RFID Based Universal Transaction System

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Abstract— Radio Frequency Identification (RFID) makes use of electromagnetic fields to identify objects. This characteristic can be used to identify RFID tags that come in the vicinity of the reader. These tags can be in the form of cards with general details of the user that will allow cashless transactions. As the world is moving towards a digital era, cashless payments are quite in demand. Smart cards that need to be swiped are vulnerable to skimming attacks and data theft. Thus, there is a need to have a cashless transaction system that is fast as well as secure and allows hassle-free transactions. Through this paper, we propose a novel approach to develop a cashless transaction system based on RFID that can be deployed anywhere to enable faster, smoother and secure transactions. The users of the system will have to be pre-registered and all the user related information will be saved in a MySQL database and the system will be programmed using Python. The RFID reader will interact with an Arduino Board and for user input, IR remote will be used.

I. INTRODUCTION

Radio Frequency Identification (RFID) enables flexible, wireless, automatic identification of an object or person using radio waves. It transmits the identity as a unique serial number [1, 2]. Radio Frequency Identification Technology (RFID) has moved from obscurity into main stream applications that help speed the handling of manufactured goods and materials [3]. Few of the advantages of RFID described in [4] are highlighted below:

- Reader can read and write data to RFID tags without direct contact and no line of sight problem.
- No maintenance costs
- RFID can work under different environments and can be used effectively for over 10 years.
- Fast read and write with the time taken for read/write being a few milliseconds

Due to these identified advantages RFID can serve as a very good technology for efficient transaction systems. Modern cards that use magnetic strips have to be swiped or the optical cards have to be placed on a glass screen to read the information. This information can be stolen by hackers using various skimming techniques. Even with drawbacks, cashless transaction system continues to be in demand and is the choice for a large number of transactions. There is a need to have a system that is cashless and yet secure and efficient. Since RFID reader can read data with no requirement of direct contact with the tag, the risk of Skimming attacks is minimized to 0. Thus, we propose an

RFID based Universal transaction system to overcome the identified issues. Storing and maintaining a database will ensure that only the authorized users can make a transaction. This will also solve the issue of multiple tags near the reader.

Rest of the paper is organized as follows, Section I contains the introduction the RFID based universal transaction system, Section II contain the related work done in RFID based transaction systems, Section III enlists the hardware and software components of the system, Section IV explains the methodology followed by the system along with a flow chart, Section V describes the obtained results and discussion, Section VI concludes the research work with future directions.

II. RELATED WORK

In paper [5], a hand held device has been designed and programmed as a smart card with RFID reader using Raspberry Pi. It has a lot of advantages as described below:

- It can be installed in any scenario and the reader has the ability to accustom itself to the existing application available.
- Recharging the smart card with money can be done through an authorized bank or at recharge points.
- To overcome the security issues, OTP generation has been used.

An identified disadvantage is that the storage memory capacity is to be improved.

In [6], a transaction system is developed that uses ATMega16 as the processor. They have made use of RFID reader which includes a contactless RFID tag. The reader will be connected to PC via CP2102. The advantages of the system are:

- Centralized data storage, adding to the safety.
- Eases the transactions
- It can be installed in any scenario

A disadvantage of the system is that students and faculty have same cards; data can get leaked as no security measure is identified.

In paper [7], an RFID based Cash less payment system is invented to help the customer to make payment without involving any cash but using RFID tag that contains electronic cash yet it can increase the smoothness while making payment. The advantages are described below:

- This system is able to function for tag identification and item tracking system.
- The RFID enable the data information to be transferred for tag identification purpose during data tracking process. The development and installation of this system helps the user to make payment without involving any cash yet increasing the smoothness while making payment.

The disadvantages of this system are:

- This system can be improved by building it in a portable and compact size.
- Battery can be included as a power source in order to create a portable device.
- Low frequency RFID reader can be replaced with a high frequency RFID which has a long range detection range.
- Barcode label can be replaced with RFID technology in order to make the system more efficient and reliable.

III. METHODOLOGY

Tags will be in the form of cards or smart cards. Once a tag is detected, the database will be checked to ensure whether the user is registered, that is whether it is an authorized user. If a matching entry is found, the system proceeds with further processing, otherwise an error message is displayed.

If the user is an authorized user, s/he will be prompted to enter the amount via the IR Remote attached to the system. This amount will be deducted from his account and the database will be updated. If the amount entered is not valid, the user will be notified by the display of an error message.

The workflow of the RFID based Universal transaction system can be understood by referring to the flowchart below:
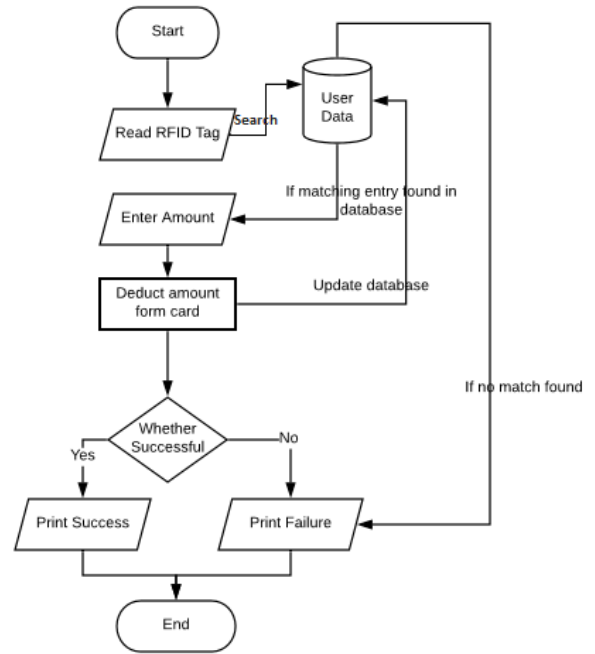

Figure 1 Workflow of the RFID based Universal Transaction system

IV. HARDWARE & SOFTWARE COMPONENTS

The various hardware and software components used in the system are described below.

Hardware Requirements:

i. Arduino UNO: A 14 pin microcontroller used to control the system. The Arduino serves as the brain of the system.

ii. RF Module (RC522): The RF module that consists of the reader and the tag.

iii. Display: To display success and failure messages.

iv. IR Remote: To allow user to add the transaction amount.

Software Requirements

i. Arduino IDE: To program the Arduino board.

ii. Miguel Bilboa RFID Library: To add RF module to Arduino code.

iii. Rafi Khan IR Remote Library: To add IR module to Arduino code.

iv. MySQL Database: To store the registered users.

V. RESULTS AND DISCUSSION

Table 1 Results Obtained

RFID Tags	Whether Identified	Whether Transaction Completed
Tag1(Authorized)	Yes	Transaction completed successfully
Tag2(Unauthorized)	No	N/A

Two different tags were used to test the system. Tag1 was registered in the system while Tag2 was not. As soon as Tag1 came in the vicinity of the reader, the user was prompted to add the transaction amount. Upon addition, the same amount was deducted from the card and the database was updated. When Tag2 came near the reader, the message "User not found" was displayed. Thus, the expectation was the outcome and hence, efficiency of the system was 100%.

VI. CONCLUSION AND FUTURE SCOPE

The RFID based Universal transaction system offers a simple and efficient alternative to modern transaction systems. The system is easy to build and deploy. Though the initial setup cost would be high the maintenance cost would be negligible. As soon as the tag comes in the vicinity, it is identified by the reader, thus it is very fast in identification. To improve the speed or for even faster transactions, it can be modified to use in systems where only a fixed amount is deducted such as for coffee shops. User then would not have to enter amount and money will be deducted. It can also be connected to mobile phones and the need of IR remote and LCD display will then be omitted.

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