DESIGN OF NFC READER FOR ENHANCEMENT OF MOBILE PAYMENTS

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Abstract- The NFC concept was mainly based on RFID tags which has the frequency range of 13.56MHz.NFC concept was initially determined to exchange data between two devices at very short distance. RFID uses electromagnetic fields to automatically identify and trace tags attached to objects which contain electronically stored information. The major problem with the RFID tags was their cost and the RFID tags had the possibility to be interfered with metals and liquids when we try to read them. There is a possibility of unauthorized reading of passports and credit cards. NFC readers are more secure and hence the NFC enabled credit cards are much safer than a credit card with magnetic strip. We specially use PIC16F877A for the purpose of matching the details in mobile phone with the information in the NFC reader that are required to make mobile payments.

Index terms*:* Radio Frequency Identification, Near Field Communication, PIC16F877A.

I. INTRODUCTION

The Near Field Communication (NFC) technology is a short-range contactless RF communication Standard. NFC relies on RFID technology which has been widely used for over 30 years and has reached a high level of maturity. The term "near-field" merely reflects a technical choice for two devices to communicate over very short distances, for security reasons, ease of implementation and low power consumption. This choice was made on RFID HF of 13.56 MHz that has been used for contactless smart cards and met an acceptable compromise to meet the functional and technical requirements.

By 2000, the introduction of the first integrated circuits specifically designed for contactless card readers has led some experts to think of other possible applications then simple card & reader communication. Ideas rang out from all stakeholders, especially that to make communicate two readers together on short distances and bilaterally (detailed later as "peer to peer"). Then the proliferation of mobile phones and contactless RFID reader emulation functions.

RFID can be defined as automatic identification technology which uses radio-frequency electromagnetic fields to identify objects carrying tags when they come close to a reader. However, RFID cannot be reduced to one technology. RFID uses several radio frequencies and many types of tag exist with different communication methods and power supply sources. The information contained within an RFID tag's electronic chip depends on its application. It may be a unique identifier.

RFID tags do not have integrated circuits. They are read-only transponders and do not include embedded energy. They are also called RF barcode. Passive tags only backscatter magnetic or electromagnetic waves coming from the interrogator. That is the only way they can communicate with the interrogator. Active tags have their own RF emitter on board. They can either send RF signals to the interrogator as they receive a comprehensive command or function without any external command.

There are 6 classes of RFID tag. Class 0 and Class 1 have Read-only passive tags. Class 2 has Passive tags with additional functionality. Class 3 has semi-passive RFID tags. Class 4 has active tags with broad-band peer-to-peer communication. Class 5 Readers-powers Classes 1, 2 and 3 tags and communicates with Classes 4 and 5.

Contactless payments are chip payments, which guarantees payment security. No chip information is known to have been successfully read or copied for criminal purposes so that the card could have been misused. Contactless smart chip technology relies on a secure microcontroller or equivalent intelligence, internal memory and a small antenna embedded in a device that communicates with a reader through a contactless radio frequency (RF) interface.

They can perform internal functions such as encryption and interact intelligently with the contactless reader. Contactless smart chip technology is available in a variety of forms-plastic cards, watches, key fobs, documents and other handled devices, such as mobile phones. This technology is not related to "non-smart" RF chip technologies, such as the RFID tags used for inventory management/product tracking applications, which require minimal functionality.

Fig.1: Communication among NFC controller and mobile phone

II. Related Work

The contactless NFC payment using cloud infrastructure has its own security and availability issues. In cloud based and on-premises software, most security breaches are attributable to human error.

Cloud computing is a quickly changing field, and there's always the danger that a new company might go out of business or radically change its service. There is a need for reliable internet service.

Early, NFC was available in only few models of mobile phones in Norway. But, nowadays NFC was available in most of the recent phones worldwide. Mobile phones like SONY, SAMSUNG consists of inbuilt NFC.

NFC applications were early based on peer to

peer communication which actually requires Trusted Third Party (TTP) which leads to some security threats.

Generally NFC security standards that key agreement is required for secret communications between users. Existing RFID system has some collision problem and NFCID needs to be updated each time.

However, the method using the pseudonym requires additional cost for storage and communication. It requires additional computation time. A separate hardware is mostly needed for smart card and RFID tags.

III. Experimental Work

i) Keypad

A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters.

Pads mostly containing numbers are called a numeric keypad. Numeric keypads are found on alphanumeric keyboards and on other devices which require mainly numeric input such as calculators, push-button telephones, vending machines, ATMs, combination locks and digital door locks.

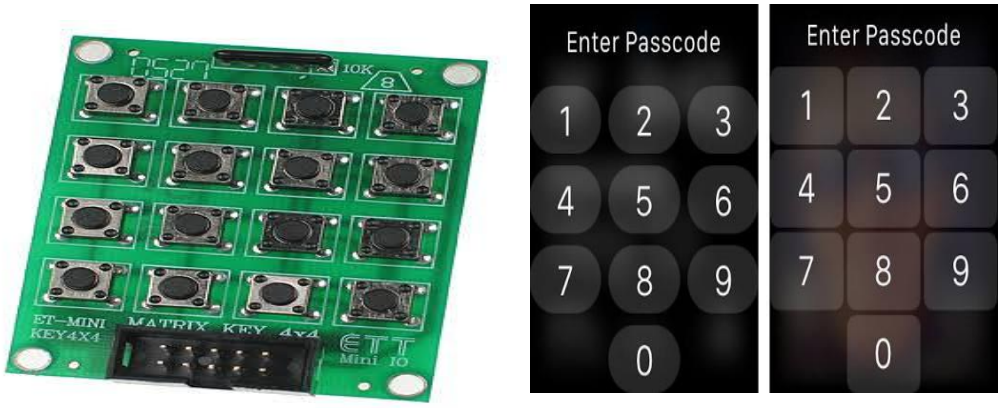

Fig.2: Internal and external structure of keypad

ii) NFC Reader

It enables the devices to read information stored on inexpensive NFC tags embedded in labels or smart posters. NFC tags are passive data stores which can be read, and under some circumstances written to, by an NFC device. They typically contain data and are read-only in normal use, but may be rewritable. NFC tags can be custom-encoded by their manufacturers or use the industry specifications.

NFC is a set of short-range wireless technologies, typically requiring a separation of 10cm or less. NFC operates at 13.56MHz on ISO/IEC 18000-3 air interface and at rates ranging from 106 kbit/s to 424 kbit/s. NFC always involves an initiator and a target; the initiator actively generates an RF field that can power a passive target. This enables NFC targets to take very simple form factors such as unpowered tags, stickers, key fobs, or cards. NFC peer-to-peer communication is possible, provided both devices are powered.

Fig.3: Structure of NFC reader

iii) PIC16F877A

It has 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Integrated (SPI) or the 2-wire Inter-Integrated Circuit (I2C) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

The PIC used simple microcode stored in ROM to perform its tasks, and although the term RISC was not used at the time, it shares some common features with RISC designs. Today, a huge variety of PICs are available with various on-board peripherals (serial communication modules, UARTs, motor control kernels, etc.) and program memory from 256 words to 64K

words and more ("word" is one assembly language instruction, varying in length from 8 to 16 bits, depending on the specific PIC micro family).

Fig.4: PIC microcontroller-pin diagram

iv) LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time.

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes and two polarizing filters, the axes of transmission of which are perpendicular to each other. Since LCD panels produce no light of their own, they require external light to produce a visible image. In a "transmissive" type of LCD, this light is provided at the back of the glass "stack" and is called the backlight. While passive-matrix displays are usually not backlit, active-matrix displays almost always are.

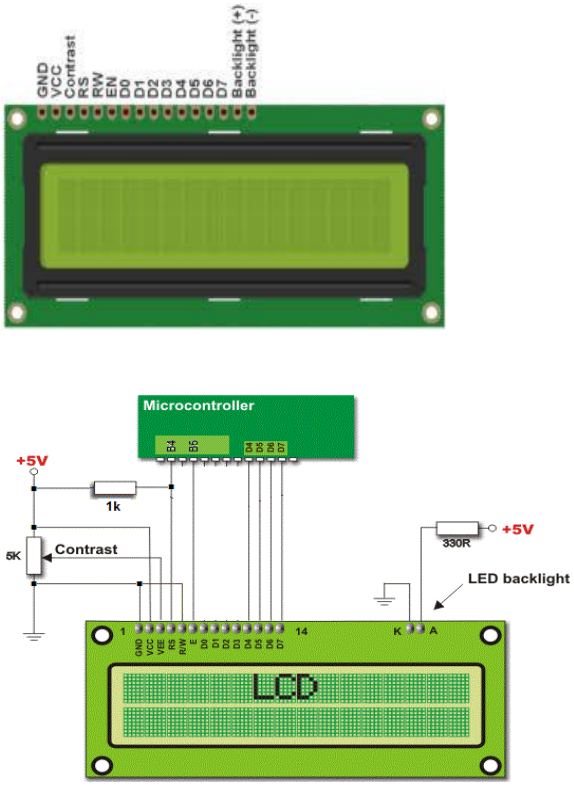

Fig.5: Circuit diagram of LCD

IV. Working

The operating principle of NFC reader is as follows:

The NFC is made to be turned on in the mobile phone.The NFC reader trace the signal from the mobile phone and passes the signal to the PIC microcontroller.

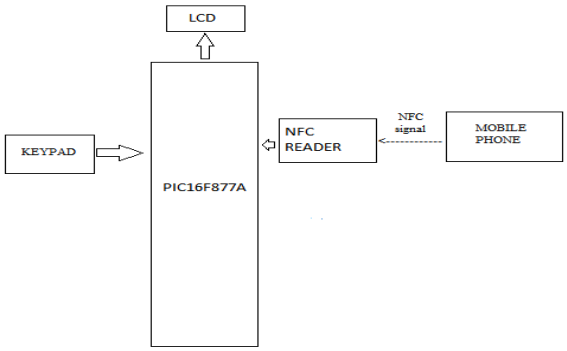

fig.6: Block diagram

The PIC controller compares the keypad input with the details in the mobile phone and then passes the conformation message to the mobile phone.The LCD display will indicates the end of tracking the account details from mobile phone.

V. Result and discussion

This work is very easy to implement and the amount transaction through NFC technique was more secure when compared to any other methods which involves in money transaction. Customers can swipe their smart phone over a card reader to make a purchase without fumbling through credit and debit cards or counting out cash. This technology allows the customer to load multiple cards and choose which one they wish to use for each transaction. Not only does this save time, but it also reduces the chances of losing a credit card that comes with carrying multiple cards around.

Fig 7: Symbol of NFC

Contactless payments are made in close physical proximity; they are usually distinguished from mobile payments which can also take place on mobile phones, but mobile payments use broad-area cellular or WiFi networks and do not involve close physical proximity.

Some suppliers claim that transactions can be almost twice as fast as a conventional cash, credit or debit card purchase. Because no signature or PIN verification is typically required, contactless purchases are typically limited to small value sales. Lack of authentication provides a window during which fraudulent purchases can be made.

As with all payment devices, contactless cards have a number of security features. Depending on the economic space, there may be a payment limit on single transactions and some contactless cards can only be used a certain number of times before customers are asked for their PIN. Contactless debit and credit transactions use the same chip and PIN network as older cards and are protected by the same fraud guarantees.

Fig.8: Extraction of NFC signal from mobile phone to reader

VI. Conclusion

Thus the detail related to the amount transaction available in the mobile phone gets transacted to the NFC reader. This method of NFC with PIC microcontroller was very safe and easier than any other method of data transfer. There exist different currencies in different countries. Hence, also if we shift to other countries, there will not be any issues of payments. It remains in the same procedure of transactions and payments.

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