80	1	ac	-73.0	-21.3
41	IT_Wi-Fi	9C:8C:D8:05:5F:D0	52	ac	-83.0	-3.7
42	eduroam	74:3E:2B:FD:E3:78	11	ax	-80.0	-14.7
43	@MSU-Net via AIS	74:3E:2B:BD:E3:78	11	n	-79.3	-14.0
44	@MSU-Net Plus	74:3E:2B:7D:E3:78	11	ax	-78.3	-13.0
45	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:E3:78	11	n	-80.7	-15.3
46	IT_Wi-Fi	9C:8C:D8:01:E5:60	1	ac	-79.7	-14.0
47	IT_Wi-Fi	9C:8C:D8:01:E5:70	100	ac	-85.5	-9.2
48	AIS SMART Login	74:3E:2B:3D:E3:79	11	n	-78.0	-12.7
49	@MSU-Net Plus	9C:D5:7D:03:ED:0D	52	ax	-83.0	-1.3
50	@MSU-Net Plus	2C:1A:05:6D:F1:0D	100	ax	-91.0	-18.0
51	eduroam	2C:1A:05:6D:F1:0E	100	ax	-91.0	-18.0
52	eduroam	9C:D5:7D:03:ED:0E	52	ax	-79.3	2.3.0
53	AIS SMART Login	74:3E:2B:3D:A0:4D	44	ac	-91.0	-11.7
54	eduroam	74:3E:2B:FD:A0:4C	44	ax	-91.0	-11.7
55	@MSU-Net via AIS	74:3E:2B:BD:A0:4C	44	ac	-90.0	-10.7
56	@MSU-Net Plus	74:3E:2B:7D:A0:4C	44	ax	-92.0	-12.7
57	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A0:4C	44	ac	-90.0	-10.7

Table S6: Continue

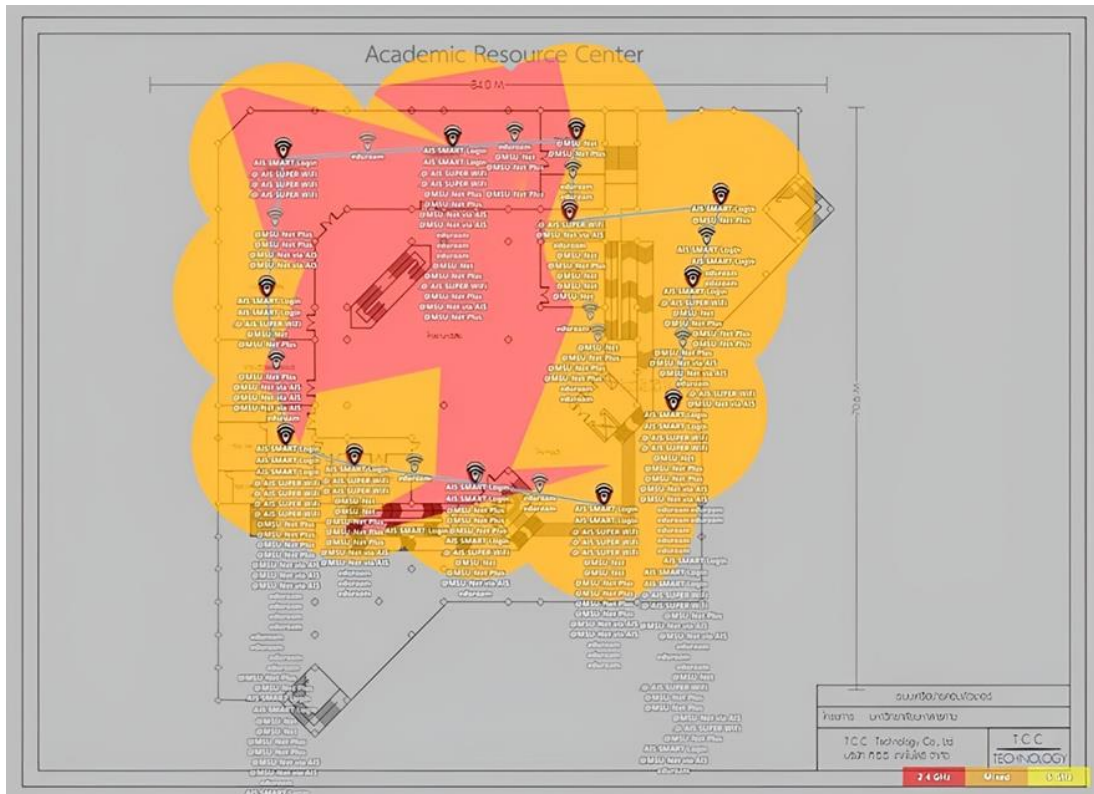
58	.@ AIS SUPER Wi-Fi	2C:5D:93:0F:7D:7C	36	ac	-88.0	-6.3
59	AIS SMART Login	2C:5D:93:0F:7D:7D	36	ac	-88.0	-6.3
60	eduroam	2C:5D:93:CF:7D:7C	36	ax	-87.0	-5.3
61	@MSU-Net via AIS	2C:5D:93:8F:7D:7C	36	ac	-87.0	-5.3
62	@MSU-Net Plus	2C:5D:93:4F:7D:7C	36	ax	-87.0	-5.3
63	IT_Wi-Fi	9C:8C:D8:04:2C:80	1	ac	-88.0	-22.3
64	IT_Wi-Fi	9C:8C:D8:02:40:90	52	ac	-84.0	-4.7
65	IT_Wi-Fi	9C:8C:D8:02:0E:D0	52	ac	-82.5	-3.2
66	AIS SMART Login	74:3E:2B:3D:E3:7D	153	ac	-88.0	-5.7
67	eduroam	74:3E:2B:FD:E3:7C	153	ax	-90.0	-7.7
68	@MSU-Net via AIS	74:3E:2B:BD:E3:7C	153	ac	-90.0	-7.7
69	@MSU-Net Plus	74:3E:2B:7D:E3:7C	153	ax	-89.0	-6.7
70	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:E3:7C	153	ac	-90.0	-7.7
71	eduroam	9C:D5:7D:07:2E:0E	100	ax	-89.3	-13.0
72	@MSU-Net	9C:D5:7D:03:ED:0F	52	ax	-79.3	2.3
73	AIS SMART Login	2C:5D:93:0F:7D:79	1	ac	-80.0	-15.0
74	eduroam	2C:5D:93:CF:7D:78	1	ax	-79.3	-14.3
75	@MSU-Net via AIS	2C:5D:93:8F:7D:78	1	ac	-78.0	-13.0
76	.@ AIS SUPER Wi-Fi	2C:5D:93:0F:7D:78	1	ac	-80.7	-15.7
77	@MSU-Net Plus	2C:5D:93:4F:7D:78	1	ax	-80.0	-15.0
78	IT_Wi-Fi	9C:8C:D8:04:7D:F0	52	ac	-95.0	-15.7
79	@MSU-Net Plus	9C:D5:7D:07:2E:02	1	ax	-81.0	-16.0
80	eduroam	9C:D5:7D:07:2E:01	1	ax	-79	-14.0
81	@MSU-Net Plus	9C:D5:7D:07:2E:0D	100	ax	-89	-12.7
82	@MSU-Net Plus	9C:D5:7D:03:ED:02	11	ax	-73	-17.0
83	eduroam	9C:D5:7D:03:ED:01	11	ax	-72	-16.0
84	@MSU-Net Plus	74:3E:2B:7E:78:58	1	ax	-86	-21.0
85	@MSU-Net	9C:D5:7D:07:2E:0F	100	ax	-92	-15.7
86	@MSU-Net	9C:D5:7D:03:ED:00	11	ax	-73	-17.0



(a)



(b)



(c)

Fig. S7: Power levels decibel-milliwatts (dBm) in the academic resource center; (a) The very strong power at -50 dBm; (b) The very weak power at -95 dBm; (c) The signal quality in dBm encompassing all the measurements

Table S7: Survey results of the number of access points (faculty of tourism and hotel management)

	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	eduroam	74:3E:2B:FD:D8:8C	161	ax	-41.7	20.0
2	.@ AIS SUPER Wi-Fi	74:3E:2B:BD:D8:8C	161	ac	-41.3	20.3
3	@MSU-Net via AIS	74:3E:2B:7D:D8:8C	161	ac	-41.3	20.3
4	@MSU-Net Plus	74:3E:2B:3D:D8:8C	161	ax	-41.3	26.3
5	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:8D:98	11	ac	-51.3	4.3
6	.@ AIS SUPER Wi-Fi	74:3E:2B:BD:8D:9C	149	ac	-67.7	16.0
7	@MSU-Net Plus	74:3E:2B:3D:A2:5C	157	ax	-47.0	31.7
8	eduroam	2C:1A:05:6D:AF:81	1	ax	-74.0	-26.3
9	@MSU-Net via AIS	74:3E:2B:7D:8D:9C	149	ac	-67.7	16.0
10	AIS SMART Login	74:3E:2B:3F:4B:4D	161	ac	-50.7	14.7
11	eduroam	74:3E:2B:FF:4B:4C	161	ax	-50.7	14.7
12	@MSU-Net Plus	74:3E:2B:3D:8D:9C	149	ax	-67.7	24.3
13	AIS SMART Login	74:3E:2B:3D:A2:5D	157	ac	-47.0	31.7
14	@MSU-Net	2C:1A:05:6D:AF:80	1	ax	-75.0	-27.3
15	eduroam	74:3E:2B:3D:D8:89	11	ax	-37.3	16.0
16	@MSU-Net via AIS	74:3E:2B:BD:8D:98	11	ac	-48.3	7.3
17	@MSU-Net Plus	2C:1A:05:6D:AF:8D	36	ax	-83.0	10.0
18	eduroam	74:3E:2B:FD:A2:5C	157	ax	-47.3	31.3
19	.@ AIS SUPER Wi-Fi	74:3E:2B:BD:A2:5C	157	ac	-47.0	31.7
20	@MSU-Net via AIS	74:3E:2B:BD:D8:88	11	ac	-40.3	13.7
21	@MSU-Net Plus	74:3E:2B:7D:D8:88	11	ax	-39.3	14.7
22	AIS SMART Login	74:3E:2B:3D:D8:8D	161	ac	-41.7	20.0
23	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:A2:58	6	ac	-37.3	20.7
24	@MSU-Net Plus	74:3E:2B:7D:9F:58	1	ax	-30.3	30.0
25	eduroam	74:3E:2B:3F:4B:49	1	ax	-39.3	21.0
26	.@ AIS SUPER Wi-Fi	74:3E:2B:BF:4B:4C	161	ac	-50.7	14.7
27	@MSU-Net via AIS	74:3E:2B:BF:4B:48	1	ac	-40.0	20.3
28	@MSU-Net Plus	74:3E:2B:7F:4B:48	1	ax	-38.7	21.7
29	eduroam	74:3E:2B:3D:A2:59	6	ax	-39.3	18.7
30	@MSU-Net via AIS	74:3E:2B:7F:4B:4C	161	ac	-50.7	14.7
31	@MSU-Net Plus	74:3E:2B:3F:4B:4C	161	ax	-51.0	26.3
32	@MSU-Net via AIS	74:3E:2B:7D:A2:5C	157	ac	-47.0	31.7
33	AIS SMART Login	74:3E:2B:3D:8D:9D	149	ac	-67.7	15.3
34	eduroam	74:3E:2B:FD:8D:9C	149	ax	-68.0	15.7
35	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:D8:88	11	ac	-40.0	14.0
36	AIS SMART Login	74:3E:2B:3F:4B:48	1	ac	-39.0	21.3
37	AIS SMART Login	74:3E:2B:3D:8D:98	11	ac	-52.7	3.0
38	eduroam	74:3E:2B:3D:8D:99	11	ax	-48.7	6.3
39	AIS SMART Login	74:3E:2B:3D:9F:58	1	ac	-34.0	26.3
40	AIS SMART Login	74:3E:2B:3D:D8:88	11	ac	-39.3	21.0
41	@MSU-Net Plus	74:3E:2B:7D:8D:98	11	ax	-49.0	6.7
42	@MSU-Net Plus	74:3E:2B:3D:9F:5C	44	ax	-44.3	51.7
43	@MSU-Net via AIS	74:3E:2B:BD:A2:58	6	ac	-39.3	18.7
44	@MSU-Net Plus	74:3E:2B:7D:A2:58	6	ax	-39.3	18.7
45	AIS SMART Login	74:3E:2B:3D:A2:58	6	ac	-37.7	20.3
46	eduroam	74:3E:2B:3D:9F:59	1	ax	-30.3	30.0
47	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:9F:58	1	ac	-33.7	26.7
48	@MSU-Net Plus	2C:1A:05:6D:AF:82	1	ax	-75.0	-27.3
49	@MSU-Net Plus	9C:D5:7D:03:3C:62	11	ax	-71.0	-22.7
50	eduroam	9C:D5:7D:03:3C:61	11	ax	-71.0	-22.7
51	@MSU-Net	9C:D5:7D:03:3C:60	11	ax	-71.0	-22.7
52	@MSU-Net via AIS	74:3E:2B:BD:9F:58	1	ac	-30.3	30.0
53	eduroam	2C:1A:05:6D:AF:8E	36	ax	-83.0	10.0
54	@MSU-Net	2C:1A:05:6D:AF:8F	36	ax	-83.0	10.0
55	.@ AIS SUPER Wi-Fi	74:3E:2B:FF:4B:48	1	ac	-39.3	21.0
56	AIS SMART Login	74:3E:2B:3D:9F:5D	44	ac	-44.3	48.2
57	eduroam	74:3E:2B:FD:9F:5C	44	ac	-44.3	47.7
58	.@ AIS SUPER Wi-Fi	74:3E:2B:BD:9F:5C	44	ac	-44.3	47.7
59	@MSU-Net via AIS	74:3E:2B:7D:9F:5C	44	ac	-44.3	47.7

Table S7: Continue

60	eduroam	74:3E:2B:3D:E5:C9	6	ac	-60.0	-2.0
61	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:E5:C8	6	ac	-60.7	-3.0
62	@MSU-Net via AIS	74:3E:2B:BD:E5:C8	6	ac	-59.7	-1.7
63	AIS SMART Login	74:3E:2B:3D:E5:C8	6	ac	-61.0	-3.0
64	@MSU-Net Plus	74:3E:2B:7D:E5:C8	6	ac	-61.0	-3.0
65	AIS SMART Login	74:3E:2B:3D:E5:CD	161	ac	-71.7	11.3
66	eduroam	74:3E:2B:FD:E5:CC	161	ac	-72.3	10.7
67	.@ AIS SUPER Wi-Fi	74:3E:2B:BD:E5:CC	161	ac	-72.0	11.0
68	@MSU-Net via AIS	74:3E:2B:7D:E5:CC	161	ac	-72.3	10.7
69	@MSU-Net Plus	74:3E:2B:3D:E5:CC	161	ac	-72.3	10.7
70	AIS SMART Login	74:3E:2B:3F:4A:ED	48	ac	-72.0	7.3
71	eduroam	74:3E:2B:FF:4A:EC	48	ac	-72.0	7.7
72	@MSU-Net via AIS	74:3E:2B:7F:4A:EC	48	ac	-71.0	11.3
73	eduroam	74:3E:2B:3F:4A:E9	6	ac	-66.0	-9.3
74	@MSU-Net Plus	74:3E:2B:7F:4A:E8	6	ac	-63.0	-6.3
75	AIS SMART Login	74:3E:2B:3F:4A:E8	6	ac	-62.0	-4.0
76	@MSU-Net Plus	74:3E:2B:3F:4A:EC	48	ac	-72.0	13.7
77	.@ AIS SUPER Wi-Fi	74:3E:2B:FF:4A:E8	6	ac	-60.0	-3.3
78	.@ AIS SUPER Wi-Fi	74:3E:2B:BF:4A:EC	48	ac	-71.0	11.3
79	@MSU-Net via AIS	74:3E:2B:BF:4A:E8	6	ac	-64.0	-7.3
80	@MSU-Net Plus	74:3E:2B:7F:0D:18	11	ac	-84.0	-30.7
81	AIS SMART Login	74:3E:2B:3F:0D:18	11	ac	-83.7	-30.3
82	.@ AIS SUPER Wi-Fi	74:3E:2B:FF:0D:18	11	ac	-83.0	-29.7
83	@MSU-Net via AIS	74:3E:2B:BF:0D:18	11	ac	-84.0	-30.7
84	eduroam	74:3E:2B:3F:0D:19	11	ac	-82.0	-28.7
85	@MSU-Net Plus	74:3E:2B:7D:8D:A8	1	ac	-85.0	-27.0
86	AIS SMART Login	74:3E:2B:3D:8D:A8	1	ac	-84.0	-26.0
87	eduroam	74:3E:2B:3D:8D:A9	1	ac	-84.0	-26.0
88	.@ AIS SUPER Wi-Fi	74:3E:2B:FD:8D:A8	1	ac	-86.0	-28.0
89	@MSU-Net via AIS	74:3E:2B:BD:8D:A8	1	ac	-86.0	-28.0

Table S8: Survey results of the number of access points (MSU computer center)

	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	@MSU-Net	D8:84:66:5A:5D:39	1	ax	-54.0	6.7
2	eduroam	74:3E:2B:CE:6B:D8	1	ax	-47.0	13.0
3	@MSU-Net via AIS	74:3E:2B:8E:6B:D8	1	ac	-48.0	12.0
4	@MSU-Net Plus	74:3E:2B:4E:6B:D8	1	ax	-47.0	13.0
5	@MSU-Net Plus	D8:84:66:5A:5D:3A	1	ax	-53.0	7.7
6	@MSU-Net Plus	2C:1A:05:6D:F0:CD	128	ax	-68.7	27.3
7	AIS SMART Login	74:3E:2B:3F:69:3D	40	ac	-79.0	-7.0
8	eduroam	74:3E:2B:FF:69:3C	40	ax	-81.0	-9.0
9	@MSU-Net via AIS	74:3E:2B:BF:69:3C	40	ac	-82.0	-10.0
10	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:3C	40	ac	-82.0	-10.0
11	eduroam	74:3E:2B:CE:9C:C8	11	ax	-51.0	2.7
12	@MSU-Net via AIS	74:3E:2B:BE:74:18	6	ac	-44.3	19.7
13	@MSU-Net Plus	74:3E:2B:7E:74:18	6	ax	-42.0	22.0
14	AIS SMART Login	74:3E:2B:3F:2E:4D	48	ac	-50.0	23.0
15	eduroam	74:3E:2B:FF:2E:4C	48	ax	-49.0	24.0
16	@MSU-Net via AIS	74:3E:2B:BF:2E:4C	48	ac	-49.0	24.0
17	@MSU-Net via AIS	74:3E:2B:BF:0A:88	1	ac	-48.0	12.0
18	@MSU-Net Plus	74:3E:2B:7F:2E:4C	48	ax	-49.0	24.0
19	eduroam	74:3E:2B:FE:74:18	6	ax	-42.0	22.0
20	AIS SMART Login	74:3E:2B:0E:90:99	1	ac	-56.0	4.0
21	eduroam	74:3E:2B:CE:90:98	1	ax	-54.0	6.0
22	@MSU-Net via AIS	74:3E:2B:BF:09:38	6	ac	-43.3	20.7
23	AIS SMART Login	74:3E:2B:0E:6B:DD	161	ac	-62.0	24.0
24	eduroam	74:3E:2B:CE:6B:DC	161	ax	-62.3	23.7
25	eduroam	74:3E:2B:CE:9C:CC	36	ax	-67.0	5.0
26	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:9C:CC	36	ac	-66.7	5.3
27	@MSU-Net	2C:1A:05:6D:F0:C0	11	ax	-67.0	-13.3

Table S8: Continue

28	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:75:48	1	ac	-51.0	9.0
29	@MSU-Net Plus	74:3E:2B:7F:69:DC	40	ax	-51.0	21.0
30	@MSU-Net	2C:1A:05:6D:F0:CF	128	ax	-67.7	28.3
31	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:DC	40	ac	-51.0	22.0
32	@MSU-Net via AIS	58:B6:33:BF:1D:28	11	ac	-50.0	3.7
33	@MSU-Net Plus	58:B6:33:7F:1D:28	11	ax	-52.0	1.7
34	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:D8	11	ac	-41.3	14.7
35	AIS SMART Login	58:B6:33:3F:23:89	11	ac	-54.0	-0.3
36	eduroam	58:B6:33:FF:23:88	11	ax	-57.0	-3.3
37	@MSU-Net via AIS	58:B6:33:BF:23:88	11	ac	-56.0	-2.3
38	@MSU-Net Plus	74:3E:2B:4E:9C:C8	11	ax	-52.7	1.0
39	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:9C:C8	11	ac	-51.7	2.0
40	AIS SMART Login	74:3E:2B:3F:09:39	6	ac	-44.3	21.0
41	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:26:08	1	ac	-64.0	-8.0
42	eduroam	74:3E:2B:FF:0D:A8	6	ax	-81.0	-17.0
43	@MSU-Net via AIS	74:3E:2B:BF:0D:A8	6	ac	-80.0	-17.3
44	@MSU-Net via AIS	74:3E:2B:8E:75:48	1	ac	-50.3	9.7
45	AIS SMART Login	74:3E:2B:3F:26:0D	40	ac	-73.0	0.5
46	eduroam	74:3E:2B:FF:09:38	6	ax	-44.7	19.3
47	.@ AIS SUPER Wi-Fi	74:3E:2B:0D:23:08	11	ac	-61.0	-7.0
48	eduroam	74:3E:2B:FF:26:0C	40	ax	-74.3	-1.3
49	@MSU-Net via AIS	74:3E:2B:BF:26:0C	40	ac	-74.0	-1.0
50	@MSU-Net Plus	74:3E:2B:7F:26:0C	40	ax	-74.0	-1.0
51	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:26:0C	40	ac	-74.0	-0.5
52	@MSU-Net Plus	74:3E:2B:4D:23:08	11	ax	-56.0	-2.0
53	@MSU-Net via AIS	74:3E:2B:8E:6B:DC	161	ac	-62.3	23.7
54	AIS SMART Login	74:3E:2B:3F:69:D9	11	ac	-38.3	17.7
55	eduroam	D8:84:66:5A:5D:38	1	ax	-52.3	8.3
56	@MSU-Net Plus	74:3E:2B:4E:52:38	1	ax	-53.3	7.7
57	@MSU-Net Plus	74:3E:2B:7F:26:08	1	ax	-62.0	-6.0
58	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:74:18	6	ac	-42.0	22.0
59	@MSU-Net via AIS	74:3E:2B:8E:90:98	1	ac	-57.7	2.3
60	@MSU-Net Plus	58:B6:33:7F:34:78	1	ax	-49.3	6.7
61	@MSU-Net via AIS	74:3E:2B:BF:69:D8	11	ac	-41.0	12.7
62	@MSU-Net	D8:84:66:5A:5D:31	60	ax	-65.5	8.0
63	@MSU-Net via AIS	74:3E:2B:BF:2E:48	11	ac	-34.7	19.0
64	eduroam	74:3E:2B:FF:2E:48	11	ax	-36.7	17.0
65	AIS SMART Login	74:3E:2B:0D:23:09	11	ac	-58.0	-4.3
66	@MSU-Net Plus	74:3E:2B:7F:2E:48	11	ax	-33.7	20.0
67	@MSU-Net	D8:84:66:5A:5F:B0	56	ax	-73.3	-0.3
68	AIS SMART Login	74:3E:2B:3F:69:DD	40	ac	-58.3	13.7
69	AIS SMART Login	74:3E:2B:3F:0A:89	1	ac	-49.0	7.0
70	@MSU-Net via AIS	74:3E:2B:BF:0F:88	6	ac	-62.0	0.7
71	eduroam	74:3E:2B:CE:75:48	1	ax	-48.3	11.7
72	eduroam	74:3E:2B:FF:69:DC	40	ax	-58.3	13.7
73	@MSU-Net via AIS	74:3E:2B:BF:69:DC	40	ac	-51.0	21.0
74	eduroam	D8:84:66:5A:5D:30	60	ax	-65.5	8.0
75	eduroam	74:3E:2B:CD:23:08	11	ax	-62.0	-8.0
76	@MSU-Net Plus	D8:84:66:5A:5D:32	60	ax	-65.5	8.0
77	eduroam	74:3E:2B:FF:69:D8	11	ax	-40.7	13.0
78	@MSU-Net Plus	74:3E:2B:4E:6B:DC	161	ax	-63.0	23.0
79	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:6B:D8	1	ac	-59.0	1.0
80	@MSU-Net via AIS	74:3E:2B:8D:23:08	11	ac	-52.0	2.0
81	@MSU-Net Plus	74:3E:2B:7F:69:3C	40	ax	-79.0	-7.0
82	AIS SMART Login	74:3E:2B:3F:26:09	1	ac	-58.0	2.0
83	eduroam	74:3E:2B:FF:26:08	1	ax	-55.0	5.0
84	@MSU-Net via AIS	74:3E:2B:BF:26:08	1	ac	-61.7	-1.7
85	@MSU-Net Plus	74:3E:2B:4E:75:48	1	ax	-54.0	6.0
86	AIS SMART Login	74:3E:2B:3F:2E:49	11	ac	-36.3	17.3
87	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:2E:4C	48	ac	-50.0	24.0

Table S8: Continue

88	@MSU-Net Plus	74:3E:2B:7F:09:38	6	ax	-47.3	16.7
89	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:6B:DC	161	ac	-63.0	33.0
90	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:2E:48	11	ac	-34.3	21.3
91	@MSU-Net Plus	74:3E:2B:7F:69:D8	11	ax	-39.3	14.3
92	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:09:38	6	ac	-43.3	22.3
93	AIS SMART Login	74:3E:2B:3E:74:19	6	ac	-42.0	22.0
94	eduroam	2C:1A:05:6D:F0:CE	128	ax	-68.3	27.7
95	eduroam	74:3E:2B:CE:52:38	1	ax	-53.0	8.0
96	AIS SMART Login	74:3E:2B:0E:9C:CD	36	ac	-66.3	5.7
97	@MSU-Net via AIS	74:3E:2B:8E:52:38	1	ac	-52.0	9.0
98	AIS SMART Login	74:3E:2B:0E:75:4D	44	ac	-59.0	14.0
99	@MSU-Net Plus	74:3E:2B:4E:75:4C	44	ax	-52.0	21.0
100	.@ AIS SUPER Wi-Fi	58:B6:33:3F:34:78	1	ac	-48.3	11.7
101	AIS SMART Login	74:3E:2B:0E:6B:D9	1	ac	-56.7	-0.7
102	AIS SMART Login	74:3E:2B:0E:75:49	1	ac	-49.0	11.0
103	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:52:38	1	ac	-53.0	11.7
104	@MSU-Net Plus	74:3E:2B:7F:0D:A8	6	ax	-78.0	-14.0
105	eduroam	58:B6:33:FF:34:78	1	ax	-49.7	10.3
106	eduroam	D8:84:66:5A:5F:B2	56	ax	-73.0	0.0
107	@MSU-Net Plus	D8:84:66:5A:5F:B1	56	ax	-73.7	-0.7
108	@MSU-Net via AIS	74:3E:2B:8E:75:4C	44	ac	-59.0	14.0
109	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:75:4C	44	ac	-52.0	21.0
110	@MSU-Net Plus	74:3E:2B:4E:90:98	1	ax	-57.3	2.7
111	eduroam	74:3E:2B:FF:0A:88	1	ax	-48.0	12.0
112	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0A:88	1	ac	-51.3	8.7
113	eduroam	74:3E:2B:CE:75:4C	44	ax	-59.0	14.0
114	AIS SMART Login	74:3E:2B:3F:0A:8D	161	ac	-65.0	15.0
115	eduroam	74:3E:2B:FF:0A:8C	161	ac	-66.3	14.0
116	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0A:8C	161	ac	-65.7	18.3
117	@MSU-Net Plus	D8:84:66:5A:55:E1	52	ac	-65.7	7.3
118	@MSU-Net via AIS	58:B6:33:BF:34:78	1	ac	-49.7	10.3
119	eduroam	74:3E:2B:CD:23:0C	44	ac	-78.0	-5.0
120	@MSU-Net via AIS	74:3E:2B:BF:0A:8C	161	ac	-65.7	14.7
121	@MSU-Net Plus	74:3E:2B:7F:0A:8C	161	ac	-65.7	14.7
122	AIS SMART Login	74:3E:2B:0D:23:0D	44	ac	-79.3	-6.3
123	@MSU-Net via AIS	74:3E:2B:8D:23:0C	44	ac	-78.3	-5.3
124	@MSU-Net Plus	74:3E:2B:7F:0A:88	1	ax	-47.0	13.0
125	@MSU-Net via AIS	74:3E:2B:8E:9C:C8	11	ac	-51.3	1.7
126	eduroam	74:3E:2B:FE:74:1C	149	ax	-52.0	27.0
127	@MSU-Net Plus	2C:1A:05:6D:F5:2D	100	ax	-58.7	37.3
128	eduroam	2C:1A:05:6D:F5:2E	100	ax	-58.3	37.7
129	@MSU-Net	2C:1A:05:6D:F5:2F	100	ax	-58.3	37.7
130	.@ AIS SUPER Wi-Fi	58:B6:33:3F:23:8C	44	ac	-52.0	16.0
131	@MSU-Net Plus	74:3E:2B:4D:23:0C	44	ax	-76.3	-9.3
132	.@ AIS SUPER Wi-Fi	74:3E:2B:0D:23:0C	44	ac	-78.0	-11.0
133	eduroam	74:3E:2B:FF:0F:88	6	ax	-63.0	-0.3
134	@MSU-Net	D8:84:66:5A:58:28	1	ax	-74.0	-14.0
135	@MSU-Net	D8:84:66:5A:55:E0	52	ax	-65.0	2.0
136	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:90:98	1	ac	-60.0	0.0
137	@MSU-Net Plus	D8:84:66:5A:55:E9	1	ax	-49.0	6.0
138	eduroam	58:B6:33:FF:23:8C	44	ax	-52.0	15.0
139	@MSU-Net Plus	58:B6:33:7F:23:8C	44	ax	-52.0	15.0
140	AIS SMART Login	74:3E:2B:0E:9C:C9	11	ac	-53.0	-1.0
141	eduroam	58:B6:33:FF:1D:28	11	ax	-55.3	-3.3
142	eduroam	58:B6:33:FF:1D:2C	161	ax	-65.0	6.0
143	.@ AIS SUPER Wi-Fi	58:B6:33:3F:23:88	11	ac	-58.0	-6.0
144	AIS SMART Login	74:3E:2B:3F:0F:89	6	ac	-65.0	-7.0
145	AIS SMART Login	58:B6:33:3F:1D:2D	161	ac	-66.0	3.0
146	@MSU-Net via AIS	58:B6:33:BF:1D:2C	161	ac	-65.0	6.0
147	@MSU-Net Plus	74:3E:2B:4E:90:9C	161	ax	-71.0	-3.0

Table S8: Continue

148	@MSU-Net via AIS	74:3E:2B:8E:90:9C	161	ac	-70.3	-2.3
149	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:90:9C	161	ac	-70.0	2.0
150	@MSU-Net Plus	58:B6:33:7F:1D:2C	161	ax	-65.0	6.0
151	eduroam	74:3E:2B:CE:90:9C	161	ax	-71.0	-3.0
152	.@ AIS SUPER Wi-Fi	58:B6:33:3F:1D:2C	161	ac	-65.0	6.0
153	eduroam	D8:84:66:5A:56:70	100	ax	-77.0	9.0
154	@MSU-Net Plus	74:3E:2B:7F:0F:88	6	ax	-64.0	-6.0
155	@MSU-Net Plus	D8:84:66:5A:56:72	100	ax	-77.0	9.0
156	@MSU-Net	D8:84:66:5A:56:71	100	ax	-77.0	9.0
157	AIS SMART Login	74:3E:2B:0E:90:9D	161	ac	-70.7	-2.7
158	@MSU-Net Plus	D8:84:66:5A:67:12	108	ax	-80.0	10.7
159	.@ AIS SUPER Wi-Fi	58:B6:33:3F:1D:28	11	ac	-47.0	5.0
160	@MSU-Net Plus	74:3E:2B:7E:74:1C	149	ax	-52.0	19.0
161	@MSU-Net Plus	74:3E:2B:4E:8B:F8	1	ax	-64.5	-4.5
162	.@ AIS SUPER Wi-Fi	74:3E:2B:3E:74:1C	149	ac	-52.0	19.0
163	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8B:F8	1	ac	-65.0	-5.0
164	AIS SMART Login	58:B6:33:3F:34:79	1	ac	-56.0	4.0
165	AIS SMART Login	74:3E:2B:3F:5F:8D	40	ac	-71.0	-4.0
166	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:88	6	ac	-64.3	-6.3
167	@MSU-Net Plus	D8:84:66:5A:56:12	36	ax	-78.0	-11.0
168	@MSU-Net via AIS	74:3E:2B:8E:8B:F8	1	ac	-62.0	-2.0
169	@MSU-Net via AIS	74:3E:2B:BF:0F:8C	44	ac	-78.0	-16.3
170	@MSU-Net Plus	74:3E:2B:7F:0F:8C	44	ax	-79.0	-17.3
171	AIS SMART Login	74:3E:2B:0E:8B:FD	157	ac	-76.0	-8.0
172	eduroam	74:3E:2B:CE:8B:FC	157	ax	-79.0	-11.0
173	AIS SMART Login	74:3E:2B:3F:0F:8D	44	ac	-77.0	-15.3
174	eduroam	74:3E:2B:FF:0F:8C	44	ax	-77.0	-15.3
175	@MSU-Net via AIS	74:3E:2B:8E:8B:FC	157	ac	-76.0	-8.0
176	@MSU-Net via AIS	74:3E:2B:BF:5F:8C	40	ac	-71.0	-4.0
177	@MSU-Net Plus	74:3E:2B:7F:5F:8C	40	ax	-72.0	-5.0
178	@MSU-Net via AIS	74:3E:2B:8E:95:A8	1	ac	-63.0	-10.3
179	eduroam	D8:84:66:5A:67:10	108	ax	-80.0	10.7
180	@MSU-Net	D8:84:66:5A:67:19	1	ax	-74.0	-21.3
181	@MSU-Net Plus	74:3E:2B:4E:95:A8	1	ax	-69.0	-9.0
182	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:95:A8	1	ac	-66.0	-13.3
183	@MSU-Net	D8:84:66:5A:56:11	36	ax	-78.0	-16.3
184	eduroam	74:3E:2B:CE:95:A8	1	ax	-69.0	-9.0
185	@MSU-Net Plus	74:3E:2B:4E:8B:FC	157	ax	-75.0	-7.0
186	@MSU-Net	D8:84:66:5A:67:11	108	ax	-80.0	10.7
187	eduroam	D8:84:66:5A:56:10	36	ax	-78.0	-11.0
188	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:8B:FC	157	ac	-79.0	-11.0
189	@MSU-Net Plus	D8:84:66:5A:5F:B9	1	ax	-71.0	-18.3
190	eduroam	D8:84:66:5A:5F:BA	1	ax	-70.7	-18.0
191	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:0F:8C	44	ac	-79.0	-17.3
192	AIS SMART Login	58:B6:33:3F:1D:29	11	ac	-57.7	-5.7
193	eduroam	D8:84:66:5A:56:78	1	ax	-67.0	-7.0
194	@MSU-Net via AIS	74:3E:2B:BE:74:1C	149	ac	-52.0	19.0
195	AIS SMART Login	74:3E:2B:0E:52:39	1	ac	-54.3	5.7
196	AIS SMART Login	74:3E:2B:0E:95:A9	1	ac	-69.0	-9.0
197	eduroam	D8:84:66:5A:66:78	11	ax	-73.0	-21.0
198	AIS SMART Login	74:3E:2B:3E:74:1D	149	ac	-52.0	19.0
199	AIS SMART Login	74:3E:2B:3F:5F:89	11	ac	-53.0	-1.0
200	eduroam	74:3E:2B:FF:5F:88	11	ax	-57.0	-5.0
201	.@ AIS SUPER Wi-Fi	58:B6:33:3F:1D:7C	40	ac	-80.0	-18.3
202	AIS SMART Login	58:B6:33:3F:1D:7D	40	ac	-80.0	-18.3
203	.@ AIS SUPER Wi-Fi	C8:C4:65:BA:F8:B0	116	ac	-87.0	-3.7
204	AIS SMART Login	C8:C4:65:BA:F8:B1	116	ac	-86.0	-2.7
205	@MSU-Net Plus	58:B6:33:7F:23:88	11	ax	-53.0	-1.0
206	@MSU-Net Plus	2C:1A:05:6D:F5:22	1	ax	-50.5	2.2

Table S8: Continue

207	eduroam	2C:1A:05:6D:F5:21	1	ax	-52.0	1.5
208	eduroam	58:B6:33:FF:1D:7C	40	ax	-81.0	-19.3
209	@MSU-Net	2C:1A:05:6D:F5:20	1	ax	-51.0	3.3
210	@MSU-Net via AIS	58:B6:33:BF:1D:78	6	ac	-72.0	-29.0
211	AIS SMART Login	74:3E:2B:0E:8B:F9	1	ac	-69.0	-9.0
212	@MSU-Net Plus	2C:1A:05:6D:68:2D	116	ax	-93.0	-18.7
213	@MSU-Net Plus	58:B6:33:7F:1D:78	6	ax	-74.0	-31.0
214	eduroam	2C:1A:05:6D:68:2E	116	ax	-92.0	-17.7
215	@MSU-Net	2C:1A:05:6D:68:2F	116	ax	-94.0	-18.7
216	eduroam	D8:84:66:5A:55:E2	52	ax	-65.7	1.3.0
217	eduroam	74:3E:2B:CE:8B:F8	1	ax	-65.7	-5.7
218	.@ AIS SUPER Wi-Fi	58:B6:33:3F:1D:78	6	ac	-75.0	-32.0
219	AIS SMART Login	58:B6:33:3F:23:8D	44	ac	-52.0	15.0
220	@MSU-Net via AIS	58:B6:33:BF:23:8C	44	ac	-52.0	15.0
221	@MSU-Net Plus	74:3E:2B:4E:D1:98	6	ax	-74.0	-16.7
222	eduroam	58:B6:33:FF:34:7C	161	ax	-58.0	14.0
223	eduroam	74:3E:2B:FF:5F:8C	40	ax	-71.0	-4.0
224	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:09:3C	157	ac	-56.0	18.7
225	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:5F:88	11	ac	-51.3	0.7
226	@MSU-Net via AIS	58:B6:33:BF:34:7C	161	ac	-58.0	14.0
227	@MSU-Net Plus	74:3E:2B:7F:5F:88	11	ax	-50.0	2.0
228	@MSU-Net	D8:84:66:5A:56:79	1	ax	-61.0	-7.5
229	AIS SMART Login	74:3E:2B:3F:09:3D	157	ac	-60.3	11.7
230	@MSU-Net via AIS	74:3E:2B:BF:09:3C	157	ac	-59.3	12.7
231	@MSU-Net Plus	74:3E:2B:7F:09:3C	157	ax	-59.3	12.7
232	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:5F:8C	40	ac	-72.0	-5.0
233	eduroam	74:3E:2B:FF:09:3C	157	ax	-59.3	12.7
234	@MSU-Net via AIS	74:3E:2B:BF:5F:88	11	ac	-58.3	-6.3
235	AIS SMART Login	58:B6:33:3F:34:7D	161	ac	-58.0	14.0
236	@MSU-Net	D8:84:66:5A:5F:B8	1	ax	-68.0	-17.3
237	@MSU-Net Plus	58:B6:33:7F:34:7C	161	ax	-58.0	14.0
238	@MSU-Net	D8:84:66:5A:55:E8	1	ax	-62.0	-15.0
239	eduroam	D8:84:66:5A:55:EA	1	ax	-56.0	-9.0
240	@MSU-Net Plus	74:3E:2B:7F:69:38	11	ax	-63.0	-13.0
241	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:69:38	11	ac	-61.0	-11.0
242	@MSU-Net Plus	2C:1A:05:6D:68:22	1	ax	-78.0	-31.0
243	@MSU-Net via AIS	74:3E:2B:8E:52:3C	149	ac	-70.0	2.0
244	@MSU-Net Plus	2C:1A:05:6D:F0:C2	11	ax	-56.0	-6.0
245	eduroam	2C:1A:05:6D:68:21	1	ax	-71.0	-24
246	@MSU-Net Plus	D8:84:66:5A:66:7A	11	ax	-73.0	-25.7
247	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:52:3C	149	ac	-74.0	-2
248	@MSU-Net Plus	74:3E:2B:4E:9C:CC	36	ax	-67.3	-6.7
249	@MSU-Net Plus	9C:D5:7D:03:F5:4D	116	ax	-90.0	-8
250	@MSU-Net	D8:84:66:5A:66:79	11	ax	-69.0	-21.7
251	AIS SMART Login	74:3E:2B:0E:52:3D	149	ac	-71.0	0
252	eduroam	74:3E:2B:CE:52:3C	149	ax	-70.0	1
253	.@ AIS SUPER Wi-Fi	58:B6:33:3F:34:7C	161	ac	-58.0	14
254	eduroam	9C:D5:7D:03:F5:4E	116	ax	-90.5	-10.8
255	@MSU-Net	9C:D5:7D:03:F5:4F	116	ax	-91.0	-9
256	@MSU-Net via AIS	74:3E:2B:8E:9C:CC	36	ac	-67.0	-7.7
257	eduroam	2C:1A:05:6D:F0:C1	11	ax	-55.7	-8.7
258	@MSU-Net Plus	D8:84:66:5A:66:72	157	ax	-85.0	-14
259	@MSU-Net via AIS	74:3E:2B:BF:69:38	11	ac	-63.0	-16
260	AIS SMART Login	74:3E:2B:0E:D1:99	6	ac	-73.0	-19.7
261	eduroam	74:3E:2B:CE:D1:98	6	ax	-78.0	-25
262	@MSU-Net via AIS	74:3E:2B:8E:D1:98	6	ac	-69.0	-11.7
263	eduroam	D8:84:66:5A:66:70	157	ax	-85.0	-14
264	.@ AIS SUPER Wi-Fi	74:3E:2B:0E:D1:98	6	ac	-77.0	-19.7
265	@MSU-Net Plus	D8:84:66:5A:58:21	153	ax	-78.0	-7

Table S8: Continue

266	@MSU-Net Plus	74:3E:2B:4E:52:3C	149	ax	-69.5	2.5
267	@MSU-Net	D8:84:66:5A:58:20	153	ax	-79.0	-8.0
268	@MSU-Net	D8:84:66:5A:66:71	157	ax	-84.0	-12.0
269	eduroam	74:3E:2B:CE:93:CC	153	ax	-88.0	-16.0
270	@MSU-Net via AIS	74:3E:2B:8E:93:CC	153	ac	-87.0	-16.0
271	eduroam	D8:84:66:5A:58:22	153	ax	-82.0	-10.0
272	@MSU-Net Plus	D8:84:66:5A:56:7A	1	ax	-63.5	-3.5
273	@MSU-Net	9C:D5:7D:03:23:E0	1	ax	-67.0	-7.0
274	eduroam	74:3E:2B:FF:69:38	11	ax	-62.0	-23.7
275	@MSU-Net Plus	9C:D5:7D:03:23:ED	60	ax	-87.0	-27.7
276	eduroam	9C:D5:7D:03:23:EE	60	ax	-88.0	-37.0
277	eduroam	9C:D5:7D:04:02:8E	120	ax	-91.0	-9.3
278	@MSU-Net Plus	9C:D5:7D:03:23:E2	1	ax	-67.0	-12.7
279	eduroam	9C:D5:7D:03:23:E1	1	ax	-67.0	-12.7
280	@MSU-Net Plus	9C:D5:7D:04:02:8D	120	ax	-90.0	-8.3

Table S9: Survey results of the number of access points (academic resource center)

	SSID	Mac address	Channel	IEEE802.11	Signal(dBm)	SIR(dB)
1	@MSU-Net via AIS	F0:3E:90:B6:C0:9C	161	ac	-59.3	13.7
2	@MSU-Net	D8:84:66:5A:58:F1	112	ax	-45.7	42.3
3	@MSU-Net via AIS	F0:3E:90:B6:CF:58	1	ac	-34.7	27.3
4	AIS SMART Login	F0:3E:90:36:C0:9D	161	ac	-59.3	13.7
5	eduroam	F0:3E:90:F6:C0:9C	161	ax	-59.3	13.7
6	AIS SMART Login	74:3E:2B:3D:A0:59	6	ac	-41.7	22.3
7	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:EE:F8	1	ac	-72.0	-19.7
8	@MSU-Net via AIS	74:3E:2B:BD:EE:F8	1	ac	-64.0	-11.7
9	@MSU-Net Plus	74:3E:2B:7D:EE:F8	1	ax	-72.0	-19.7
10	eduroam	F0:3E:90:F6:CD:78	11	ax	-40.0	17.0
11	@MSU-Net via AIS	74:3E:2B:BD:A0:58	6	ac	-42.3	21.7
12	@MSU-Net Plus	74:3E:2B:7D:A0:58	6	ax	-42.7	21.3
13	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A0:58	6	ac	-43.7	13.7
14	@MSU-Net Plus	F0:3E:90:76:C4:C8	1	ax	-41.0	20.3
15	@MSU-Net Plus	F0:3E:90:76:CF:58	1	ax	-35.0	21.0
16	@MSU-Net via AIS	F0:3E:90:B6:CD:78	11	ac	-39.7	27.0
17	eduroam	F0:3E:90:F6:C4:C8	1	ax	-40.7	17.3
18	@MSU-Net via AIS	74:3E:2B:BD:A9:A8	6	ac	-52.3	21.3
19	AIS SMART Login	F0:3E:90:36:CF:5D	149	ac	-43.3	11.7
20	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:98	11	ac	-52.3	29.7
21	eduroam	74:3E:2B:FD:A9:A8	6	ax	-51.7	4.7
22	@MSU-Net Plus	F0:3E:90:76:C0:98	6	ax	-37.3	12.3
23	@MSU-Net Plus	F0:3E:90:76:C4:CC	44	ax	-45.3	26.7
24	eduroam	74:3E:2B:FD:A0:58	6	ax	-43.3	26.7
25	@MSU-Net	D8:84:66:5A:4E:31	52	ax	-54.0	20.7
26	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CF:58	1	ac	-35.3	18.0
27	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A0:5C	40	ac	-55.7	27.0
28	AIS SMART Login	F0:3E:90:36:CF:59	1	ac	-36.0	12.7
29	@MSU-Net Plus	D8:84:66:5A:4E:32	52	ax	-54.3	17.7
30	eduroam	D8:84:66:5A:4E:30	52	ax	-54.3	17.7
31	@MSU-Net Plus	F0:3E:90:76:B9:68	6	ax	-61.0	3.0
32	eduroam	F0:3E:90:F6:CF:5C	149	ax	-43.3	29.7
33	@MSU-Net Plus	74:3E:2B:7D:A9:9C	44	ax	-55.0	17.0
34	@MSU-Net Plus	D8:84:66:5A:4E:3A	11	ax	-36.3	26.0
35	eduroam	D8:84:66:5A:4E:38	11	ax	-30.0	32.3
36	@MSU-Net	D8:84:66:5A:58:F9	1	ax	-41.0	21.0
37	eduroam	D8:84:66:5A:58:F8	1	ax	-38.0	24.0
38	@MSU-Net via AIS	F0:3E:90:B6:CF:5C	149	ac	-43.3	29.7
39	@MSU-Net Plus	F0:3E:90:76:C0:9C	161	ax	-59.0	14.0
40	.@ AIS SUPER Wi-Fi	F0:3E:90:36:C0:9C	161	ac	-59.3	26.7
41	@MSU-Net Plus	2C:1A:05:6D:AE:4D	108	ax	-86.0	2.0
42	@MSU-Net Plus	2C:1A:05:6D:66:CD	112	ax	-75.7	6.7

Table S9: Continue

43	@MSU-Net	2C:1A:05:6D:66:CF	112	ax	-76.0	6.3
44	@MSU-Net via AIS	F0:3E:90:B6:C4:C8	1	ac	-40.7	21.3
45	.@ AIS SUPER Wi-Fi	F0:3E:90:36:C4:C8	1	ac	-41.0	21.0
46	@MSU-Net Plus	D8:84:66:5A:58:FA	1	ax	-54.0	8.0
47	@MSU-Net via AIS	74:3E:2B:BD:A9:AC	44	ac	-61.3	10.7
48	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:AC	44	ac	-60.0	12.0
49	@MSU-Net	00:1F:45:DE:A1:C0	44	ax	-89.0	-26.7
50	AIS SMART Login	74:3E:2B:3D:A0:5D	40	ac	-55.7	12.7
51	eduroam	74:3E:2B:FD:A0:5C	40	ax	-55.7	12.7
52	@MSU-Net via AIS	74:3E:2B:BD:A0:5C	40	ac	-55.7	12.7
53	@MSU-Net Plus	74:3E:2B:7D:A0:5C	40	ax	-55.7	12.7
54	AIS SMART Login	F0:3E:90:36:CD:79	11	ac	-39.0	18.0
55	@MSU-Net	D8:84:66:5A:4E:39	11	ax	-39.0	23.3
56	@MSU-Net Plus	F0:3E:90:76:CB:28	11	ax	-51.7	5.3
57	eduroam	F0:3E:90:F6:C0:98	6	ax	-37.7	26.3
58	@MSU-Net Plus	F0:3E:90:76:CF:5C	149	ax	-43.3	29.7
59	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CF:5C	149	ac	-43.3	39.7
60	eduroam	9C:D5:7D:06:63:6E	124	ax	-82.7	7.3
61	@MSU-Net via AIS	F0:3E:90:B6:C0:98	6	ac	-39.0	25.0
62	@MSU-Net	9C:D5:7D:06:63:6F	124	ax	-82.7	7.3
63	.@ AIS SUPER Wi-Fi	F0:3E:90:36:C0:98	6	ac	-38.0	33.0
64	@MSU-Net via AIS	74:3E:2B:BD:9F:28	11	ac	-64.0	-7.0
65	AIS SMART Login	74:3E:2B:3D:A9:99	11	ac	-54.0	3.0
66	@MSU-Net Plus	74:3E:2B:7D:A9:98	11	ax	-52.0	5.0
67	AIS SMART Login	74:3E:2B:3D:EE:F9	1	ac	-70.0	-17.7
68	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:8A:38	1	ac	-77.0	-24.7
69	eduroam	74:3E:2B:FD:EE:F8	1	ax	-64.0	-11.7
70	eduroam	2C:1A:05:6D:66:CE	112	ax	-76.0	6.3
71	AIS SMART Login	74:3E:2B:3D:A9:AD	44	ac	-60.3	11.7
72	AIS SMART Login	F0:3E:90:36:C4:CD	44	ac	-45.3	26.7
73	eduroam	F0:3E:90:F6:C4:CC	44	ax	-45.7	26.3
74	eduroam	00:1F:45:DE:A1:82	153	ax	-83.0	-11.0
75	@MSU-Net via AIS	74:3E:2B:BD:A9:9C	44	ac	-58.0	14.0
76	eduroam	F0:3E:90:F6:CB:2C	36	ax	-69.7	2.3
77	@MSU-Net via AIS	F0:3E:90:B6:CB:2C	36	ac	-69.7	2.3
78	@MSU-Net	00:1F:45:DE:A1:81	153	ax	-75.0	-3.0
79	@MSU-Net Plus	F0:3E:90:76:CB:2C	36	ax	-69.7	2.3
80	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CB:2C	36	ac	-69.3	2.7
81	AIS SMART Login	F0:3E:90:36:C4:C9	1	ac	-41.0	21.0
82	eduroam	74:3E:2B:FD:A9:98	11	ax	-50.7	6.3
83	@MSU-Net via AIS	74:3E:2B:BD:A9:98	11	ac	-52.3	4.7
84	@MSU-Net Plus	9C:D5:7D:06:63:6D	124	ax	-83.3	6.7
85	@MSU-Net Plus	D8:84:66:5A:58:F2	112	ax	-45.7	42.3
86	eduroam	2C:1A:05:6D:AE:4E	108	ax	-85.7	2.3.0
87	@MSU-Net Plus	00:1F:45:DE:A1:80	153	ax	-83.0	-11.0
88	@MSU-Net via AIS	74:3E:2B:BD:EA:F8	6	ac	-71.3	-7.3
89	AIS SMART Login	F0:3E:90:36:B9:69	6	ac	-62.7	2.0
90	eduroam	F0:3E:90:F6:CF:58	1	ax	-34.7	27.3
91	AIS SMART Login	74:3E:2B:3D:A9:9D	44	ac	-58.0	14.0
92	eduroam	74:3E:2B:FD:A9:9C	44	ax	-58.0	14.0
93	@MSU-Net via AIS	F0:3E:90:B6:C4:CC	44	ac	-46.0	26.0
94	eduroam	F0:3E:90:F6:B9:68	6	ax	-62.0	2.0
95	@MSU-Net via AIS	F0:3E:90:B6:B9:68	6	ac	-62.0	2.0
96	@MSU-Net Plus	F0:3E:90:76:CD:78	11	ax	-40.3	16.7
97	.@ AIS SUPER Wi-Fi	F0:3E:90:36:B9:68	6	ac	-62.3	2.7
98	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:9C	44	ac	-57.7	14.3
99	eduroam	D8:84:66:5A:58:F0	112	ax	-45.7	42.3
100	AIS SMART Login	74:3E:2B:3D:A9:A9	6	ac	-50.3	13.7
101	@MSU-Net	2C:1A:05:6D:AE:4F	108	ax	-86.7	1.3.0
102	@MSU-Net Plus	74:3E:2B:7D:A9:A8	6	ax	-52.3	11.7

Table S9: Continue

103	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:A8	6	ac	-53.7	10.3
104	AIS SMART Login	F0:3E:90:36:C0:99	6	ac	-40.3	23.7
105	.@ AIS SUPER Wi-Fi	F0:3E:90:36:C4:CC	44	ac	-45.7	26.3
106	eduroam	74:3E:2B:FD:A9:AC	44	ax	-61.0	11.0
107	@MSU-Net Plus	74:3E:2B:7D:A9:AC	44	ax	-60.0	12.0
108	AIS SMART Login	F0:3E:90:36:CB:2D	36	ac	-69.7	2.3
109	AIS SMART Login	74:3E:2B:3D:9F:29	11	ac	-68.0	-11.0
110	eduroam	74:3E:2B:FD:9F:28	11	ax	-64.0	-7.0
111	AIS SMART Login	74:3E:2B:3D:75:79	11	ac	-75.0	-18.0
112	eduroam	F0:3E:90:F6:CB:28	11	ax	-50.7	6.3
113	@MSU-Net via AIS	F0:3E:90:B6:B:28	11	ac	-50.0	7.0
114	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CB:28	11	ac	-50.0	9.3
115	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CD:78	11	ac	-40.0	30.3
116	eduroam	2C:1A:05:6D:AE:41	1	ax	-79.0	-30.0
117	eduroam	00:1F:45:DE:A1:C2	44	ax	-89.0	-26.7
118	@MSU-Net Plus	00:1F:45:DE:A1:C1	44	ax	-89.0	-26.7
119	@MSU-Net Plus	74:3E:2B:7D:9F:28	11	ax	-66.0	-9.0
120	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:9F:28	11	ac	-68.0	-11.0
121	eduroam	9C:D5:7D:06:63:61	6	ax	-69.0	-12.0
122	AIS SMART Login	F0:3E:90:36:CD:7D	48	ac	-47.7	24.3
123	eduroam	F0:3E:90:F6:CD:7C	48	ax	-47.0	25.3
124	@MSU-Net via AIS	F0:3E:90:B6:CD:7C	48	ac	-46.7	25.7
125	@MSU-Net Plus	F0:3E:90:76:CD:7C	48	ax	-47.0	25.3
126	.@ AIS SUPER Wi-Fi	F0:3E:90:36:CD:7C	48	ac	-46.7	31.7
127	eduroam	74:3E:2B:FF:48:4C	36	ax	-85.0	-13.0
128	@MSU-Net Plus	00:1F:45:DE:A1:8A	13	ax	-72.0	-15.0
129	@MSU-Net	00:1F:45:DE:A1:89	13	ax	-73.0	-16.0
130	AIS SMART Login	74:3E:2B:3D:EA:F9	6	ac	-69.3	-5.3
131	eduroam	74:3E:2B:FD:EA:F8	6	ax	-71.7	-7.7
132	@MSU-Net Plus	74:3E:2B:7D:EA:F8	6	ax	-70.0	-6.0
133	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:EA:F8	6	ac	-74.7	-10.7
134	AIS SMART Login	74:3E:2B:3F:48:49	1	ac	-82.0	-33.0
135	eduroam	74:3E:2B:FF:48:48	1	ax	-81.0	-32.0
136	@MSU-Net via AIS	74:3E:2B:BF:48:48	1	ac	-81.0	-32.0
137	@MSU-Net Plus	74:3E:2B:7F:48:48	1	ax	-76.0	-27.0
138	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:48:48	1	ac	-80.0	-31.0
139	AIS SMART Login	74:3E:2B:3D:A9:BD	36	ac	-74.0	-12.0
140	AIS SMART Login	74:3E:2B:3F:48:4D	36	ac	-90.0	-28.0
141	eduroam	74:3E:2B:FD:A9:BC	36	ax	-74.5	-12.5
142	@MSU-Net via AIS	74:3E:2B:BD:A9:BC	36	ac	-74.5	-12.5
143	AIS SMART Login	74:3E:2B:3D:A9:B9	11	ac	-69.0	-12.0
144	eduroam	74:3E:2B:FD:A9:B8	11	ax	-67.0	-10.0
145	@MSU-Net via AIS	74:3E:2B:BD:A9:B8	11	ac	-69.0	-12.0
146	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:B8	11	ac	-70.3	-13.3
147	eduroam	00:1F:45:DE:A1:88	13	ax	-75.0	-18.0
148	eduroam	00:1F:45:DE:C3:9A	6	ax	-64.0	0.0
149	eduroam	00:1F:45:DE:A1:CA	6	ax	-71.0	-7.0
150	@MSU-Net	00:1F:45:DE:A1:C8	6	ax	-72.0	-8.0
151	@MSU-Net Plus	74:3E:2B:7D:8A:38	1	ax	-74.0	-21.7
152	@MSU-Net via AIS	74:3E:2B:BD:EE:FC	161	ac	-87.0	-24.3
153	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:A9:BC	36	ac	-74.0	-16.7
154	@MSU-Net Plus	74:3E:2B:7D:A9:BC	36	ax	-74.5	-17.2
155	@MSU-Net Plus	00:1F:45:DE:A1:C9	6	ax	-70.0	-10.3
156	@MSU-Net	00:1F:45:DE:C3:90	36	ax	-77.0	-5.0
157	eduroam	00:1F:45:DE:A4:A2	161	ax	-80.0	-8.0
158	@MSU-Net via AIS	74:3E:2B:BD:8A:38	1	ac	-74.0	-21.7
159	eduroam	00:1F:45:DE:C3:92	36	ax	-79.0	-7.0
160	@MSU-Net Plus	00:1F:45:DE:C3:91	36	ax	-78.7	-6.7
161	@MSU-Net Plus	9C:D5:7D:03:2F:22	11	ax	-77.0	-28.0
162	@MSU-Net	9C:D5:7D:03:2F:20	11	ax	-77.0	-28.0

Table S9: Continue

163	@MSU-Net Plus	00:1F:45:DE:A4:A1	161	ax	-79.0	-7.0
164	@MSU-Net	00:1F:45:DE:A4:A0	161	ax	-78.0	-6.0
165	AIS SMART Login	74:3E:2B:3D:EE:FD	161	ac	-91.0	-19.0
166	AIS SMART Login	F0:3E:90:36:CB:29	11	ac	-50.7	3.3
167	@MSU-Net	00:1F:45:DE:C3:98	6	ax	-67.3	-3.3
168	eduroam	20:B3:99:49:4B:DA	6	ax	-77.0	-32.7
169	@MSU-Net via AIS	74:3E:2B:BD:75:78	11	ac	-70.0	-16.0
170	.@ AIS SUPER Wi-Fi	74:3E:2B:3D:75:78	11	ac	-72.3	-18.3
171	@MSU-Net Plus	74:3E:2B:7D:A9:B8	11	ax	-71.7	-21.7
172	eduroam	74:3E:2B:FD:8A:38	1	ax	-76.0	-31.7
173	eduroam	2C:1A:05:6D:B7:81	6	ax	-80.0	-35.7
174	@MSU-Net Plus	00:1F:45:DE:C3:99	6	ax	-63.7	0.3
175	AIS SMART Login	74:3E:2B:3D:8A:39	1	ac	-72.0	-27.7
176	@MSU-Net Plus	9C:D5:7D:06:63:62	6	ax	-69.0	-12.3
177	@MSU-Net Plus	74:3E:2B:7D:75:78	11	ax	-71.0	-17.0
178	@MSU-Net	9C:D5:7D:06:63:60	6	ax	-71.0	-14.3
179	@MSU-Net via AIS	74:3E:2B:BF:48:4C	36	ac	-84.0	-12.0
180	@MSU-Net Plus	74:3E:2B:7F:48:4C	36	ax	-92.0	-20.0
181	eduroam	2C:1A:05:6C:FF:4E	60	ax	-93.0	-34.0
182	@MSU-Net	2C:1A:05:6C:FF:4F	60	ax	-94.0	-35.0
183	@MSU-Net Plus	2C:1A:05:6C:FF:4D	60	ax	-92.0	-33.0
184	@MSU-Net	2C:1A:05:6D:66:C0	11	ax	-71.0	-21.3
185	eduroam	74:3E:2B:FD:75:78	11	ax	-75.0	-25.3
186	@MSU-Net Plus	00:DC:B2:1F:10:D0	100	ax	-88.0	-12.3
187	eduroam	00:DC:B2:1F:10:D2	100	ax	-89.0	-13.3
188	@MSU-Net	00:DC:B2:1F:10:D1	100	ax	-88.0	-12.3
189	eduroam	2C:1A:05:6D:66:C1	11	ax	-75.0	-35.3
190	@MSU-Net Plus	2C:1A:05:6D:66:C2	11	ax	-76.0	-36.3
191	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:48:4C	36	ac	-84.0	-24.7
192	@MSU-Net Plus	74:3E:2B:7F:0F:88	6	ax	-81.0	-17.0
193	AIS SMART Login	F0:3E:90:36:B9:6D	36	ac	-92.0	-34.7
194	eduroam	F0:3E:90:F6:B9:6C	36	ax	-92.0	-34.7
195	@MSU-Net via AIS	F0:3E:90:B6:B9:6C	36	ac	-92.0	-34.7
189	eduroam	2C:1A:05:6D:66:C1	11	ax	-75.0	-35.3
190	@MSU-Net Plus	2C:1A:05:6D:66:C2	11	ax	-76.0	-36.3
191	.@ AIS SUPER Wi-Fi	74:3E:2B:3F:48:4C	36	ac	-84.0	-24.7
192	@MSU-Net Plus	74:3E:2B:7F:0F:88	6	ax	-81.0	-17.0
193	AIS SMART Login	F0:3E:90:36:B9:6D	36	ac	-92.0	-34.7
194	eduroam	F0:3E:90:F6:B9:6C	36	ax	-92.0	-34.7
195	@MSU-Net via AIS	F0:3E:90:B6:B9:6C	36	ac	-92.0	-34.7