

Smart Attendance Recording System using RFID and e-Certificate using QR Code-based Digital Signature

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Abstract— Nowadays, the development of Information Technology is growing very rapidly. The term smart is widely used in the field of Information Technology as a smart system such as a smart library, smart campus. There are many components of technology associated with smart campuses, one of which is the Internet of Things. RFID is one of the Internet of Things solutions that will have a positive impact on universities. This paper will discuss how to implement a smart attendance recording system using RFID and integrate the e-Certificate system for organizing activities at Maranatha Christian University, by a QR Code-based digital signature as a guarantee of the authenticity of the e-Certificate generated.

Keywords— RFID, Internet of Things, Smart Campus

⁷ I. INTRODUCTION

Nowadays, the development of Information Technology is growing very rapidly. The term smart is widely used in the field of Information Technology as a smart system such as a smart city, smart campus.[1] There are many components of technology associated with smart campuses, one of which is the Internet of Things[2]. IoT helps ICT to expand the services provided, providing flexibility and affordability and real-time data from anywhere to anyone around the world.[3][4][5][6] Nowadays almost all IT devices are connected to the internet. In the future, it is certain that almost all IT devices will have internet connectivity and will be more autonomous.[2]

For example, a smart card that will replace a student card in the concept of a larger smart campus will be able to be used to enter the room, can be used to shop in the cafeteria, to pay for parking can even be used to know about personal information data. IoT is useful in a variety of fields, including medicine, agriculture, education, and others.

This shifts the paradigm in the field of education. Lecturers will save time assessing students' work by using online IoT processes such as Kahoot. Lecturers can share lecture materials via Google Docs and write posts via Telegram. Students will receive more and better information from lecturers and other internet resources. They will be able to compare the level of knowledge and competence of lecturers and provide immediate feedback so that the university can improve. The impact of IoT solutions on universities will be positive. [4][5].

Students and staff can be identified and attendance can be automatically recorded using RFID tags, biometric parameters, or facial recognition algorithms. Based on the foregoing, this paper will discuss how to implement one component of an IoT smart campus, attendance recording using RFID, and integrate the e-Certificate system for organizing activities at Maranatha Christian University, using a QR Code-based digital signature to ensure the authenticity of the e-Certificate generated. The Part 2 will discuss the theory and how RFID and QR Code implementation can be done. Part 3 describes the result and discussion. Part 4 describes the conclusion.

II. MATERIALS AND METHODS

1) RFID

RFID is one form of development of wireless technology that is used as a substitute for barcode technology. This technology works by utilizing radio transmission frequency waves to identify an object in the form of a small device called a tag or transponder⁴ (transmitter + responder). The identification system in RFID is a type of automatic identification system that aims to allow the data transmitted³ the RFID tag to be read by an RFID reader which will then be processed according to the needs of the application being made. Data received by the RFID reader is data obtained from the process of transmitting data from the tag. This data is a unique array of numbers that contains identification information that can be used for smart card applications, location searches, as well as specific information contained in a product that has a tag.[7][8]

Because each tag has a unique number arrangement, RFID is classified as a technology that is difficult to forge. So, nowadays more and more applications are being made using RFID technology to increase the reliability of a system. The RFID system consists of 3 components, namely RFID tags, RFID readers, and computers[8], which can be seen in the RFID Components in Figure 1.

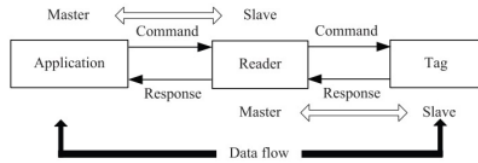


Fig 1 Components of RFID System[8]

The working principle of the RFID system is when the reader emits radio waves, if the RFID tag is within the range of the radio frequency waves, the chip in the RFID tag will be generated through an inducted voltage and will respond, i.e. the RFID tag will send a unique stored number. In this way, the RFID tag will send a unique stored number wirelessly to the RFID reader to be read. After that, the reader will forward the read data to the host computer that is connected to the reader, which can be seen in Figure 2.

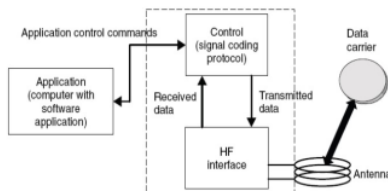


Fig 2 Workflow RFID System[8]

2) QR Code

QR Code is an image in the form of a two-dimensional matrix that can store data in it. QR Code is an evolution of barcodes. Barcode is a symbol of tagging real objects made of black and white rod patterns for easy to recognize by the computer.

QR Code stands for Quick Response Code or can be translated into quick response code. QR Code was developed by Denso Corporation, a Japanese company engaged in automotive. The QR Code was published in 1994 to track vehicles in manufacturing parts quickly and getting a quick response.

Each QR code is made up of a black (logical "1") and a white (logical "0") module. The code is distributed in a squared mesh of fields, and according to the ISO/IEC18004 standard, one module must be 4 X 4 px (pixels) in size and have a print resolution of 300 dpi (dots per inch), which can be seen in Figure 3.

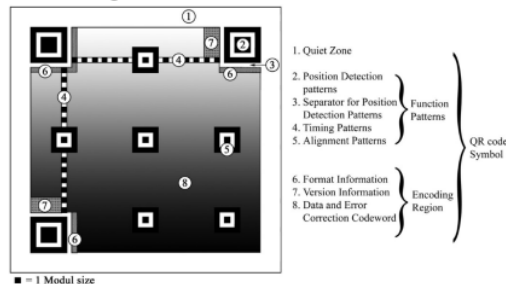


Fig 3 QR Code Structure [9]

QR code-based technology is currently widely used because it has a large data storage capacity, lower implementation

costs, simple, widespread use, and is widely available, a free program for reading and detecting QR codes by smartphones equipped with cameras. [10]

The procedure of generating a QR Code from a text can be explained by the flow chart in figure 4.

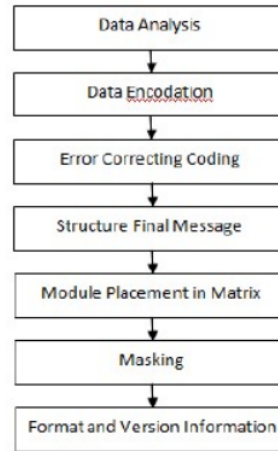


Fig 4. Flowchart of QR Code generation process[11]

The steps to read the QR Code into the original text are reverse or the opposite of the steps on generating the QR Code. In general, the QR code reading procedure can be explained by the flowchart in figure 5.

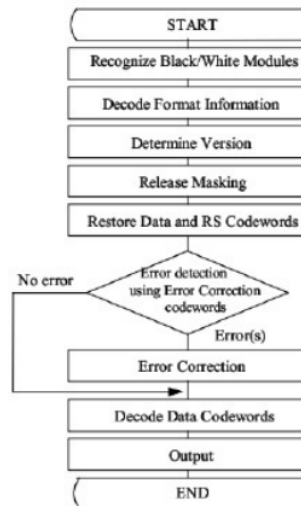


Fig 5 Flowchart of QR Code reading process [11]

The use case diagram of this system (figure 6) involves two actors namely Admin Committee and members namely lecturers and students. Admins can create an event, make a template of e-certificate, Registration, Add File event dan Login. Member can log in, get e-certificate, manage attendance, choose an event, and get file event.

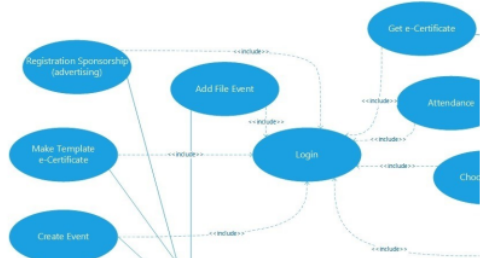


Fig 6 Use Case Diagram Event Attendance using RFID

Database Diagram for Event Attendance using RFID is shown in Figure 7.

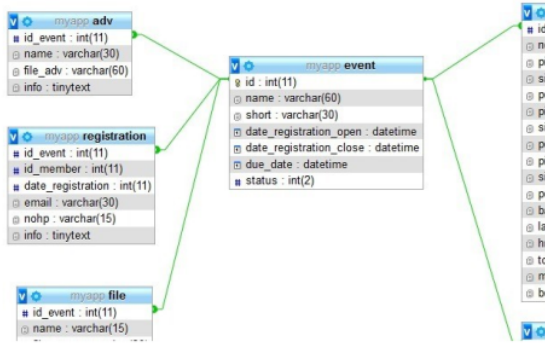


Fig 7 Database Diagram

The rest of this study is organized as follows: Section II describes the research methodology used in this study. Section III provides an overview of the smart campus model. Section IV concludes the review study.

III. RESEARCH AND DISCUSSION

Following is the implementation of the application to attend the event which starts from the login process. The administrator can create an event or class for the first time before a member can attend the event (Figure 8). After logging in, the user can choose the menu to create an event. Figure 9 contains a view of the event menu to choose from.

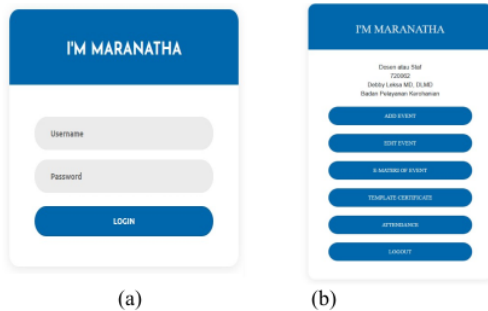


Fig 8. (a) Login Menu (b) Event Menu

Admin can add activities done by selecting the add menu will be displayed the fill according to figure 9a. After the

admin inputs, some events then appear the entire activity created by the administrator. Yellow background color in the event means there is data (field) of activities that have not been filled in. The green background color of the data is complete but the event has not been attended by participants. Changing activities can only be done for yellow and green backgrounds (figure 9b). Admin can also create a certificate print template that will be printed automatically in pdf format when the user comes and fills out the present list (Figure 10a) and also can store conference materials on servers that can be accessed by the participants (figure 10b)

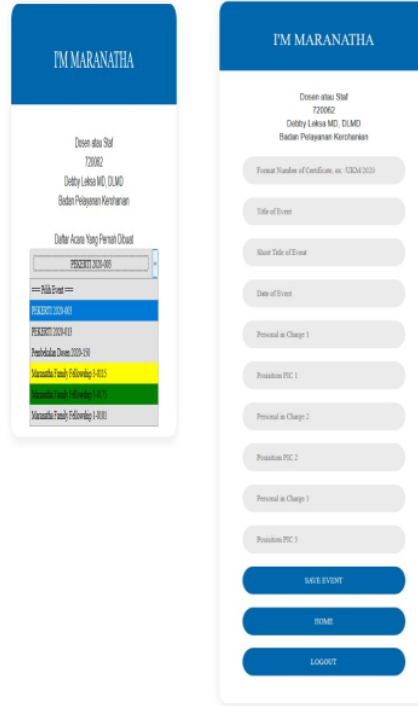


Fig 9. (a) Create Event (b) Choose an Event



(a) (b)

Fig 10 (a).Create e-certificate menu (b) conference material

For attendance, the attendance menu is selected, participants can tap the employee card to the RFID reader connected to the computer and internet network to connect to SAT Database (Figure 11).



Fig 11. RFID Reader and Card.



Fig 12 User interface record attendance at an event.

IV. CONCLUSION

A participant attendance recording application has been successfully created for activities held at Maranatha Christian University. Verification is done by using a login from SAT database so that it is more secure than without authentication. The participant attendance recording application has been integrated with the e-certificate application so that after the system checks the data from the attendance recording application then the e-certificate can be downloaded by the participant.

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