Design and Implementation of RFID Card Based Authentication Software in Universitas Advent Indonesia's Dining Room

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ABSTRACT

Universitas Advent Indonesia is a boarding school that provides meal services to the students who live in the dormitory. However, not all of the students live in the dormitory, the students can opt to stay outside of the dormitory and stay in the campus' surroundings. Thus, it is necessary to have a system that can differentiate which student is eligible to have meals in the campus' dining room. Therefore, in this research we propose to use cards embedded with an RFID chip that can be authenticated using a card reader that connects to the university's online system to determine and record the students that have meals in the dining room.

Keywords: Software development, web-based software development, authentication system, RFID-based authentication.

INTRODUCTION

Universitas Advent Indonesia (UNAI) is a boarding school located in Bandung Barat, West Java Province, Indonesia. One of the services provided in UNAI is meal service to the students who live in the dormitory. UNAI has a cafeteria/dining room that is located near the students' dormitories. The university provides the students three meals a day during the in certain hours: Morning, 06:00-07:00, Afternoon 12:00-13:00, Evening 17:00-18:00. However, not all of the students live in the dormitory, the students can opt to stay outside of the dormitory and stay in the campus' surroundings. Thus, it is necessary to have a system that can differentiate which student is eligible to have meals in the campus' dining room.

The student registration process that occurs at the beginning of the semester is an important process determines the eligibility of a student to be able to have meals in the campus dining room for the semester. The registration process begins with student paying an amount of money to the cashier or through bank transfer. Then they must go to the student finance officer to be approved of their registration for the current semester. If the student opts to stay at the

dormitory, then by default they are registered to have meal service in the dining room. However, in special cases, with authorization from the Vice President of Student Affairs, a student that stays in the dormitory can choose not to have meal service in the dining room. Furthermore, if a student opts to stay outside of the dormitory, by default the cannot have meals in the dining room. However, it is also possible if an outside student chooses to have meals in the dining room for the current semester. Before we developed an integrated computerized and networked system for dealing with these problems, the student finance office issued a meal card for every student that is registered to have meals in the dining room. After their registration process is complete, students need to take their meal cards from the student finance office. Then every time they want to have meal at the dining room, there is an officer that checks their card and marked the card based on the date and meal time. However, there are a lot of problems with this old process: 1) The meals card is made of paper and can be broken easily due to of folding, moisture or water. 2) Many students lost their card because of various reasons 3) The student finance officers need to re-issue and maintain these student cards in daily basis and this is time consuming. 4) Student can make their own card, as there is no security printing or security mechanism in preventing student to create or duplicate the meals card. 5) Student can use other students' card to have meal in the dining room. Thus, it is necessary to develop a system that can solve the abovementioned problems. This system needs to be integrated with the registration system and can differentiate or identify which students is eligible to have meals in the dining room for the active semester.

In this research we design and implement Radio Frequency Identification (RFID) card based authentication in UNAI dining room that can authenticate eligible student that is registered to have meals in the dining room. Furthermore, the system records if a student have meals and provide reports for the student, dining room officers and also University's management to provide historical account on students, days and meal time.

LITERATURE REVIEW

RFID has been used in many areas such as public transport, ticketing, hotel, door access, etc. It allows us quick and contactless authentication of a person owning an RFID tag. RFID used radio wave in retrieving and storing data without any physical contact (Lahiri, 2005). RFID tags can be read several meters away and does not require line of sight between the tag and the reader. An RFID consists of a microchip and antenna. The microchip stores a unique sequence

identifier than can be used as the tag identity. Table 1 lists different types of tag that are available for different applications and environment (Agrawal & Bansal, 2006):

Table 1. **Features of Types of Tags.**

Features	Type of Tag		
	Passive	**Active**	**Semi-Active**
Read range	Short (up to 10 m)	Long (up to 100 m)	Long (up to 100 m)
Lifespan	Up to 20 years	Between 5-10 years	Up to 10 years
Battery	No	Yes	Yes
Cost	Cheap	Very Expensive	Expensive
Availability	Only in field of reader	Continuous	Only in field of reader
Storage	128 bytes read/write	128 Kbytes read/write	128 Kbytes read/write

There are several related researches that consider the RFID based authentication implementation in different areas. RFID tag can be integrated in the student card to create a smart card for student that can be used in marking attendance, taking books from library or a hall ticket in exams, payment in canteen and student bus (Sonar, Walke, & Bane, 2018). In preventing cheating when using paper as student as attendance, RFID can provide an alternative way of taking student attendance (Shaibu, Ibrahim, & Ale, 2019). Moreover, RFID combined with fingerprint authentication has been implemented in a secured parking area in university campus (Utomo, Karna, & Mayasari, 2019). However, the abovementioned researches did not discuss the usage of RFID card for student authentication for having meals in a campus dining room. Therefore, we propose to design and implement an integrated system that incorporates a student card that has integrated passive RFID tag that is cheap to procure and RFID reader to read the card's serial number. We will explain the detail working mechanism in the following section.

METHODS

The method used in this research needs to ensure fast and efficient solution that can be implemented without a prolong waiting time. Thus, in this research we choose to use protopying paradigm that enables the detailed requirements, functions and features to be identified as the project being constructed. Figure 1 shows the prototyping paradigm used in this research. The methods start with communication with the stakeholders to define the overall objectives for the software, continued with quick plan and modeling and construction of prototype. After the prototype is complete, it is used as a mechanism for identifying software requirements (Pressman, 2010).
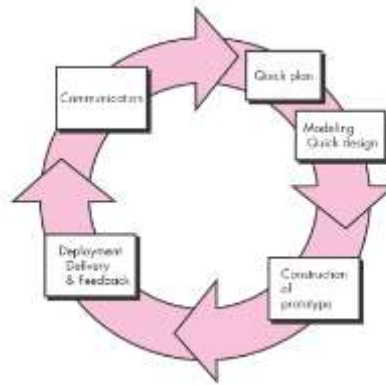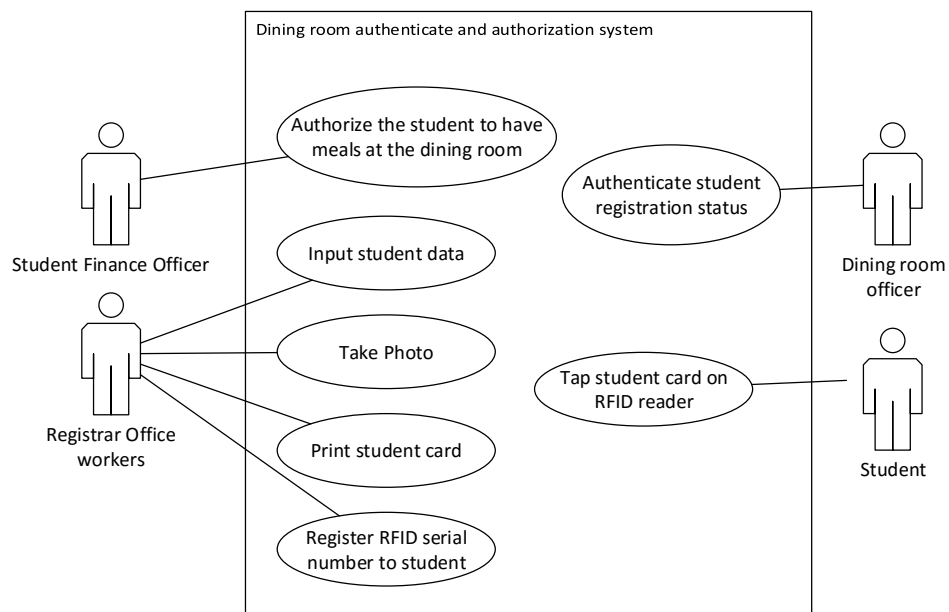
Figure 1. Prototyping Paradigm.

RESULTS

Figure 2. Use case diagram of the proposed system

The proposed RFID based authentication system is implemented with cooperating with different departments in the university. Figure 2 shows the Use Case diagram of the proposed RFID based software authentication. There are four actors involved with different responsibilities to enable the system works with integration different departments in UNAI. The registrar office is responsible to input the student data into the database, take photo, print the student card, registers the RFID serial number, and distributes the cards to the students. The student finance officer is responsible to determine the student is registered to have meals in the dining room or not. The dining room department provides the computer, RFID reader and human resources to run the system. The Information Technology (IT) department is responsible

to provide the necessary application for all departments and connect the computers and the RFID reader to the system.

Figure 3 shows the user interface (the user interface is in Indonesian language) of student registration used by the student finance officer to decide whether to accept or decline a student registration for the current semester. The form shows the NIM (student number), Nama (student name), Program Studi (student major), Sponsor, Tahun Ajaran (academic year), Semester, Status Tinggal (Living Status), Agama (Religion). Below the mentioned information, the table shows the registration number (usually shown in NIM), Saldo (Balance), Asrama (Dormitory), Luar Asrama (Outside), Setujui/Hapus (Approve/Decline). The student finance officer asks a student whether he/she wants to stay in the dormitory or not. If the student decides to stay at the dormitory then the officer will click the the Asrama (Dormitory) option and choose the dormitory type. When the dormitory button is clicked, the Makan di Kafetaria (Have meals in Cafetaria/Dining room) option is automatically selected. Then the officer clicks the Simpan (Save) button and the confirmation shown with green background that the student registration has been approved.

Figure 1. **User Interface for student registration (including meals) in student finance Office**

The current implementation of the system requires each student that wants to have meals in the dining room to bring their RFID enabled student card with them. In each counter there is an RFID reader, a computer and monitor that is used to authenticate the user, whether they are eligible to have meals or not. In the computer, an operator opens the web based authentication software in the browser. Figure 4 shows the user interface of the authentication form. When a student approaches a counter, he/she needs to tap their student card to the RFID reader and the device reads the serial number of the card. The card number is sent to the software that further sends a query to the database server and retrieve the student registration status from the database. The retrieved info is shown in the form along with the student photo and the operator allows the student to take a plate for meals if the information matches.

Figure 2. Form for authenticating the student to have meals in the dining room

DISCUSSION

Conclusion

The implemented system proved can identify the students that are permitted to have meals at the campus dining room using RFID cards. When a student taps his/her card to the reader, the application reads the unique number and compared it with the record in the database and

display the student's name, photo and their status. The software also records the students who have tapped their card and prevent the student to take more than one plate in a meal time. The stored record in the database is integrated to the existing online system in the university and can be accessed by authorized parties in campus.

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