**DEVELOPMENT OF SMART PAYMENT SYSTEM**

**FOR USLS – IS CAFETERIA**

A Design Project Presented to

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**INTRODUCTION**

This section is an overview on the Development of SMART Payment System for the University of St. La Salle – Integrated School Cafeteria. This will give a background on the said project, including its statement of the problem, significance, scope and limitations of the study and the review of related literature. Terms will be conceptually and operationally defined as well.

**Background of the Study**

In the University of St. La Salle – Integrated School (USLS-IS), the cafeteria is one of the most visited places by the students. Also, majority of purchases are done here. There is a large of number of sellers but the number of employees under one seller is low, thus, making transactions slower and more tedious. This also leads to congestion while buying food items.

Parents, in one hand, also face the problem of being unassured. Since they are not always around their children, they have no means of monitoring what their children are buying or whether the food they eat is safe.

This design project aims to automate transactions in the USLS – IS cafeteria using Radio-frequency Identification (RFID) in making cashless purchases. It also makes use of Cloud Computing to keep track of the vendor’s list of items that are available for buying, along with their prices, the number of purchases made by the students and the total revenue that they have accumulated throughout a certain period. This payment scheme also comes with a mobile application which the parents can download in order to monitor the student’s transactions, see the available balance in the child’s account and control the child’s daily expenditure budget.

**Statement of the Problem**

The main goal of this design project is to analyze the efficiency of the SMART Payment System in automating the transactions made in the University of St. La Salle – Integrated School cafeteria. Aside from that, there are other supporting questions for the problem. These queries are as follows:

1. What are the factors needed to be taken into consideration when automating transactions in the USLS – IS cafeteria?
2. How efficient will the SMART Payment System be in terms of automating transactions in the USLS – IS cafeteria?
3. What are the data needed to monitor the regulation of the products sold in the USLS – IS cafeteria?
4. How will the SMART Payment System automate the transactions in the USLS – IS cafeteria?
5. What are the important features of the SMART Payment System needed to automate transactions in the USLS – IS cafeteria?

**Scope and Limitations**

This project is a payment system using RFID that is linked to the student’s Identification (ID) card. It is built with a cloud computing system where transactions and other data are present. An app is provided to the parents so that they can track the things the students buy and limit the child's expenses during the day. The RFID can be loaded anytime via a kiosk machine. The loading machine does not dispense cash and is limited only for Philippine paper bills; therefore the exact amount must be deposited. If the RFID is lost, a temporary RFID card, along with the student’s credit information, will be provided. The client is then obliged to return the temporary card as soon as the lost card is replaced. The administrator will then wipe out all the information in the temporary RFID card.

Every store in the cafeteria has a list of all the products they sell and each product item has a barcode. Product lists, together with the number of purchased items, are then stored in the cloud and monitored by the administrator. The administrator is the only person granted with access to the cloud. The vendors need to surrender to the administrator the product they want to sell so that the existing barcode will be saved to the system. If the product has no barcode, the administrator will generate it using the system. All these data will then be added to the store’s product list in the cloud. The setup on the vendor side is a barcode scanner, a Near-field Communication (NFC) device in reader mode, and a Programmable Interface Controller (PIC) Microcontroller with a ESP8266 Wireless Fidelity (Wi-Fi) module that connects to the cloud.

The transaction method goes this way: first, the student picks a product to buy then the vendor will scan its barcode. The student will proceed to payment by tapping the RFID card on the NFC reader. After that, the transaction is sent to the cloud, then transaction of the student will reflect on the app given to the parents. The administrator monitors every transaction that is done in every store, including their daily income. The store can retrieve their liquidation reports from the administrator and claim their revenues. In redeeming the money, rents and other utilities are automatically deducted.

**Significance of the Study**

This design project will be significant to the following stakeholders:

**The parents of USLS – IS students.** The design project will provide a mobile application which the parents can download. In this app, they will be able to see the student’s transactions throughout the day, the daily expenses as well as the remaining balance under the student’s account. This way, the parent will be able to ensure that the student’s purchases are both safe to eat and within budget. Loading kiosks will also be provided so that the parents can reload their children’s account once in a while at their most convenient time.

**The USLS – IS students.** Purchases will be easier for the students since all they have to do is to order from the vendor and tap to pay. Congestion will be lessened since there will be a decrease on the transaction time. The student does not have to worry about bringing their money because their ID will act as their e-wallet. Also, the possibility of being overcharged and receiving the wrong amount of change will be minimized since the exact amount will be deducted from the student’s account.

**The vendors of USLS – IS cafeteria**. It has always been a struggle for some vendors to keep up with the amount of students that buys in their store. Some stores only have around 2 employees to accommodate more than 10 customers. This may result to student congestion and prolongs each transaction time. The study will provide convenience for the vendors since their transaction times will decrease and therefore increase the amount of customers each employee can accommodate at a time. This is because the payment will be automated, with the use of RFID and products have registered barcodes. In every transaction, only the exact amount will be deducted from the students’ remaining balance. This way, there’s no need for the vendors to manually process the money through receiving the payment and returning the change. And since the student pays the exact amount, this can prevent vendors from overcharging the students.

**The University of St. La Salle – Integrated School.** This project will also help regulate the food items that are being sold in the cafeteria. Since the products sold are registered with barcodes via the administrator, products sold in the cafeteria can be regulated. Regulated product supply means regulated consumption. This way, the University can ensure the student’s welfare and lessen the amount of products that the students consume which are considered unhealthy.

Technology has been spreading around the world mostly for the purpose of automation. There are facilities and even universities that have implemented automated technology which makes the lives of the people more convenient. The study aims to help the University to slowly step into automation not only for convenience, but to introduce advanced systems and technologies to the new students of the University, which in return can make them interested in studying them as well.

**Definition of Terms**

For the purpose of this study, the following key terms are defined conceptually and operationally:

**App.** Mobile Apps can come preloaded on the mobile device as well as can be downloaded by users from mobile App stores or the Internet. Moreover, mobile Apps usually help users by connecting them to Internet services more commonly accessed on desktop or notebook computer, or help them by making it easier to use the Internet on their portable devices. It is a software application downloaded on a device for personal use by a user (Wang, 2013).

In this study, it is the application provided to the parents of USLS – IS students for the monitoring of their children’s accounts.

**Cloud Computing.** Cloud computing is a powerful technology to perform massive-scale and complex computing. It eliminates the need to maintain expensive computing hardware, dedicated space, and software (Hashem et al, 2015).

Cloud computing, in this study, is used to manage transactions made in the USLS – IS cafeteria as well the USLS – IS students.

**ESP8266 Wireless Fidelity (Wi-Fi) Module.** Conceptually, [ESP8266](https://www.datasheets.com/pd/esp8266-olimex-67257755.html?utm_medium=PartNumber&utm_source=electroschematics&utm_term=ESP8266) offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. (Marian, 2015)

Operationally, the ESP8266 Wi-Fi Module is used to connect the vendor to the internet and upload data on the SMART Payment System’s cloud.

**Near – field Communication (NFC) Device in Reader Mode**. Conceptually, the “NFC Device” in reader mode behaves like a simple contactless card reader. It initiates communication by generating a magnetic field and then sending a command to the target. The target responds to the interrogator by retro-reflecting the incident wave. (Retrieved from: http://www.centrenational-rfid.com/how-nfc-works-article-133-gb-ruid-202.html)

Operationally, the NFC device in reader mode will be used as a means for the vendor to receive payment from the student. The student will his RFID card on this device to pay.

**Programmable Interface Controller (PIC) Microcontroller**. PIC microcontrollers (Programmable Interface Controllers) are electronic circuits that can be programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. (Ryan, 2017)

In this study, a PIC Microcontroller will be used in order to operate the vendor side of the SMART Payment System.

**Radio-frequency Identification (RFID).** According to George Roussos, it is an umbrella term that refers to several information and communication technologies that share the capability to automatically identify objects, locations, and individuals to computing systems without any need for manual intervention.

In this study, RFID refers to the student’s ID that has been encoded with the student’s account information.

**SMART System**. Smart Systems developments are ultimately driven by the application to user-level needs of individuals and society. They identify the key systems functionalities in the domains of sensing and actuation, interfaces, signal and cognitive processing, energy management and scavenging, communication and networking, and knowledge base to address those needs, some of which are general whereas others are specific for a particular application, and they marshal the most appropriate technologies in combinations to enable those functionalities (Retrieved from: <http://www.ecsel-austria.net/eposs.html>).

Operationally, a SMART System will be used as a payment scheme in this study. The researchers will be using RFID, Cloud Computing, and a Mobile App in automating the transactions.

**Vendor.** A vendor, also known as a supplier, is an individual or company that sells goods or services to someone else in the economic production chain (Rouse, 2015).

Operationally, this refers to the store, the store owners and the employees affiliated to the cafeteria within the University of St. La Salle – Integrated School.