Smart Home Security System using IOT

Shreya Pandey, Shreyansh Gupta, Somiya Saxena, Devvrat Tyagi*
ABES Engineering College, Ghaziabad
Corresponding author's email id: *devvrat.tyagi@abes.ac.in**
DOI: *http://doi.org/10.5281/zenodo.2709387*

Abstract

Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring real world objects (things) through the Internet [1]. When it comes to our house, this concept can be aptly incorporated to make it smarter, safer and automated. This IoT project focuses on building a smart wireless home security system which sends alerts to the owner by using Internet in case of any trespass and raises an alarm optionally. Besides, the same can also be utilized for home automation by making use of the same set of sensors. The leverage obtained by preferring this system over the similar kinds of existing systems is that the alerts and the status sent by the wifi connected microcontroller managed system can be received by the user on his phone from any distance. The microcontroller used in the current prototype is the Atmel 89S52 along with a wifi module i.e. ESP8266 Node MCU to control the system and send the alerts to the user on the mobile app.

Keywords: *Alerts, anti-theft, alarm, application, controller, fire, gas, home, intrusion, internet, IoT, module, notifications, security, sensors, smartphone, system, wi-fi.*

INTRODUCTION

Now-a-days, the issue on safety of homes is a big concern. This is the feature of this project to secure the home smartly in the absence of the owner of the house. The currently built prototype of the project sends alerts through sms using internet to the owner if any sort of movement is detected near the entrance of his home or if any wrong password is entered at the door lock an immediate alarm is raised by the system. The hardware consists of

password protected door lock, alarm, wifi module and different types of sensors to detect unfavorable conditions. In the present time a lot of unsolicited activities like theft are increasing continuously so there is a need to modify the functionality of existing security systems. Apart from unauthorized entry and burglary, fire and LPG leakage in the house etc are the problems that society is facing and needs equal attention. With this security system, we can achieve control over these problems that also require constant attention of the owner. These issues can be resolved by using various sensors like IR sensors, LPG sensor, fire sensor etc. The system is very helpful and useful when the owner has to leave the home alone for days and the place is secluded or if there is any undesired activity taking place when they are not present.

LITERATURE REVIEW

Designing and implementation of a smart home security system was discussed by Govinda in (2014) that provides a couple of methods for providing home security on the concepts of IoT [1]. One of his proposed methods was of using cameras. His idea was to set up multiple cameras at different locations such that whenever a camera detects a motion, alarm will be raised and an alert will be sent to the owner on his phone via SMS. The idea was good but cost a lot because of the requirement of high quality cameras.

Another smart security system was proposed by Karri and Daniel (2005) which proposes to the use of the concepts of Internet of Things (IoT) that means to send the alerts or notifications to the owner over the medium of internet instead of using the conventional method of SMS [2]. This idea of using internet was very good as it reduced the requirement of GSM module in the system and a SIM card.

In the year (2013), another system was implemented by Jayashri and Arvind which was a fingerprint based authentication system to unlock a door [3]. The system is good and is added with a few more home security features like fire detection and gas leakage. Though the designed system was good but the use of the fingerprint sensors along with IoT was very complex. Moreover, the fingerprint method was not very reliable as it was very likely for someone to replicate the authentic fingerprints of a person. So, in addition to this, it is advised to use another layer of security lever in the form of PIN, passcode etc.

A group of researchers also proposed an idea of IoT home security system in which a fault in any one of the components of the system does not lead to the failure of the entire safety unit [4]. The idea was to use multiple devices which may or may not be compatible with each other but can be made to work in such a way that one component can be replaced in case of any fault in the system. In addition to this, the proposed system had the feature to use overlap among various other devices which results in the fact of energy preservation, thus making the system more efficient.

After all these proposed ideas, another method was proposed by Cristian and Ursache in (2016) [5]. Their proposed idea was that Laser rays and LDR sensors should be used to detect intrusion in the premises. The working of the system was such that a continuous laser beam is focused on the LDR sensor and the moment when the laser beam is breaks because of any obstacle, the alarm connected to the system is raised alerting the neighbours and a SMS alert is also sent to the owner. This system was preferred over the idea of using cameras as this system was able to cover the areas which were blind to the cameras. But the drawback of the system was again the use of GSM based SMS alerts which are dependent on the network coverage. Moreover, due to the nature of lasers being a straight beam, intruders aware of the system can easily dodge the whole system making it completely useless.

Lee and Shen proposed an amazing way to design an electronic lock using morse code along with IoT technology in (2016) [6]. They claimed it to be an original idea which was never been tried before. The system uses LEDs as an encrypting medium to send signals. The LED in smartphone was used in order to make it more accessible to the general public. A microcontroller and a photosensitive resistor which has the ability to decrypt the code and unlock the door after checking for the authentication they claimed it to be an easy and user friendly interface.

A simpler model for smart home security was again proposed by A. Anitha in (2017) [7]. The proposed system used the concepts of IoT along with a simple microcontroller for providing security to the house door lock. The system is designed to alert the user about any unauthorized entry or whenever the door is opened, over the internet by a mobile application installed in the owner's smartphone. A reed sensor is also used in

this system to keep record of the status. The main advantage of this system was the ease of setting up, lower costs and maintenance.

More advanced version of the system could be the collection of multiple security features in a single system along with the use of IoT concepts to provide security to the left alone residence of the user. Like the system can include simple IR sensors, PIR sensors, Gas sensors and a simple PIN door lock to cover multiple security issues at a time and at a lower cost.

ADVANTAGES

- The power consumption of the device is low as the Arduino Uno is the microcontroller used that consumes less power.
- The sensors and controllers are inexpensive therefore cost effective.
- The door lock panel has LCD display which makes it Friendly user interface.
- With the help of the application the owner is notified immediately as soon as any undesired activity takes place.
- Owner can rely on the system.
- The system not only notifies the movement of any intruder to the owner but sends notification to the nearest police station with the help of the app.
- The user will have the option to arm or disarm the system with the help of the mobile Blynk app.

COMPONENTS USED

A. Atmel 89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device (shown in Fig.1) [9] is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout.

Fig.1: AT89S52 IC

The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable

Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

Features [11]

- Compatible with MCS®-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)
- Green (Pb/Halide-free) Packaging Option

B. LPG gas sensor (MQ6)

The analog gas sensor - MQ6 is used in gas leakage detecting equipments in consumer and industry markets, this sensor is suitable for detecting LPG, i-butane, propane, methane ,alcohol, Hydrogen, smoke (shown in Fig.2) [9]. It has a high sensitivity and fast response time. And the sensitivity can be adjusted by the potentiometer. The MQ series of gas sensors use a small heater inside with an electrochemical sensor. They are sensitive to a range of gasses and are used indoors at room temperature. This is a simple-to-use

liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000 ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

Fig.2: MQ6 Gas sensor

Features:

- High sensitivity to LPG, isobutane, propane
- Small sensitivity to alcohol, smoke.
- Fast response.
- Stable and long life
- Simple drive circuit

C. IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor (shown in Fig.3) [9] can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Infrared Obstacle Sensor Module has built in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The sensor has very good and stable response even in ambient light or in complete darkness.

Fig 3: IR sensor

D. Keypad

This 4x4 matrix keypad has 16 built-in push button contacts connected to row and column lines (shown in Fig.4) [9]. A microcontroller can scan these lines for a button-pressed state. In the keypad library, the Propeller sets all the column lines to input, and all the row lines to input. Then, it picks a row and sets it high. After that, it checks the column lines one at a time. If the column connection stays low, the button on the row has not been pressed. If it goes high, the microcontroller knows which row (the one

it set high), and which column, (the one that was detected high when checked). The keypad library supports pretty much any number of rows and columns.

Fig.4: 4x4 Keypad

So, the program has to tell it our keypad is has 4 rows and 4 columns, which I/O pins the lines are connected to, and what value each button represents. The rows, columns, and values arrays store that information. The rows array will be used to tell the keypad library that the top row is connected to P7, the second row to P6 and so on. Likewise, the column array lists the leftmost column as connected to P3, the next over connected to P2 and so on. The value array stores the value we want the program to give us for each button press. For example, if the top-left button is pressed, we want the number 1, and if the next one over is pressed, we want the number two. If the top right button is pressed, we want the ASCII code for the 'A' character, which is 65.

E. LCD display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display (shown in Fig.5) [9] is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Fig.5: 16x2 LCD display

Features:

- 5x8 dots with cursor
- 16 characters
- 2 lines of display
- 4-bit or 8-bit MPU interfaces
- Built-in controller

- Display mode and backlight variations
- ROHS compliant

F. ESP8266 Node MCU

The ESP8266 is the name of a micro controller designed by Espress if Systems. The ESP8266 (shown in Fig.6) [9] itself is a self-contained WiFi networking solution offering as a bridge from existing microcontroller to WiFi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

Fig.6: ESP8266 Node MCU

Specifications [12]:

- Voltage:3.3V.
- Wi-Fi Direct (P2P), soft-AP.
- Current consumption: 10uA~170mA.
- Flash memory attachable: 16MB max (512K normal).
- Integrated TCP/IP protocol stack.
- Processor: Tensilica L106 32-bit.
- Processor speed: 80~160MHz.
- RAM: 32K + 80K.
- GPIOs: 17 (multiplexed with other functions).
- Analog to Digital: 1 input with 1024 step resolution.
- +19.5dBm output power in 802.11b mode
- 802.11 support: b/g/n.
- Maximum concurrent TCP connections: 5.

G. Buzzer

A 5V Buzzer (shown in Fig.7) [9] is a buzzer or beeper is an audio signalling device. It may be mechanical, electro-mechanical or piezoelectric. Typical use of buzzers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Fig.7: Buzzer

H. Thermistor resistor

A thermistor resistor (shown in Fig.8) [9] is a type of resistor whose resistance is dependent on temperature, more so than in

standard resistors. The word is a portmanteau of thermal and resistor.

Fig.8: Thermistor resistor

When a flame is in the range of this sensor module, the module detects the flame, temperature of it increases and the resistance decreases and then the module sends signals to the controller. It is N type thermistor resistor. The use of fire sensor could also be done but the problem with it was that it was changing its readings with photo illuminance, not fire.

FLOW CHART

The Flow chart of the system's working is shown as below in Fig.9. It shows the basic idea about the operation of the complete system. It shows how the system is first idle and when any of the sensor senses some change in the readings of it, it checks for the desired problem and takes the required action along with sending a notification alert on the mobile phone application at the user side.

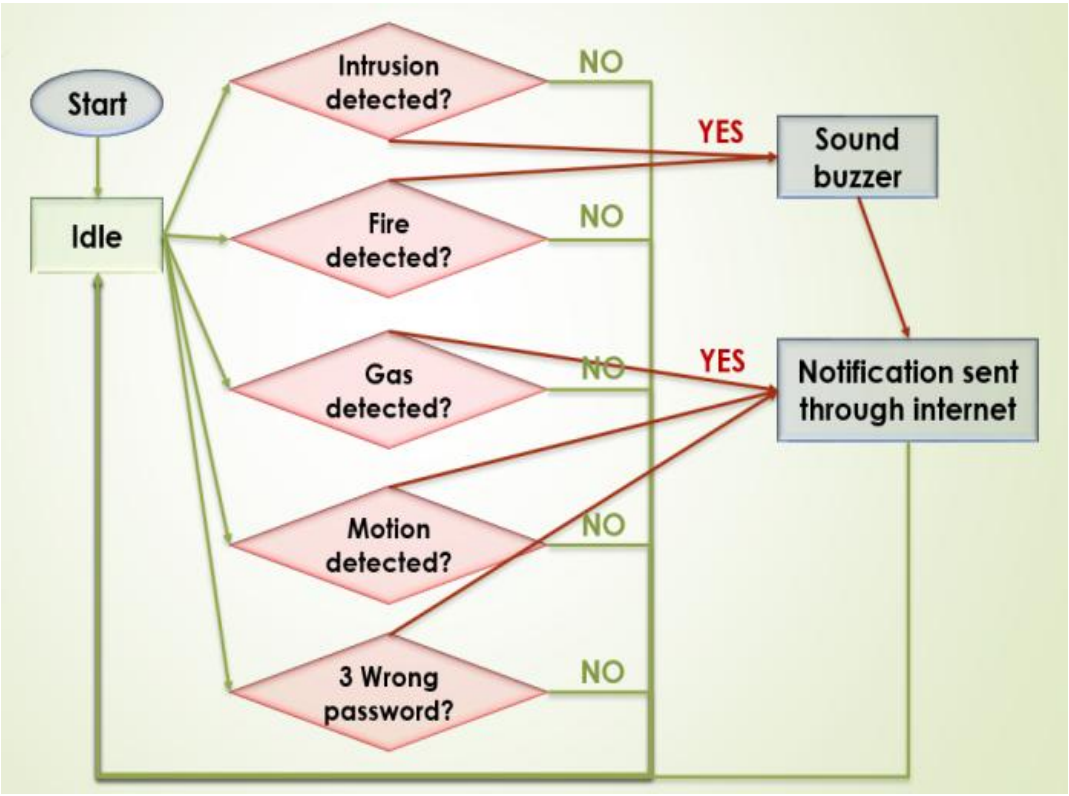


Fig.9: System Flowchart

WORKING

In this project we give a special idea of Anti Theft detection system. We provide the complete security of the house. If any person wants to enter the house then system checks and demand for id in case of valid id system allow the candidate and open the gate (shown in Fig.10). In case of invalid id system close the gate and beep the buzzer and all condition display on lcd. If any person touch window and break the window system automatically detect and weep the buzzer.

And in case of invalid or danger condition system automatically alert and provide the call on a respective number. First of all to take 220 voltage ac terminal and to give the signal in step down transformer that step-down to 12 voltage ac supply, we use the center-tap rectifier that convert in to dc 12 voltage, we use 7805 regulator ic that provide fixed five voltage .and we use the capacitor to remove the noise and occur in different case. The circuit diagram of the system has been designed on the proteus software which has been shown below in Fig.11 and Fig.12.

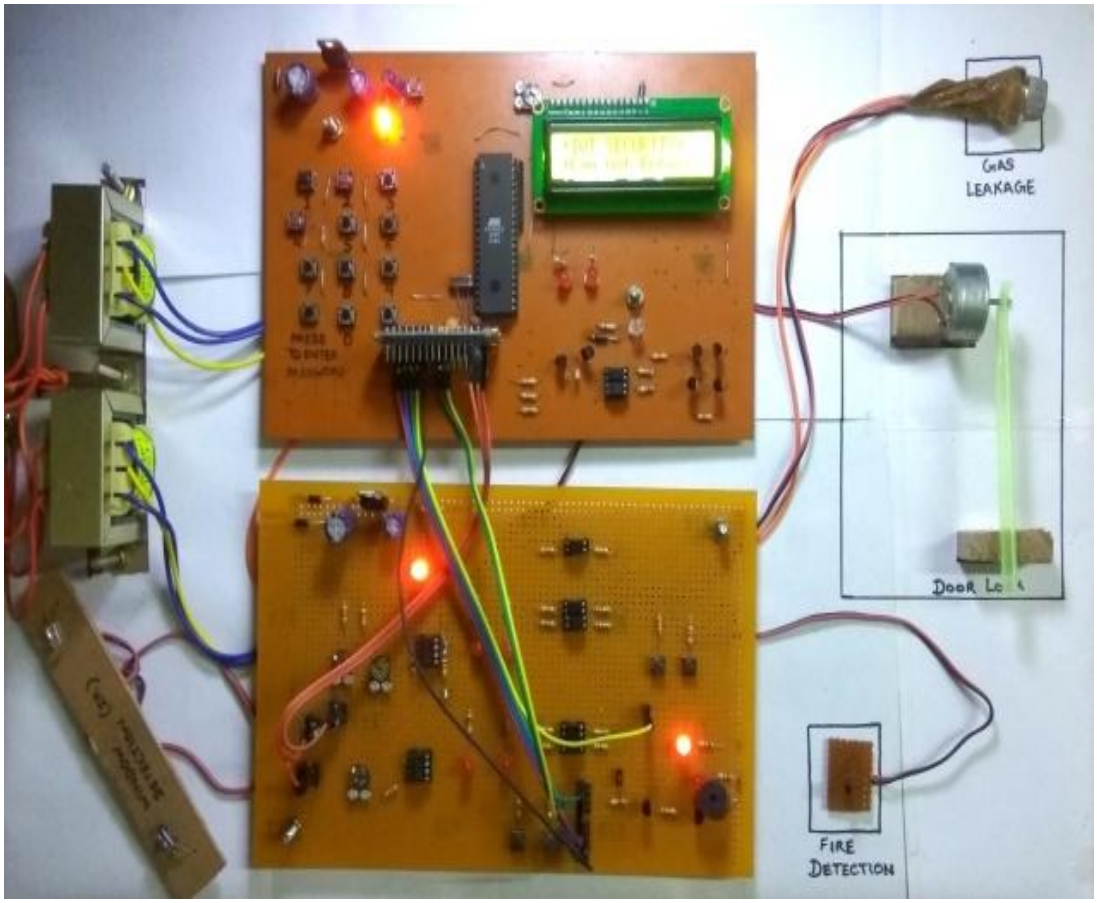


Fig.10: Project prototype

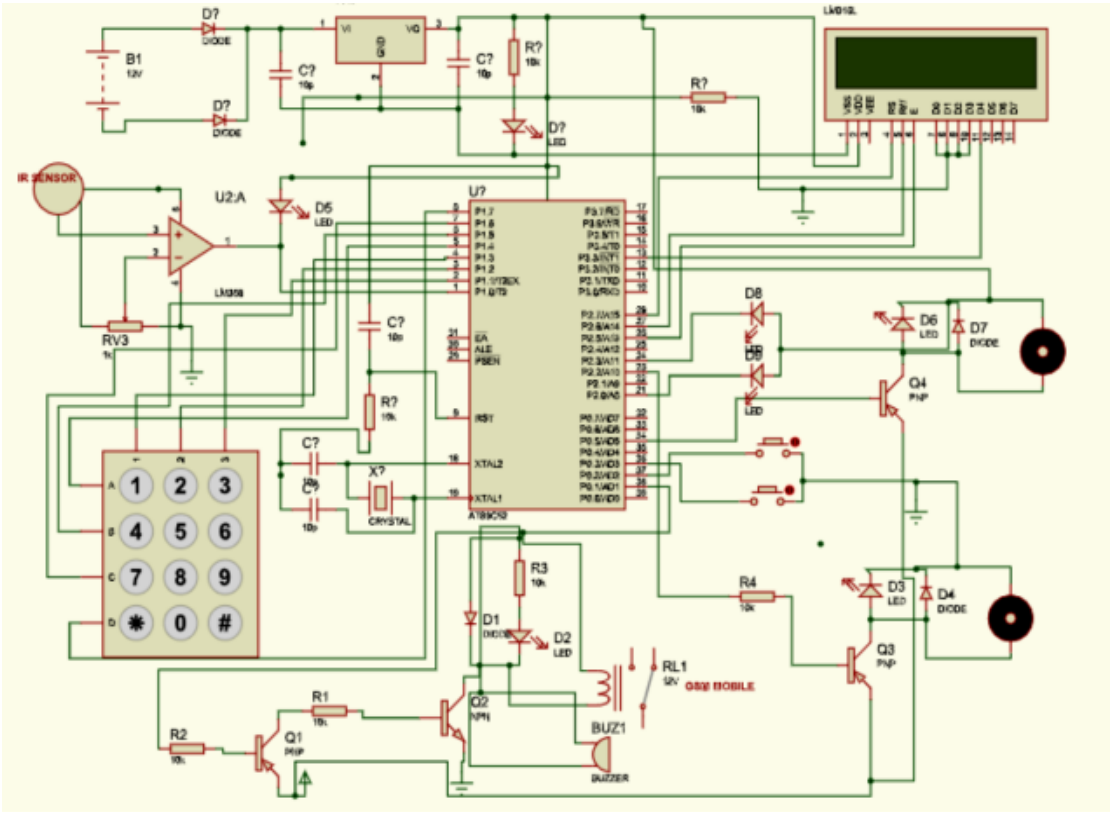
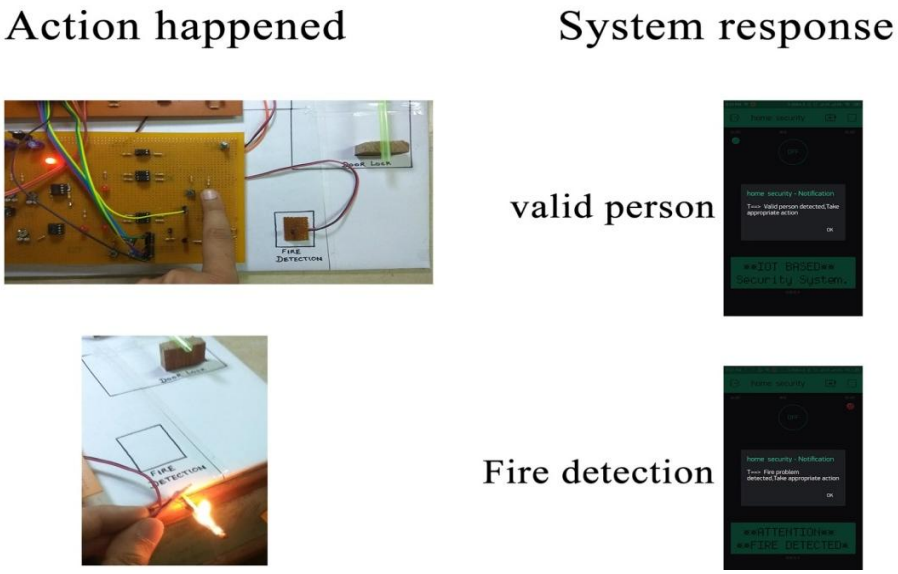
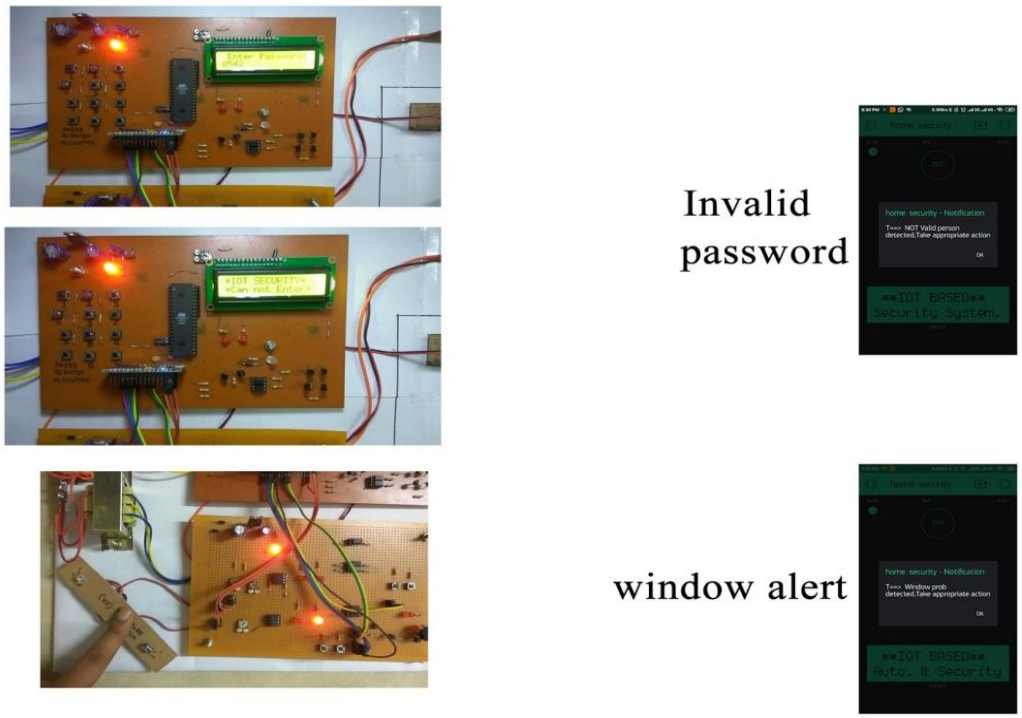


Fig.11: Circuit diagram 1





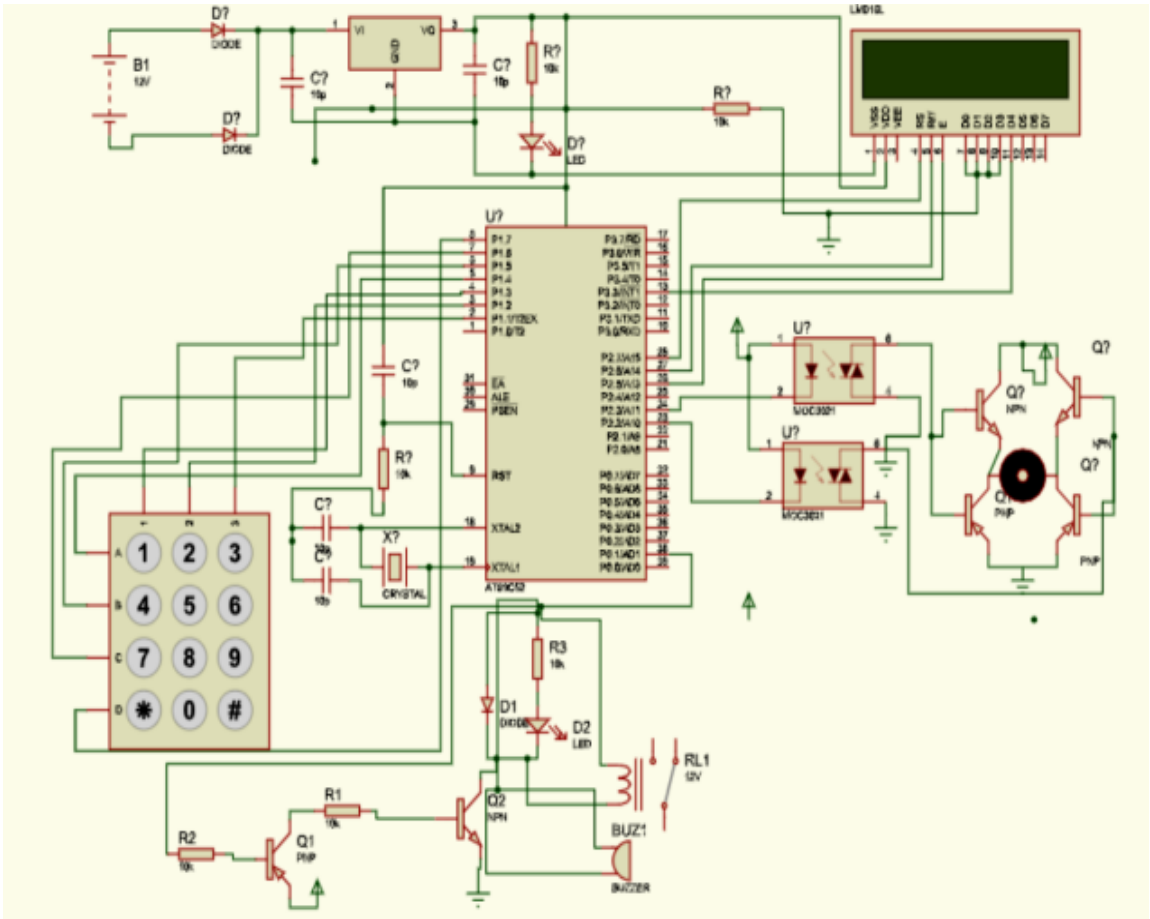


Figure:-12: Circuit diagram 2

CONFIGURING BLYNK APP

After the user installs the Blynk app[10] on the smartphone, an account has to be created in the app to access its services. The first time the app is opened, it will ask to either sign in or create an account. Create an account and add a new project to get started. Each project has its own authentication code which is used by the code to communicate with that particular model as provided. To interface with our components, we need to add widgets to our model. To add widgets press "+" to add to the model. The app provides a neat interface to add all the required widgets and setting them up according to the code. The Blynk needs to be running in the background for the user to get real time notifications.

CONCLUSION AND FUTURE SCOPE

The sensors placed on the door inform the homeowner as soon as the door is opened by sending a Push notification. The user will get this notification irrespective of whether the phone is locked or unlocked or even if any other app is opened at the moment. This was the main objective of the project, which is the user feels safe and not worries about any intrusion or break-ins when he is away from home. This setup can also be used in commercial offices where some areas are restricted for certain personnel, such a system will immediately inform the administrator of any unauthorized personnel trying to access such an area. Therefore the extensibility and applicability of such a system is only limited only by the imagination. Another important component of the project is the connectivity between the ESP8266 (WiFi module) and the Blynk server. The system successfully connected to the Blynk server using the authentication token and the Blynk libraries. As a result, we were able to get the notification on our smartphones as soon as there was any change in the status of the reed module sensor. Also the additional ability to control the alarm remotely is very beneficial and can be very useful in some unforeseen circumstances. It was also observed that the Blynk app worked smoothly and carried out all communication between the hardware and the app very accurately. The developed system can also be used to in industrial and commercial applications such as offices, warehouses and other areas where some areas are reserved for authorized personnel only or other places where safety and precautions are of primary concerns such as internet server room of a big MNC from where corporate data can be stolen. The system can also be easily upgraded to add extra safety features such

as cameras, motion detection sensors, etc. for increased safety. The system can also further be developed by adding an RFID scanner so that the authorized users need only carry a RFID or NFC tag with them on their person. The RFID scanner will work by scanning the tag wirelessly and if the user is authorized to enter, the alarm system will be disabled for some time so that the user can enter.

REFERENCES

I. Govinda K and Sai Krishna Prasad K and Sai ram susheel 2014 Intrusion detection system for smart home using laser rays International Journal for Scientific Research & Development (IJSRD) 2 176-78

II. Karri V and Daniel Lim J S 2005 Method and Device to Communicate via SMS after a Security Intrusion 1st International Conf. on Sensing Technology Palmerston North New Zealand 21-23

III. Jayashri B and Arvind S 2013 Design and Implementation of Security for Smart Home based on GSM technology International Journal of Smart Home 7 201-08

IV. Sowjanya G and Nagaraju S 2016 Design and Implementation Of Door Access Control And Security System Based On Iot Inventive Computation Technologies (ICICT), International Conference on Inventive

V. Cristian C, Ursache A, Popa D O and Florin Pop 2016 Energy efficiency and robustness for IoT: building a smart home security system Faculty of Automatic Control and Computers University Politehnica of Bucharest, Bucharest, Romania 43

VI. Lee C T, Shen T C, Lee W D and Weng K W 2016 A novel electronic lock using optical Morse code based on the Internet of Things Proceedings of the IEEE International Conference on Advanced Materials for Science and Engineering eds. Meen, Prior & Lam

VII. A Anitha “Home security System using Internet of things”, pp. in ICSET 2017

VIII. Swati Tiwari , Rahul Gedam “A Review Paper on Home

Automation System based on Internet of Things Technology", pp. in IRJET, May 2016

IX. Images source: www.google.com

X. Blynk app: https://blynk.io/

XI. AT89S52 datasheet: https://www.keil.com/dd/docs/datashts/atmel/at89s52_ds.pdf

XII. ESP8266 datasheet: https://espressif.com/sites/default/files/documentation/0a-esp8266ex_datasheet_en.pdf

Cite this Article As

Smart Home Security System using IOT (2019) **"Smart Home Security System using IOT"** Advances in Microcontrollers and Digital Signal Processing, 2(1), 1-15

http://doi.org/10.5281/zenodo.2709387

AUTHORS PROFILE

[1] Shreya Pandey, *Student*
Department: EC
College: ABES Engineering College, Ghaziabad

[2] Shreyansh Gupta, *Student*
Department: EC
College: ABES Engineering College, Ghaziabad

[3] Somiya Saxena, *Student*
Department: EC
College: ABES Engineering College, Ghaziabad

[4] Devvrat Tyagi, *Assistant Professor*
Department: EC
College: ABES Engineering College, Ghaziabad