Gateway system for portable finger scanners

T P Nugraha* and D Wahyudin
Departemen Pendidikan Teknik Elektro, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi 207, Bandung 40154, Indonesia
*teguhprataman@student.upi.edu

Abstract. The attendance system serves as authentic proof of someone's presence, in this instance the system is meant to account for lecturer's presence. The current portable finger scanner attendance tool used does not yet have a system for processing data. The purpose of this study is to create a system that is able to receive, process and store data that has been sent by a portable finger scanner. The method carried out in this study was an experiment including designing hardware, software, and testing tools. The trial results show that the tool runs in accordance with the planned specifications. Data can be received through LoRa, stored in the database, and then converted into Excel format. Each mode is able to function properly, the planned distance of acceptance is achieved, and the final purpose of designing the tool is fulfilled.

1. Introduction
The presence system has a very important role as a authentic proof. This system is applied to various offices with different equipment [1,2]. Usually a presence system uses signatures as proof of attendance. However, in current era to store data of presence, using a portable finger scanner gives a benefit. The obtained fingerprint data needs further processing. Hence, data can be utilized to the maximum use. The use of databases is needed to store presence data that has been permanently processed for archiving purposes.

Various gateway technologies for presence systems using Finger Scanner have been made using different components and connectivity. Darmawane et al. creates a fingerprint-based attendance and reporting system and sms gateway [3], Miftah create a web-based student presence system with PHP and MySQL [4]. While the author in Fakih et al. created a Fingerprint Authentication presence system for Automation of Lecture Presence using a desktop computer [5]. However, these studies still do not use devices and connectivity that are more sophisticated in terms of specifications, capabilities, and ease of manufacture. Each room has a Portable Finger Scanner to send attendance data to examiners. A gateway server will be placed in the room which functions as a receiver to store lecturer attendance data in the form of a database.

Therefore, the author tries to use Raspberry Pi and LoRa as the main components of this tool. The Raspberry Pi is as single board computer (SBC). The size of SBC of a credit card. The Raspberry Pi is equipped with all functions like a complete computer, using ARM system-on-a-chip (SoC) which is packaged and integrated on a printed circuit board (PCB). This Raspberry Pi is able to work like a computer in general with the ability to run a Linux operating system and its application [6]. LoRa (short for Long Range) is a wireless technology developed by Semtech, this technology can reduce power consumption...
using special modulation techniques. This technology can reduce power consumption and has a data transmission distance of up to 10 kilometers [7]. This tool will be made in a simple form so that it is easy to carry or move from one place to another. The author aims to create a gateway system design for portable finger scanners in the design of the lecturer attendance system. Discussion is only limited to the design of the gateway system that functions as a receiver and the results of testing.

2. Methods
The first step is to design the system by detailing the components of input, process, and output. The LoRa radio module used is the Semtech E32-TTL-100 module with the SX1278 chip as a connecting component between a server (receiver) and a portable finger scanner. It has a fixed mode format for transmitting data from multiple transmitters to a receiver. The radio frequency used is 433 MHz in accordance with government regulations. The screen used is a 3.5 inch TFT LCD to display data received from the transmitter. The data will be stored in the database and can be converted into csv format to make it easier for users to print attendance data. The hardware design is equipped with a 5V supply adapter with a maximum current of 2A. Figure 1 shows the block diagram of hardware design.

![Figure 1. Hardware design diagram.](image)

Program design is done after the hardware design is complete. So that programs are made in accordance with the components available. In the program design, there is a data reception section from LoRa. The data transmission feature via LoRa uses a fixed mode format where in one data reception there are six sub-data consisting of two initial data as the target address, the third data as the target channel, and the last three default data which means filled according to planning needs. So the author will make arrangements for this data format.

After the hardware is integrated with the program that has been created, then do a test tool. Trials include testing the suitability of the display on the hardware and programs that have been made. Then the next trial was to receive data sent by a portable finger scanner with a distance of more than 30 meters. This distance is chosen because the actual distance between the portable finger scanner server is 30 meters. If the trial does not match the purpose, it will be redesigned until the goal is reached.

3. Results and discussion

3.1. Hardware
The UART pin of the Raspberry Pi is used as a communication path with the LoRa E32-TTL 100 radio module. The pins M0 and M1 on the radio module are connected to the ground to set the radio module to
the normal mode state. Under normal circumstances the data transmission activity mode can be done. The TFT LCD screen uses an HDMI connector (High-Definition Multimedia Interface) that is available on the Raspberry Pi as a data communication path. While for the supply used it is a 5V 2A adapter to meet the required power requirements of this series.

3.2. Program
This program is created in accordance with the flowchart planned and supported by each component module using the Python programming language 3. Format of data transmission using fix mode which is a data array containing six pieces of information, including the first and second is the target address or the default address of the radio module used, the third is the target channel which is the default address of the radio module channel used, the radio module on the portable finger scanner must have the same target address and target channel configuration as the radio module used at the gateway. While the fourth data is the tool number data, the fifth data is the operating mode code that is owned by the portable finger scanner and the latest data as the user's fingerprint ID.

3.3. Trials
The following are the results of the program design that is run in the hardware circuit.

3.3.1. Initial display. In Figure 2 is the initial display when we run the program on the Raspberry Pi, in the default condition the program created will be in matching mode. In the upper left corner there is a menu bar for selecting other modes in the program.

Figure 2. Initial display.

3.3.2. Enroll mode display. Figure 3 (A) is a display of evidence of data received from a portable finger scanner in the form of an ID number and class number in the shell. The display in Figure 4 (B) is the step of giving the user name to the ID number received, so that the ID number can be recognized by the program.
3.3.3. Matching mode display. Matching mode is the name of the mode for the attendance system. In this mode there are 4 data displayed including, ID number, name, time of data received, and room number. The display in Figure 4 (A) is a display if the device receives an ID number data that has not been recognized. Registration of ID number data on enroll mode must be done first so that data can be identified. Figure 4 (B) is the display of ID number data from a portable finger scanner that was previously registered on the enroll mode, the ID number received has a name so that it can be identified who is the user of the ID number.

3.3.4. LoRa range. Distance of LoRa Measurements Measurements are carried out by placing the gateway server in the DPTE FPTK UPI room, while portable finger scanners are moved from one place to another that has been determined. Measuring distance testing between a gateway server and a portable finger scanner is drawn in a straight line.

3.3.5. Data conversion from database (.db) to excel (.csv). Data stored on the database has the format .db, so it needs to be converted to a format that can be opened by almost all computer devices. The format chosen is the format comma-separated values (.csv). Converting a .db file to a .csv format is done by entering the directory where the database is stored through the terminal, and typing special commands. Figure 5 is a terminal display image with a command to convert the .db file to a .csv file named matching.csv.
3.3.6. Final data display. Figure 6 is a data display that has a .csv format, this data is the end result of a Gateway System tool for Portable Raspberry Pi and LoRa Based Finger Scanners for Lecturer Presence System on Design of Final Defense Session in DPTE FPTK UPI. The data that has been obtained can then be easily processed or printed, because the .csv file format can be opened in almost all computers and devices that are in the DPTE FPTK UPI.

4. Conclusion
Based on the results and discussion, it can be concluded that the design of the Gateway System for Raspberry Pi and LoRa-based Portable Finger Scanners was successfully made according to the plan. On the results of the trial shows that each mode can function properly, the planned distance of acceptance is achieved, and the final goal of designing a tool that is fulfilled.

References
[1] Veer N D and Momin B F 2016 An automated attendance system using video surveillance camera 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) 1731-1735
[2] Oo S B, Oo N H M, Chainan S, Thongniam A and Chongdarakul W 2018 Cloud-based web application with NFC for employee attendance management system 2018 International Conference on Digital Arts, Media and Technology (ICDAMT) 162-167
[3] Darmawan A, Yuliawati D, Marcella O and Firmandala R 2016 Sistem Absensi dan Pelaporan Berbasis Fingerprint dan SMS Gateway *Explore: Jurnal Sistem informasi dan telematika* 7(2) 10

[4] Miftah A S 2014 Aplikasi SMS Gateway Presensi Siswa Berbasis WEB dengan PHP dan MYSQL (Tugas Akhir Teknik Informatika, Yogyakarta: UMY)

[5] Fakih A, Raharjana I K and Zaman B 2015 Pemanfaatan Teknologi Fingerprint Authentication untuk Otomatisasi Presensi Perkuliahan *Journal of Information Systems Engineering and Business Intelligence* 1(2) 41-48

[6] Jain S, Vaibhav A and Goyal L 2014 Raspberry Pi based interactive home automation system through E-mail *2014 International Conference on Reliability Optimization and Information Technology (ICROIT)* 277-280

[7] Trinh L H, Bui V X, Ferrero F, Nguyen T Q K and Le M H 2017 Signal propagation of LoRa technology using for smart building applications *2017 IEEE Conference on Antenna Measurements & Applications (CAMA)* 381-384