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Design and Implementation of Smart Home Security System

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Abstract: All over the world, security has been a major concern in every home. Automated security systems are a useful addition to todays home where safety is an important issue. Vision-based security systems have the advantage of being easy to set up, inexpensive and non-obtrusive. Here, a security system has been developed that uses sensors to detect any security violation and sends out the alert signal by high intensity Buzzer. In this paper it has been ensured three level security systems. NFC tag use, providing Password and PIR motion sensor. To open the door a person should provide NFC tag and password. If one of them absence the door will not open. The door will opened by servomotor with a lock coupled in its shaft. When wrong password is pressed, error text is displayed in the LCD. When an authorized person leaves the door, he has to show his tag in the reader. Otherwise the door will not close. Now if an unwanted man enters the room by password breaking or without NFC the PIR sensor works .It sounds the buzzer. NFC card reader, PIC 16F877A, Arduino Uno, PIR sensor is used for this project .So, maximum security will be maintained in home. This security can be applied not only home but also the place where important document, file are preserved also the bank vault.

Keywords: Security system, NFC shield and NFC tag, Arduino Uno, EEPROM, Proteus, PIR sensor

I. INTRODUCTION

A security system is defined as to detect intrusion, unauthorized entry into a building or a protected area and deny such unauthorized access to protect personnel and property from damage or harm. Security systems are mainly used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, as well as personal protection against intruders. Car alarms likewise protect vehicles and their contents. Prisons also use security systems for control of inmates. Among home security in residential is most prominent. Now days, home security and surveillance system is an essential part of any modern automated home. The basic design of a security system begins with analyzing the needs of the inhabitants, surveying existing technology and hardware, reviewing system costs, considering monitoring choices and finally planning the installation. According to the European Institute for Crime Prevention and Control International statistics on crime and control 2011, to analyze the no. of burglaries in a year we experienced that Bangladesh got 2.2 points and ranked 53rd position as well as 0.7 points and ranked 71st position for autotheft in the world. Now if we look the worlds one of rich country USA we see that they positioned 6th in autotheft and 9th in burglary [8]. Their surveying also shows that most of the burglary occurred in residential area, office as well as bank. Non-Automated security systems were found non-reliable. Doors were fitted with lock and key system which can be opened easily. Even the human presence of security guard may not be completely trustworthy. Every system from the past has been found to be very much vulnerable. Home is a place where security is must, to keep all the valuables and appliances safe. The owner should have the confidence to step out of the house with the feel that nothing can happen to the Home. This feel will only arise when the home is equipped with a reliable security system. For this reason, in this paper it has focused about the maintenance of home security.

II. METHODOLOGY

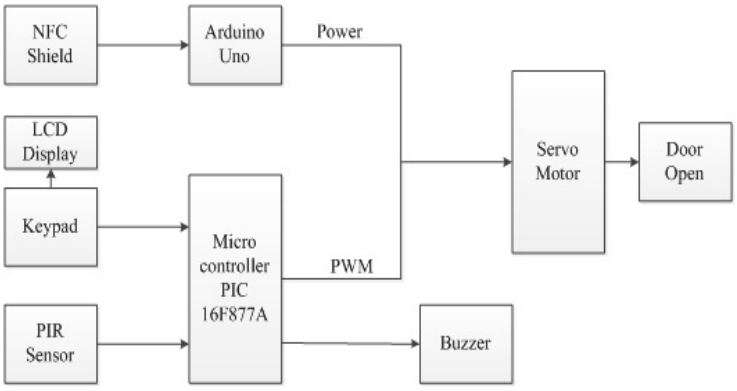

Figure 1.1: Block Diagram of Operational Method.

Above block diagram shown in figure 1.1 represents the working method of our project work. Here we have taken NFC (Near field Communication) tag card, password from keypad and infrared ray i.e motion by PIR sensor as input. The output

of this project is LCD display, Buzzer alarm and servo motor. For hardware implementation we have used interfacing a PIC (Peripheral Interface Controller) microcontroller 16F877A 16_2 LCD display, a matrix (4_4) keypad, a 21 servo motor used for door locking and PIR sensor also incorporates a power supply unit. Arduino Uno provides power supply and microcontroller provide PWM signal to operate the servo motor. If keypad only pressed or wrong password provided servo only get PWM. So it will not operate to open the door owing to absence of required power. Besides, if only NFC tag card is provided in front of shield the servo only gets power but owing to PWM it will not operate. Here microcontroller also takes PIR sensor signal as input. When it gets this signal it send signal to Buzzer and sounds alarm.

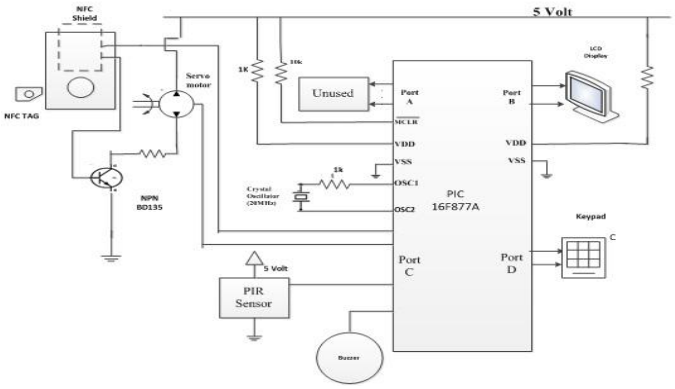

Figure 1.2: Circuit Diagram of required project.

The above figure 1.2 shows the complete circuit diagram of the project. Here microcontroller PIC 16F877A has four port. Port A Port B, Port C and Port D. Every port has eight pin such as A0- A7 similarly B0- B7. Here port A is remained unused. Port B is connected to 16 2 LCD display in where 8pin of port B is attached with LCDs 8 wire. Beside Port D is connected with 4$_4 keypad similarly here all pin is connected with keypad. Now remaining port C one of pin is connected with PIR sensor, other pin is connected with servo motor and another pin is connected with buzzer. Here 2pin for VDD and 2 pin for VSS. We have connected VDD with power supply 5 volt through 1k resistor and VSS with ground. There is also a pin MCLR for clearing any data saved in memory. It also connects with 5 volt power supply through 10 kilo ohm resistor. OSC1 and OSC 2 pin is used for supply clock for PIC operation. Here crystal oscillator is used to generate clock and capable of generating 20 MHz clock signal. When instructions are loaded into the microcontroller, microcontroller verifies the input from keypad with the stored password, to interface with peripheral devices and to change the current password. The EEPROM of PIC stores the passwords set by the user. when any password is inserted through the keypad, microcontroller decode the input, verify it with the stored password..If password matches which was set by authorized person, microcontroller sends signal to servo motor . On the other side when NFC tag card is placed near the shield, the coil inside the tag is energized, get power from shield and match. Then a signal comes from arduino uno to the base of NPN transistor. Transistor acts as a switch when it gets signal its base and turned on. Then it connects servo to power supply on the other side when the correct password is pressed then a signal goes to servo which in turn operates the shaft. and the lock is operated. Password changing option is another important part of the mentioned electronic lock system. It is restricted to unauthorized person because there is a fixed security code which is only known to the authority of the lock. LCD shows the output result, the password is being inserted whether correct or wrong. Keypad is used as input unit of the lock system.

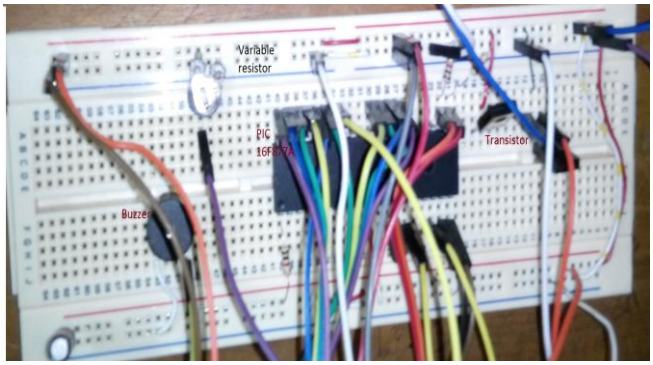

Figure 1.3: Different parts of Hardware Setup.

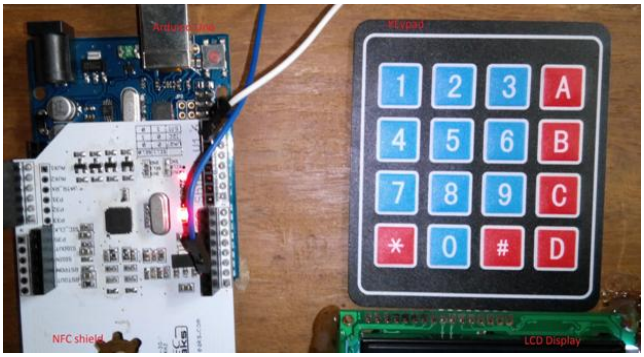

Figure 1.4: Keypad, LCD Display and NFC shield.

III. SOFTWARE IMPLEMENTATION

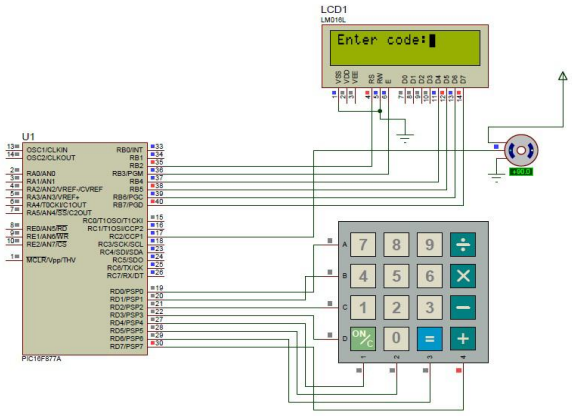

Figure 2.1: Circuit Diagram after Simulation

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. Anyone cab build any project on computer screen using Proteus. It has been used 7.7SP2 software to simulate the project. For simulation the proteus window has opened. Then it has placed the all necessary component from library (E.g. PIC16F77A). The Port B is connected with LCD display 8 pin. Port D all pins are connected with Keypad. Here one pin of port C is connected with servo motor. Then we loaded the HEX file generated from microC Pro into microcontroller. After simulating the circuit it found no error. Then the correct password has pressed which represents the password is right beside servo operates.

IV. RESULT & DISCUSSION

When it shows NFC tag in front of NFC shield and presses password there is a text in a LCD display Enter Code is shown in figure 3.1 If correct password is pressed then it shows Correct Password and wrong password pressed it shows Wrong Password in display shown in figure 3.2 and 3.3

Figure 3.1: Enter Code.

Figure 3.2: Correct Password.

When password is correct servo motor gets power and open the door. After entrance, PIR sensor will not work [16]. When the person goes out of the door, he should provide NFC tag in the door and then press C for close in keypad. For password changing the person should press A in keypad. Then there is a text in a display Enter Old Code. After pressing old code, display shows it wants Enter New Code. Providing new code, the password will be unchanged until user does not want to change password is shown in figure 3.4 and 3.5. Now if a person enters the room without providing NFC tag and password PIR sensor works and sounds alarm.

Figure 3.3: Wrong Password.

Figure 3.4: Enter Old Code.

Figure 3.5: Enter New Code.

V. CONCLUSION

In this paper it has been seen the prototype model works without any basic error. So it can be implemented in practical field. Beside the cost of the project is not too much. Here it has provided utmost security so it is quite impossible to any burglar to enter the room without concern of owner. If available financial and technical support from the concerned Govt. section and organizations is found, then it will be possible to commercialize the proposed lock for the benefit of the people of our country. Some feature has been added to make the project more efficient. It could be implemented it by GSM based home security system. For this when a burglar enters the room without the concern of owner a sms will be sent to the user. Then he will take precautionary measure. It may be used another technique called biometrics which is more prominent and a recognized means of positive identification. Some new technologies such as fingerprint scanning, retinal scanning and iris scanning, and voiceprint identification also can be inserted. Moreover it could be useful for various sensors such as gas sensor, fire sensor for more improvement of the security of home.

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