SMART SWITCH USING NFC

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.ABSTRACT

Near Field Communication (NFC) technology utilizes the electromagnetic fields for data transfer in order to perform automatic detection and tracking of tags or tags of objects. It can provide ways to design and implement relatively inexpensive systems particularly for security aspects. In this paper, we have proposed a digital access control system that can be employed to a protected area where none but people with authenticated credentials can enter. In fact, we have implemented the system in the room of an educational Institute to test its efficiency as well as expenditure. The implemented system comprises of digital door lock which is unlock able in real time to ensure secured access specifying activation, authentication and validation of users prior to bringing the RFID card close to the reader. The entire system is associated with a central client- server sub-system to ensure and maintain the overall system integrity. Associated sub-system also generates a log report to maintain check-in and check-out status of visitors in accordance with the primary credentials of each. This system will certainly provide an idea about the design and installation of a relatively inexpensive security system which is suitable in the perspective of a developing country like India.

***Index Terms*—Authentication, Credentials, RFID Card, NFC tag, Secured Access.**

I. INTRODUCTION

RFID in congregation with biometric technologies has gained immense popularity for security issues. Identification of individuals is always prioritized in secured places like bus and train stations, national and international airports, commercial complexes, movie theaters and so on. Undoubtedly, associated expense is an important factor to be considered while promoting security solutions for such locations. In that sense, RFID is a relatively inexpensive technology which is capable of transmitting data without the usage of any guided media.

In fact, the levels of security provided by RFID technologies are reasonably efficient. Enhancement in the usage of this emerging technology is being traced in the fields of business, industry and logistics support in particular due to its capability to detect, track, classify and manage the flow of information systematically . An ideal RFID system comprises of RFID tag, RFID reader, application software at back-end for management, computing hardware for operation handling and middle-ware to cover up any incompatibility among the components regarding the data formats .

In our proposed system, a magnetic door lock is administered via RFID reader and NFC tags that initiates the authentication as well as validation of the user or controls the access in short. The systems also maintain evidences regarding the access and exit records of each user in the form of a log report against every access. The administrator of the central sub-system can terminate the validity of any user at anytime to avoid unexpected situations. In fact, a double layer of security has been applied. First, the user needs to get permission from the system administrator to access and then comes the combined process of authentication and validation. The events of access and log report generation take place at real time. The system is more convenient to install and implement as access security solution of a particular arena due to its cost effectiveness with respect to the satisfactory level of protection provided. Another advantage is that the system consumes considerably less space for installation and maintenance purposes.

The prime objective of this paper is to describe how to design, develop, implement and install a comparatively inexpensive security solution with considerable scale of security assurance. The remaining of the paper has been arranged in the sequence: System Architecture in Section II, Section III explains Working Mechanism of the System, Observations and Discussion are in Section IV, Section V with conclusion followed by Acknowledgement

II.SYSTEM ARCHITECTURE

In the proposed security system, we have controlled a magnetic door lock after processing of the information obtained from RFID cards. The entire system can be splitted into hardware as well as software components. The hardware components include RFID cards, NFC tags, Audino MEGA 2560, LCD (16 2), Bridge rectifier, SPDT relay, stepdown transformer, LCD (16 *2), buzzer, connection cables etc. The schematic block diagram of Figure 1 provides an outline of the major components involved. In fact, the system completes the entire operation in a number of steps:

- Step-1: Information contained within the RFID tag is retrieved by RFID module when the card is brought in the readable range.
- Step-2: The visitor has to type the password assigned earlier by central sub-system against a particular RFID card upon receipt of RFID tag information (Authentication).
- Step-3: The central sub-system also checks the database to ensure whether the credentials are correct or not (Validation).
- Step-4: For valid credentials, micro-controller takes the responsibility to unlock the magnetic door lock.
- Step-5: At the same time, a log is generated having the record of time and date with credentials against the RFID card.

The system has been implemented with passive NFC tags. Detection of NFC tag from a particular RFID card is being done by the reader module when the card is taken in a range of 10 meters. After NFC tag detection, obtained information is passed to the central sub-system via serial port. The central database remains acquainted with the registered user via certain credentials. Cross checking of the transmitted information is performed locally as well as centrally to ensure proper authentication and validation of visitors. Matching of information initiates the event to unlock the magnetic door lock. Meanwhile, a log (along with a time stamp) is generated in accordance with the details of the user. Log records are preserved by the central server. It is possible to generate weekly or monthly reports for a particular user or even for multiple users with their time and frequency of access. RFID reader module communicates with the system via USB port **while** the generated output is transmitted through parallel port that manipulates the unlocking of magnetic lock. The technical identifications of the RFID reader module

5V supply

13.56 mHz read frequency

EM4001 64-bit NFC tag compatible

Data rate of 424kbits/sec

Magnetic stripe emulation output

Read range of 200mm

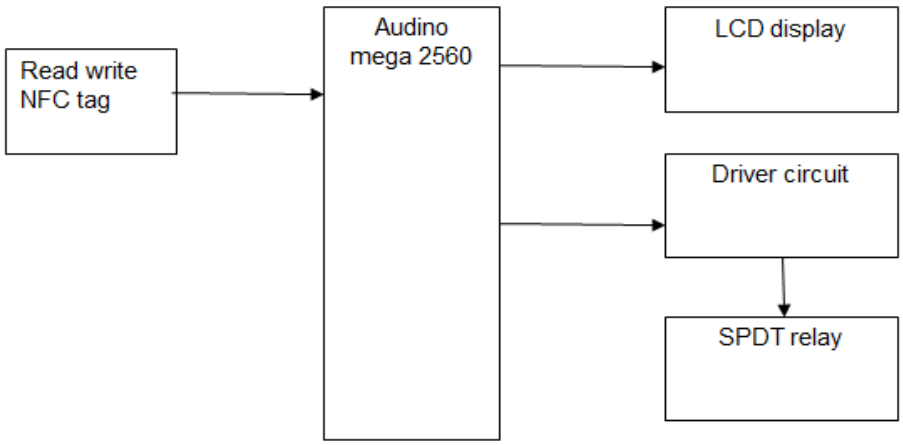

Fig.1 Block diagram

III SYSTEM WORKING MECHANISM

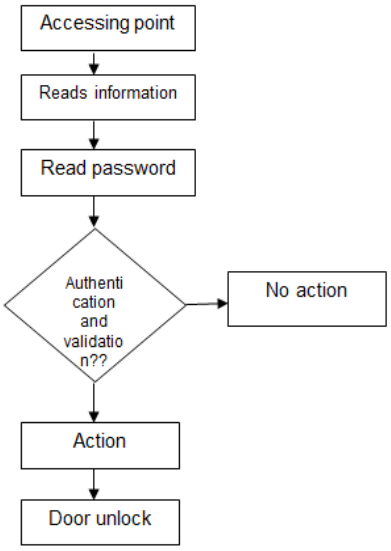

Fig. 2. Flow diagram of the System

Power requirements for the reader module is +5v. The system is initiated upon providing the power supply. Module MAX232 is used to avoid any inconvenience regarding data or information compatibility among the components. An LCD display has been used to inform the user visually about the next state to be initiated by the system. A beep sound from buzzer ensures that RFID reader has read the information stored in the card prior to bringing the card in readability range. LCD also assists a user for providing accurate password that is eventually subjected to transmission to the system. In case of matching of transmitted information along with the particular valid user credentials, the process of unlocking gets instantiated via a stepper motor. L293D has been used as motor controller.

The door remains open for a pre-specified time and then the door closes when it is indicated. In case of information mismatch, the door remains closed to prevent unauthorized access. That's how security is preserved.

Required information regarding authorized users credentials has been stored in the central sub-system. It is to be noted that the central sub-system software that maintains and tracks the user information has been designed entirely by us for the intranet of the institute. If an authorized user comes to the access point and punches the card issued against his credentials then transmission of accurate information invokes authentication and validation process to be executed successfully. At the same time, a log report is recorded in the database against the user to store check-in as well as check out status with time.

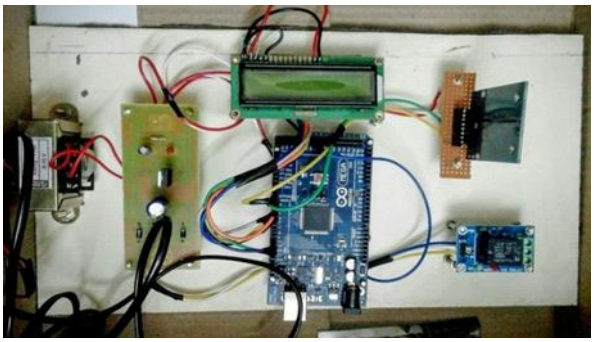

Fig.3 Demonstration

IV SYSTEM COMPONENTS

A. NFC Tag :

IPC80 passive NFC tag operating at a frequency of 13.56MHz is issued to the user. The tag transmits information to the reader in ASK format.

Fig.4 NFC tags

B RFID Reader:

IP10 proximity card reader with operating frequency of 125KHz and reading distance up to 4 inches is used. The reader can be easily installed on metal doors, provides the tag information serially in RS232 format and is suitable for indoor as well as outdoor operations. Three such readers are installed for hostel security: hostel entrance gate, hostel exit gate and mess entrance gate

Fig.5 RFID reader

C. Door Locks :

Solenoid operated door locks are used in entrance, exit and mess gates of hostels. A relay is used to energize the solenoid to open the gate.

D . PDT relay:

05VDC- It means that you need 5V to activate the relay. In other words, it means that the voltage across the relay coil has to be 5V-DC. 10A 250VAC 10A 125VAC – The maximum AC current and AC voltage specification that can be passed through NC, NO and pole pins/terminals of relay.

Fig.6 SPDT relay

E. Bridge rectifier:

A bridge rectifier is an arrangement of four or more diodes in a bridge circuit configuration which provides the same output polarity for either input polarity. It is used for converting an alternating current (AC) input into a direct current (DC) output.

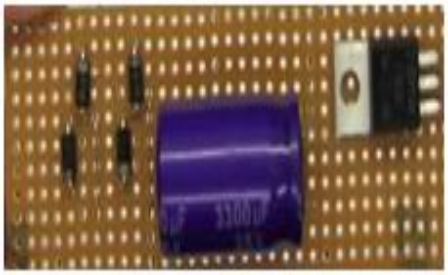

Fig.7 Bridge rectifier

F. Arduino Mega 2560:

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

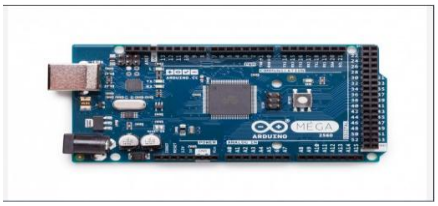

Fig. 8 Arduino Mega 2560

V CONCLUSION

The RFID Door Lock is a very cheap and affordable design that allows convenience and security for users. The design is relatively small and easy enough to install with just a couple of screws. As of now, the RFID reader used is linked to the tag and card reader. However, either by adjusting the code or using a different RFID reader, one should be able to read the RFID code of the individual tags and cards.

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