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S-Pay (Secure Payment system for students)

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ABSTRACT

S-Pay proposes a cashless transaction system for small-scale organizations such as schools and colleges, by designing an RFID terminal device and database server. The designed system consists of an RFID card as e-money which will be implemented in an ID Card, terminal transaction device, and database server. RFID acts as a unique ID owned by the user to identify themselves to authorize their transactions. The main objective of this project is to reduce the amount of human effort in dealing with cash inside campuses and also making it easy for students to purchase items inside the campus without compromising safety. Each transaction will be authorized by a PIN that is only known to the owner of the card. A website is developed from which students can log in to their account and know their current balance, see their transaction log and also change their PIN if required. Moreover, students won't be able to spend this money outside the college campus as the money is credited to their account which in turn is credited to a database that is not valid outside the campus, it is more like a currency that is only valid inside the campus.

Keywords: RFID, Raspberry Pi, Database

1. INTRODUCTION

In this century, people are completely dependent on technology. New technologies are developed to make our life less demanding and calm. Digital transactions [2] made money dealing much easier and people are openly accepting various modes of digital transactions. The present mode of payment in educational institutions that is widely present is payment by direct cash. The payments are directly done by the students or their parents at schools or colleges in the respective administrative offices. The different types of expenditures that a student can have in their institutions are books, stationery, canteen or cafeteria, fines, fees, etc. These payments are handled by separate departments in the respective institutions. This whole process is manually done by humans and is slower and as no human is perfect, errors arise.

The past few years have witnessed an explosion of interest in RFID and supporting technology due to their rapidly expanding use

in product tracking and access to a certain area. RFID is being used in many applications such as a student's attendance system[3], automatic toll collection[1], building access control system, warehousing, and manufacturing, etc. This RFID technology can improve the operation efficiency and reduce the economic losses since it is used non-contact to others to operate. RFID tag does not require any battery and is powered by a radio frequency signal.

The payments in many of the institutions, not just in India, but all around the world are mainly by direct payment of cash although some colleges allow the usage of e-wallets like Paytm or Paypal. However, school students are not allowed to make transactions with these applications since mobile phones are banned inside campuses. The payment in such institutions can be slow and cumbersome and lead to long queues and often end up making errors in giving change.

Another major problem is the lack of change. Markets everywhere, people face coin shortage problems and tend to bill the amount rounded to the nearest multiple of 10. Shortage of change often results in balance being paid in chocolates, mints, and chewing gums which cannot be used to pay anything else. Children often tend to lose money at campuses given by their parents for various purposes and also there are many occurrences of theft inside the campus. There are also many instances of misuse of money by children. This project focuses on a contactless payment system which will be an alternative to payment of direct cash in schools and colleges for both students and staff members that makes use of RF-ID technology. This enables cashless transactions in educational institutions and also reduces all the errors present right now.

2. LITERATURE SURVEY

2.1. RFID Based System

A cashless transaction system is a system that permits a transaction to be conducted without the presence of cash. It is also equipped with an Automated Data Collection (ADC) system, where for every transaction that happens, everything will be recorded thoroughly in the database system. ADC is a system

that automatically collects the required details and stores them as programmed. This helps users to monitor their money flow in an organized manner. In advance, the database system also allows users to have access to it at anytime and anywhere.

Earlier RF-ID s were proposed to be used in toll collection systems. Automated toll collection systems [1] have done a lot in reducing the heavy congestion in front of bridges in the world's busiest cities. In this process, an RF tag along with a unique code is attached to the vehicle that emits RF signals. Every owner must have an account with an RFID tag on their vehicle. Whenever the vehicle approaches the toll gate, the signals are recognized and forwarded to the control unit. If the vehicle owners are found with sufficient balance in their account, only then they will be allowed to pass.

2.2. Existing Payment Process

The payment process that exists in educational institution is as follows.

- The students opt for the service they want like whether in book store or canteen or library.
- The product is selected and the cash is paid in currency form at the cash counter.
- The cashier collects the amount and count it and returns the balance if any.
- The amount is added to the total amount with the cashier and goes to institution’s account.
- However, some institutions do accept cashless modes[2] of transactions like the ones listed below.
- Credit or debit card is another non-cash payment method. The use of credit and debit cards was limited in India. However, the use of credit and debit cards is increasing due to demonetization.[2]
- E-wallet [2] can be used in transactions starting from purchasing items from grocery stores to airline tickets. To use the e-wallet, the client and the retailer, both need a smart phone with an active internet connection
- UPI [2] is a mobile payment system that allows you to carry out various financial transactions on your smart phone. With UPI, you can send or receive money using a virtual payment address without entering bank details. Merchants can register with banks to accept payments with UPI. In the case of a POS machine, the merchant would need a current account with a bank to accept UPI payments. Some examples of UPI applications are SBI Pay, Union Bank UPI app, Phonepe, etc.

3. DESIGN AND HARDWARE IMPLEMENTATION

The proposed project consists of the following hardware components.

3.1. Raspberry Pi 3B+



Fig 1

The Raspberry Pi 3 Model B+ (Fig 1) is a microprocessor-based board that acts as a computer. It consists of a 64-bit quad core processor clocked at 1.4GHz, wireless LAN with dual-band 2.4

GHz and 5 GHz, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT.

3.2. 16*2 I2C LCD display

This 16*2 LCD Screen is using an I2C communication interface. It can display 16x2 characters on 2 lines. All connectors are standard XH2. It only requires 4 pins for the LCD display: VCC, GND, SDA, SCL.

3.3. SIM 800 GSM Module

SIM800 (Fig 2) is a quad-band GSM / GPRS module that operates on 850 MHz GSM, 900 MHz EGSM, 1800 MHz DCS, and 1900 MHz PCS. It can be used to send / receive messages, make phone calls, send / receive data over the internet, etc. This makes it useful for applications like home automation, agricultural automation, etc.



Fig 2

3.4. 3*4 Keypad

This Matrix Keypad 3 X 4 has 12 buttons, arranged in a telephone-line 3x4 grid. The buttons are connected into a matrix, so only 7 microcontroller pins (3 columns and 4 rows) are required to scan the pad.

3.5. EM-18 RFID Reader

EM18 (Fig 3) is an RFID reader that can read RFID tags at a frequency of 125 kHz. After reading the tags, it transmits a unique identification number serially to the PC or microcontroller using UART communication or the Wiegand format on the respective pins. The EM18 RFID reader reads the data from the RFID tags that contain the stored identification number, which is 12 bytes.



Fig 3

3.6. RFID Cards

Radio frequency identification makes use of electromagnetic fields to passively identify and track tags attached to objects. RFID system consists of a small radio transponder, a radio receiver and a transmitter. When triggered by an electromagnetic interrogation pulse from a close-by RFID reader, the tag is activated and transmits digital data, usually an identification number, back to the reader.

4. IMPLEMENTATION

We have built a suitable working model for the proposed system and is illustrated in the Fig 4. Python programming language is used to develop the payment system.

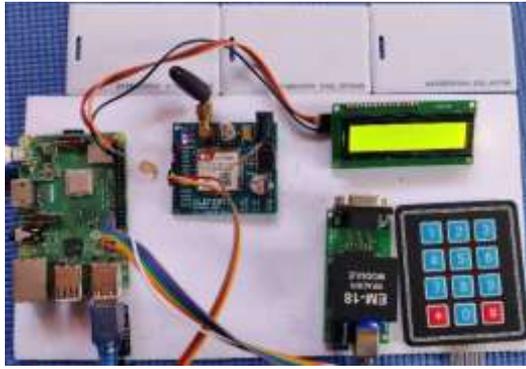


Fig 4

We had scanned each RFID tag before implementation of the project to know about the unique ID and it is stored in the database of our system. In the proposed model, when the RFID card is brought into the range of the RFID reader, the already stored unique identification number in that particular card is read by the RFID reader. This identification number is stored in the database in which details like student identity, PIN, current balance, emergency credit balance, etc. are stored. When the RFID is scanned and the correct PIN is entered by the user, the LCD shows the user identity and current balance and asks the user to enter the amount to be deducted. If there is a sufficient balance in the account, the amount will be deducted and the balance is updated. Emergency credit of a prefixed amount is available for all the users and can be used if there is no sufficient balance in the account. After each successful transaction, an SMS is sent to the registered mobile number of the user stating the transaction details and the remaining balance.

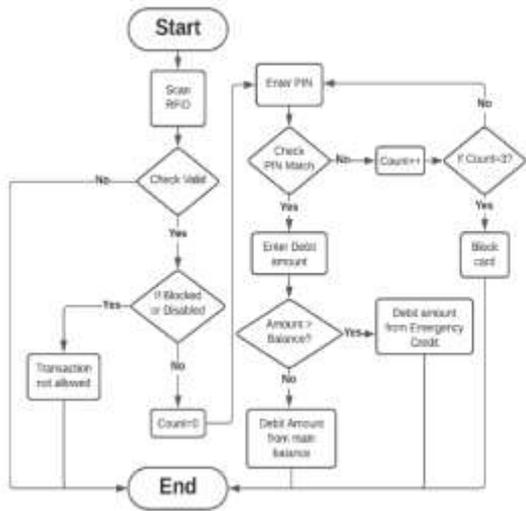


Fig 5

We have developed a website [4] which has 2 parts: Student Login and Admin Login

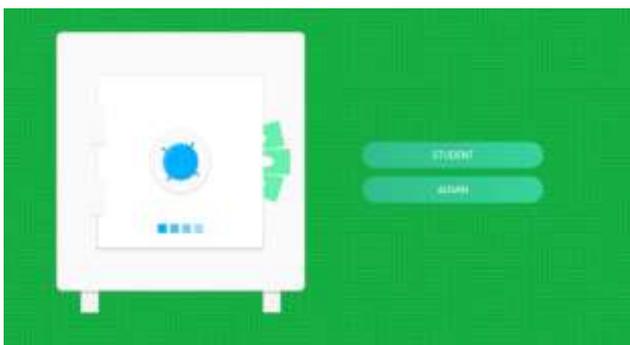


Fig 6

4.1. Student Login

A password is given to all users for their first-time login. Users can use their student id and the given password to log in to their account and they have to change their password to use other functionalities. Users can change their password, check the remaining balance, use other functionalities. Users can change their password, check the remaining balance, and view transaction logs. Changing the password will alert the user through an SMS to the registered mobile number. Three failed login attempts will block the account and only the admin can unblock the same.



Fig 7

4.2. Admin Login

Admin has the master control over the student database. A prefixed password is given to the admin to access the account. Admin can add new students, edit already existing student details, load money, view transaction logs and block/unblock/disable accounts.

When money is added to an account, the emergency credit balance will get filled up first (if the emergency credit is used) and the remaining credit amount is added to the main balance. Otherwise, money will be directly added to the main balance. Provision to enable the disabled account due to multiple failed attempts of the wrong pin is handled by the admin.

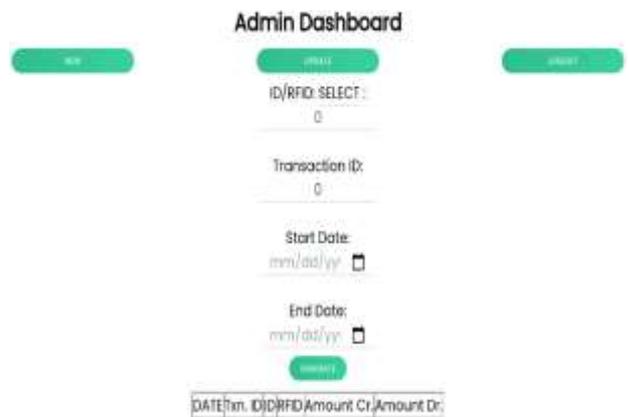


Fig 8

5. CONCLUSION AND FUTURE DIRECTION

The proposed system is a proposal of a robust and secure payment system for schools and colleges where the use of mobile phones is not permitted. This allows cashless and contactless modes of payments [5] in these institutions in a low-cost and budget-friendly manner. It makes use of RFID technology which

is proven to be the best choice for identification and authorization purposes in IOT based access control and payment systems.

This project can be extended to make use of cashless transactions in public vehicles like buses which is the primary mode of transport for most of the students. Also, a GPS chip could be attached to the ID card to ensure the safety of students. GPS would enable the parents to track their wards. Furthermore, this project could be implemented in shops or restaurants too.

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