SMART HOME SECURITY SYSTEM

MAJOR PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT REQUIREMENT FOR THE AWARD OF DEGREE OF

BACHELOR OF TECHNOLOGY
(Computer Science & Engineering)

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Abstract

Home security has been a major issue where crime is increasing and everybody wants to take proper measures to prevent intrusion, besides homes the system is also implemented in business premises and offices. through various sensors such as motion sensor -PIR (Passive Infrared) sensors for detection of any intruder in the house, upon detection an alarm is raised and the owner of the house and notification messages are provided. This project is built using a programmed microcontroller interfaced with SIM900A module, motion detectors and switches. In the current market scenario, a lot of smart home devices are available like smart plugs, smart switches that are generally operated through Alex or amazon's echo. But most of the products in the market are way too costly. In this paper, we would discuss the security features and will be using some common cheap chips to overall reduce the cost and simultaneously provide a highly scalable, user friendly system that automates a house in all aspects. It also provides a brief overview of existing security alarm solutions based on the Internet of Things (IoT) and Smart Home technologies. The idea of creating a budget solution based on Arduino and ESP32-CAM is presented. A prototype was assembled, the device was tested in operation.

Acknowledgement

WE are highly grateful to **Dr. Sehijpal Singh**, Principal, Guru Nanak Dev Engineering College (GNDEC), Ludhiana, for providing this opportunity to carry out the major project work at **SMART HOME SECURITY SYSTEM**.

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1. Introduction

1.1 Introduction to Project

Home security made drastic changes in the past few decades and will continue to advance much more in the coming years. Previously home security systems meant having an alarm that would go off when somebody would break in but a smart secure home can do much more than that. Security hardware includes doors, locks, alarm systems, lighting, motion detectors, and security camera systems. Personal security involves practices like ensuring doors are locked, alarms are activated, owning a Dog, windows are closed, and extra keys are not hidden outside. As per the most recent statistics, the average burglary in the United States takes about 90 seconds to 12 minutes, and on average, a burglar will break into a home within 60 seconds. Most target cash first followed by jewels, drugs, and electronics. Common security methods include never hiding extra keys outside, never turning off all the lights, applying small CCTV stickers on doors, and keeping good tabs with neighbors. If your security system is professionally monitored by an alarm company, they are alerted when a security problem arises in your home. Along with the high-decibel alarm that sounds, the monitoring company is alerted. A trained security expert might attempt to communicate with the homeowner via the control panel if it's set up for 2-Way Voice communication, or will call the emergency contact number listed on the account. Numerous studies show homes without security systems, when compared to those with professionally monitored systems, are up to three times more likely to be burglarized because burglars are opportunistic by nature and are on the hunt for easy targets.This project aims at giving the user an assurance of instantaneous alert in the form of SMS notification on users registered cell phone number for any form of threat to the security of the home of the user.Threat to security can be in the form of trespassing, burglary etc. If the door magnetic sensor **(MC-38)** is on then, if anyone opens the door then the owner will get an alert SMS and if they enter the room then **PIR** will detect the motion and send their picture to the owner. This security system will be more effective if owner gone out for some days and anyone try to bulgery or trespassing Because in this project 3 layers of security.

1.2 Project Category

The proposed project falls under the category of Internet of Things.

1.3 Objectives

- To design and implement the circuit layout of Laser Security Alarm System(LSAS) as an interface.
- To build and develop the framework for a door security system using Arduino.
- To capture the images of the intruder and send it to the owner's mobile phone as a text message.

1.4 Problem Formulation

A home security system is one line of defense a home can provide against intruders. A system can be off, armed while residents are home, and armed while residents are away. The difference between the latter two states is that while residents are away all monitors are active, including window and door monitors and internal motion detectors. While residents are home, the monitors remain active while the motion detectors are deactivated to allow residents free movement within the home.

2. Requirement Analysis and System Specification

2.1 Feasibility Study

The main objective of the feasibility study is to test the Technical, Operational and Economical feasibility for adding new devices and debugging old running devices/systems. All systems are feasible if they have unlimited resources and infinite time. There are aspects in the feasibility study portion of the preliminary investigation.

2.1.1 Economic Feasibility

Low cost GSM based wireless home security system which includes wireless security sensor nodes and a GSM gateway.

It has the following features:

- Low cost,
- Low power consumption,
- Simple installation,
- Fast Response

In general, GSM modem acts as the interface between the users and the sensor nodes. The owner will be notified with a short messaging service (SMS) from the server via the GSM module system in a few seconds.

2.1.2 Technical Feasibility

The project is technically feasible as it will be made with proper & prior knowledge of IoT and coding development.

2.1.3 Legal Feasibility

The project is legally feasible as the data (In the form of text or video or Image) which will be provided by the arduino will be completely confidential with the owner.

2.1.4 Operational Feasibility

It can view the ‘Ensuring message’ as well as a ‘warning message’, so as to satisfy the user on behalf of the working procedure of the system. Its ability to warn its stakeholders about the intruders. The future aspects of this detector include the GSM module and a tripper circuit which increases the efficiency of the system and provides more safety to the users.

2.2 Software Requirements Specification Document:

2.2.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross- platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the

help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution.

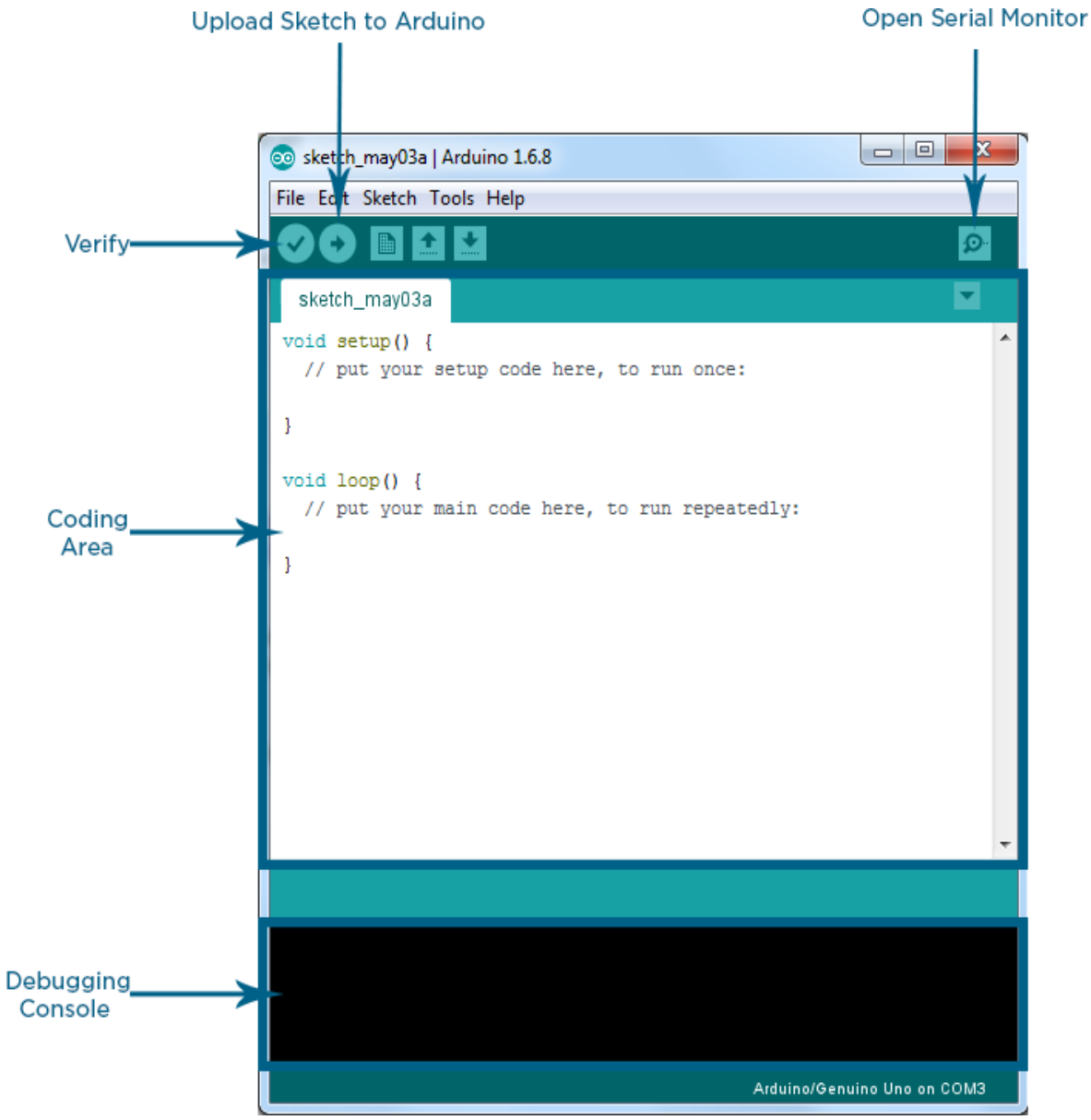

Fig 2.2.1 Arduino IDE Editor

2.2.2 Telegram API

Bots are third-party applications that run inside Telegram. Users can interact with bots by sending them messages, commands and inline requests. You control your bots using HTTPS requests to Telegram's Bot API.

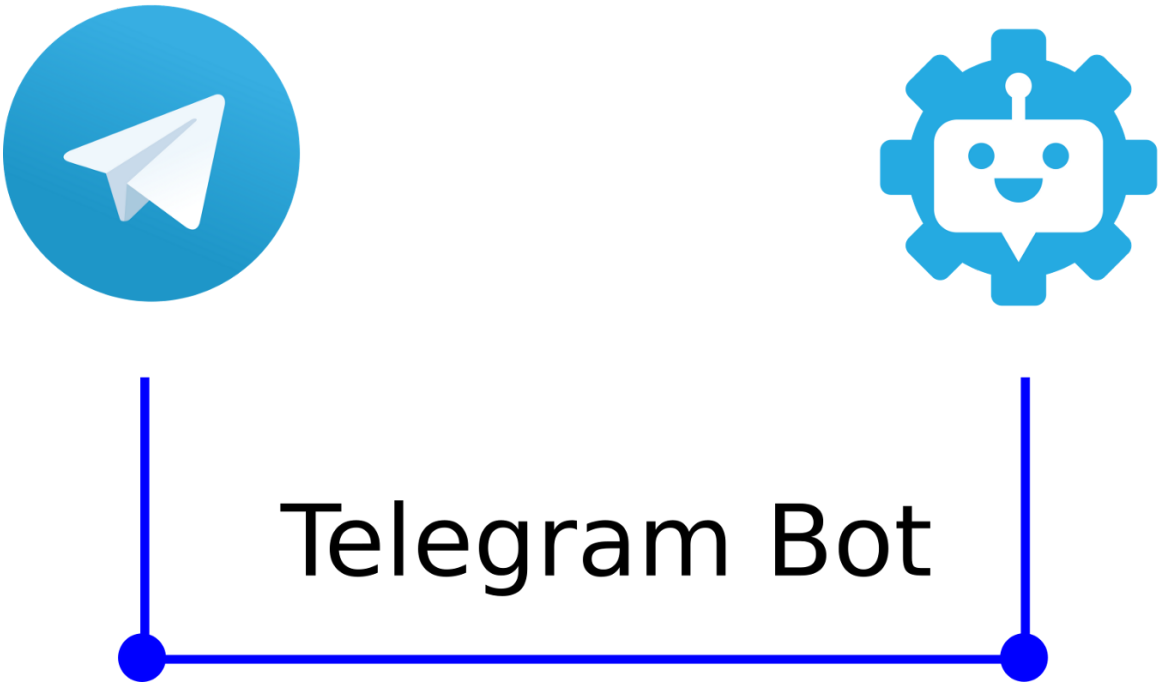

Fig2.2.2 Telegram Bot

At the core, Telegram Bots are special accounts that do not require an additional phone number to set up. Users can interact with bots in two ways:

- Send messages and commands to bots by opening a chat with them or by adding them to groups.
- Send requests directly from the input field by typing the bot's @username and a query. This allows sending content from inline bots directly into any chat, group or channel.

Messages, commands and requests sent by users are passed to the software running on your servers. Our intermediary server handles all encryption and communication with the Telegram API for you. You communicate with this server via a simple HTTPS-interface that offers a simplified version of the Telegram API. We call that interface our Bot API.

Commands

Commands present a more flexible way to communicate with your bot. The following syntax may be used:

A command must always start with the *'/'* symbol and may not be longer than 32 characters. Commands can use latin letters, numbers and underscores. Here are a few examples:

- */get_messages_stats*
- */set_timer 10min Alarm!*

Users will see a Start button when they first open a conversation with your bot. Help and Settings links will be available in the menu on the bot's profile page.

2.3 Hardware Requirement Specification Document:

2.3.1 Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. In these holes we can easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode). The bread board has strips of metal which run underneath the board and connect the holes on the top of the board. Breadboards consist of two areas called strips, and are often separated from the middle portion (commonly known as ravine).

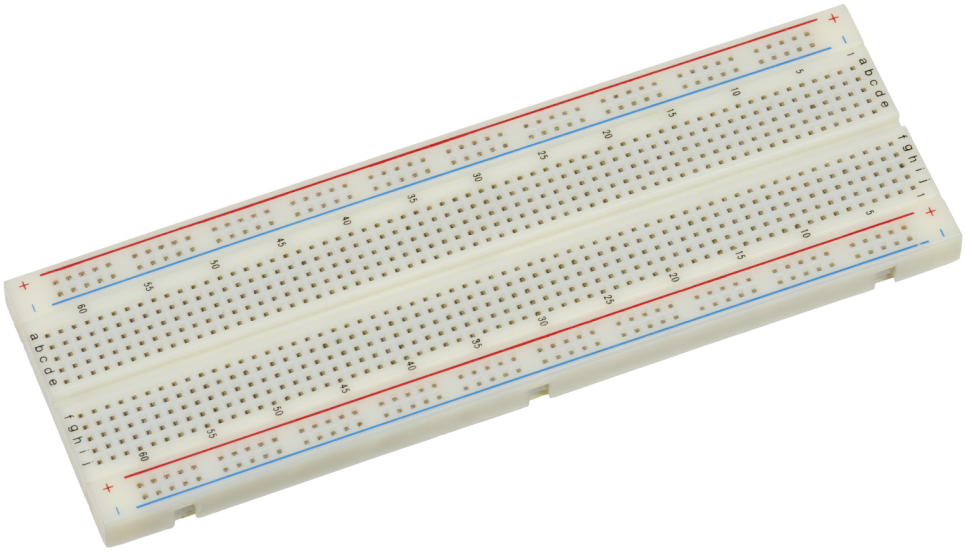

Fig 2.3.1 Breadboard

I. Bus strips are mainly used for power supply connections
II. Terminal strips are mainly used for electrical components
III. Each strip consist of 5 pinholes, indicating that you only can connect up to 5 components in one particular section

2.3.2 ESP32-CAM

The ESP32-CAM Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP32-CAM is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Each ESP32-CAM module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield. The ESP32-CAM module is an extremely cost effective board with a huge, and ever growing, community. We can also develop applications on NodeMCU using the Arduino development environment. This makes it easy for Arduino developers than learning a new language and IDE for NodeMCU

Fig 2.3.2 (i)ESP32-CAM

Features:

- Onboard ESP32-CAM module, supports WiFi + Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4G TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multi sleep modes, deep sleep current as low as 6mA

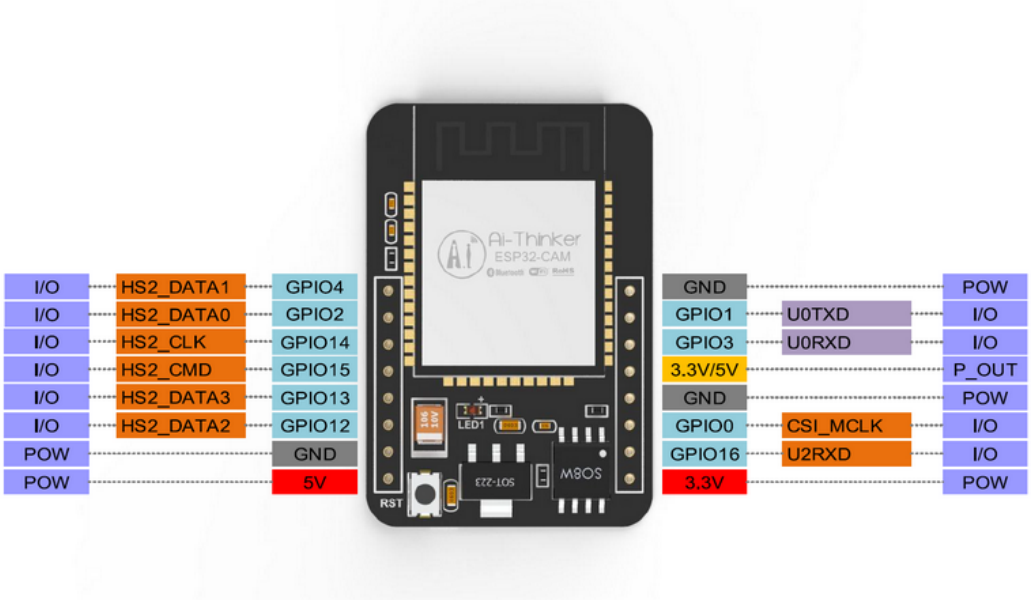

Fig 2.3.2(ii) ESP-32 CAM Pinout

2.3.3 SIM900A GSM Module

SIM900A GSM Module is the smallest and cheapest module for GPRS/GSM communication.

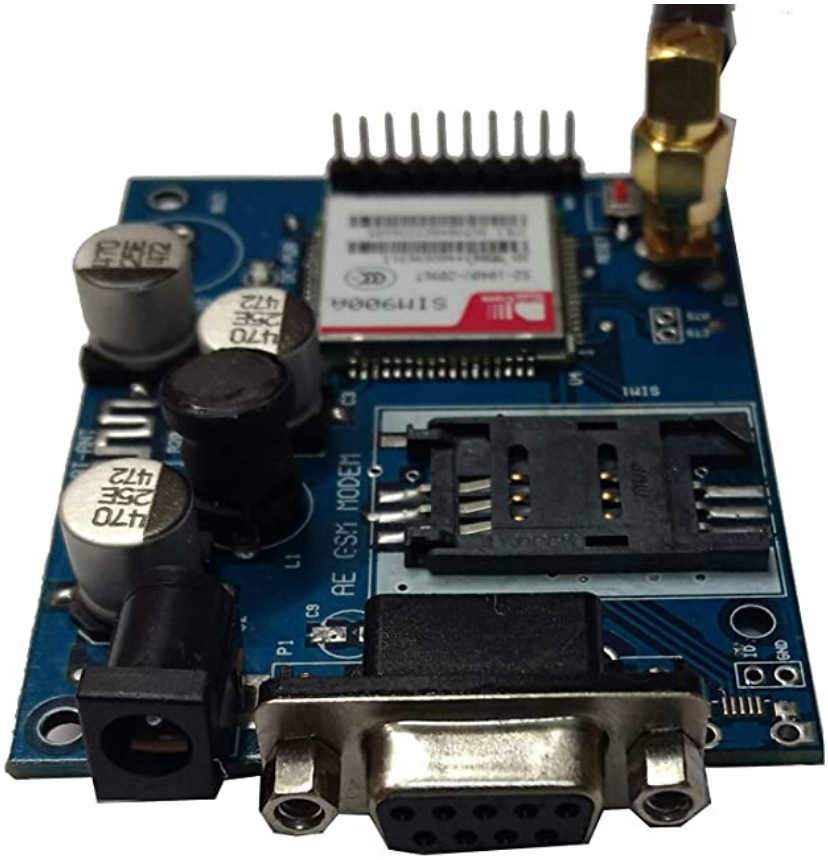

Fig 2.3.3 SIM900A GSM Module

It is common with Arduino and microcontroller in most embedded applications. The module offers GPRS/GSM technology for communication with the uses of a mobile sim. It uses a 900 and 1800MHz frequency band and allows users to receive/send mobile calls and SMS. The keypad and display interface allows the developers to make the customized application with it. Furthermore, it also has modes, command mode and data mode. In every country the GPRS/GSM and different protocols/frequencies operate. Command mode helps the developers to change the default setting according to their requirements. The Module SIM900A looks like a single chip but it has a bunch of features that can help to build almost many commercial applications. Although, there are a total of 68 pins on SIM900A and using these pins helps to build the applications. But we will need a few pins if we use a module for interfacing with Arduino.

Features:

- Send and receive SMS messages
- Send and receive GPRS data (TCP/IP, HTTP, etc.)
- Scan and receive FM radio broadcasts
- Transmit Power:
- Class 4 (2W) for GSM850
- Class 1 (1W) for DCS1800
- Serial-based AT Command Set
- U.FL and SMA connectors for cell antenna
- Accepts Full-size SIM Card

2.3.4 Arduino UNO

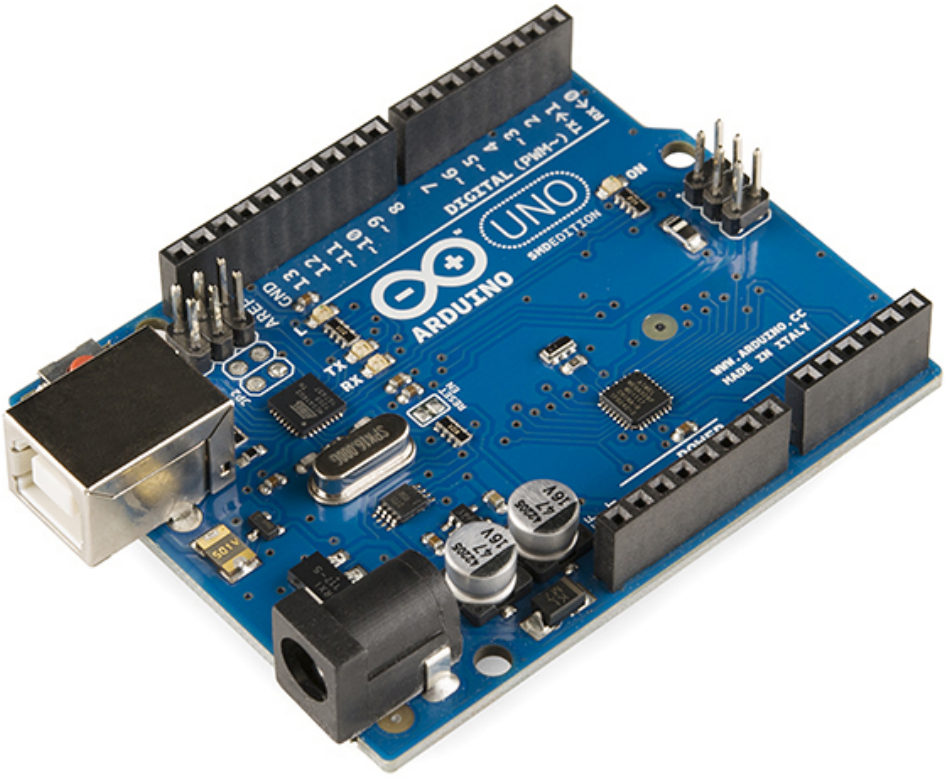

Fig2.3.4 Arduino UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller.

It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB Connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

The components of Arduino are as follows:

- ATmega328 Microcontroller- It is a single chip Microcontroller of the ATmel family. The processor code inside it is 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.
- ICSP pin - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

- Power LED Indicator- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- Digital I/O pins- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- Tx and Rx LEDs- The successful flow of data is represented by the lighting of these LED's.
- AREF- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- Reset button- It is used to add a Reset button to the connection.
- USB- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- Crystal Oscillator- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- Voltage Regulator- The voltage regulator converts the input voltage to 5V.
- GND- Ground pins. The ground pin acts as a pin with zero voltage.
- Vin- It is the input voltage.
- Analog Pins- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

2.3.5 PIR Sensor

A Passive Infrared Sensor is an electronic sensor that measures infrared light radiating from objects. PIR sensors are mostly used in PIR-based motion detectors. Also, it is used in security alarms and automatic lighting applications. The below image shows a typical pin configuration of the PIR sensor, which is quite simple to understand the pinouts. The PIR sensor consist of 3 pins,

Fig2.3.5 PIR Sensor

- Pin1 corresponds to the drain terminal of the device, which is connected to the positive supply 5V DC.
- Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor. The pin 2 of the sensor carries the detected IR signal to an amplifier from the
- Pin3 of the sensor connected to the ground.

2.3.6 Magnetic Reed Switch/Door Sensor

A reed switch is an electrical device operated using a magnet in place. It consists of two halves. One half contains the actual switch and the other half contains just a magnet in it. When the magnetic half is brought near the switch half it starts conducting electricity.

Fig 2.3.6(i) Magnetic Reed Switch

Actually the switch half contains a pair of magnetic rods. Normally when there is no magnetic field present near the switch the rods are apart from each other(Open circuit – No electric path). When we bring the magnetic half near the switch half the magnetic field brings the rods close and when the strength of the magnetic field reaches the threshold limit the rods attach with each other(Making a physical contact – Path for electricity flow).

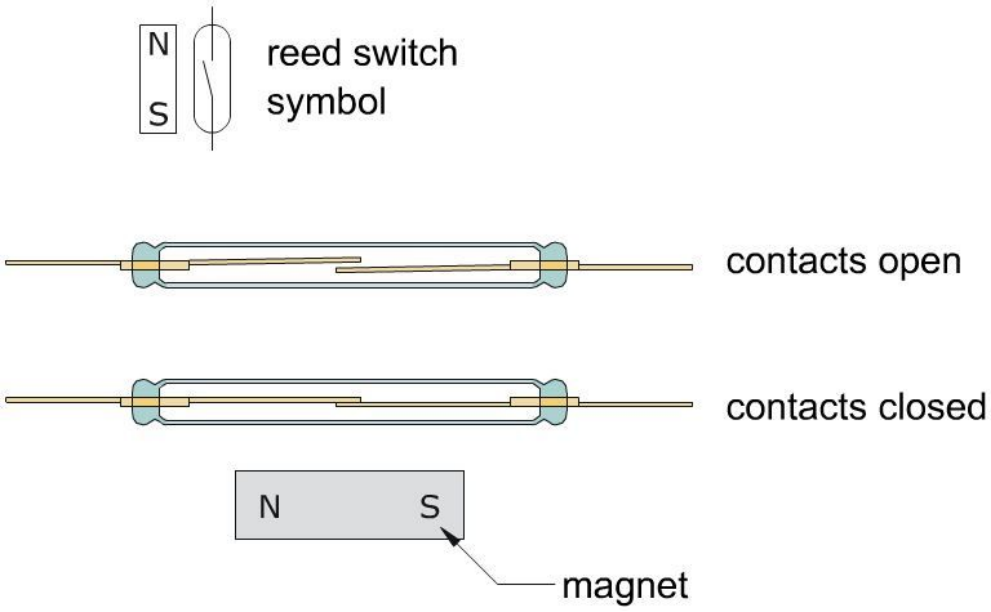

Fig 2.3.6 (ii) Construction of the Switch

2.3.7 FTDI FT232R (TTL Programmer)

The USB TTL Serial cables provide connectivity between USB and serial UART interfaces. There is a range of FTDI cables available. This USB to TTL Serial Converter also works on different output voltages like 5V, 3.3V. This all cables FTDI FT232R device integrated. This works within the cable USB type connector, which provides access to UART Transmit (Tx), Receive (Rx), RTS#, CTS#, VCC (5V) and GND connections.

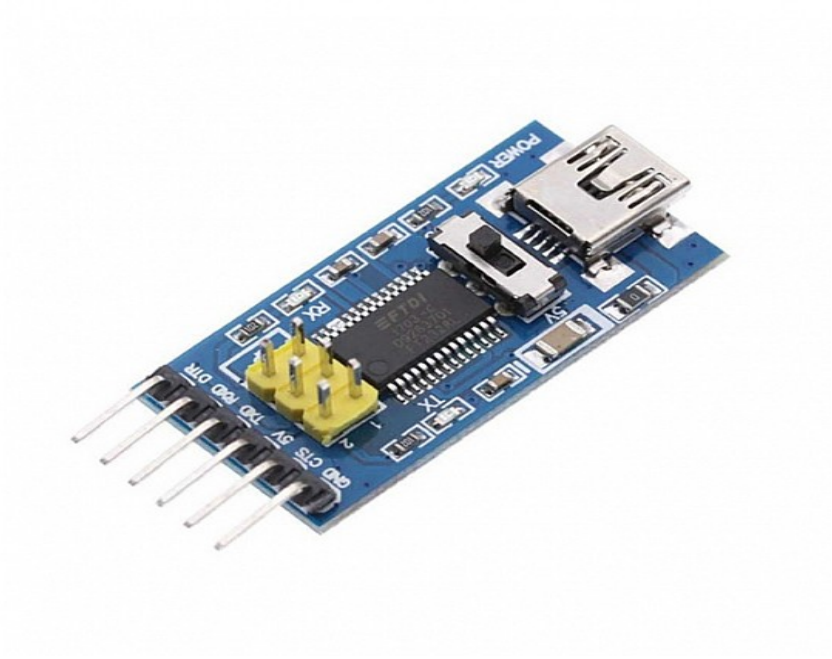

Fig.2.3.7 FTDI FT232R (TTL Programmer)

Pin Functionality

- DTR – Reset the other hardware device
- RX – Used to receive the serial data.
- TX – Used to transmit the serial data.
- VCC – Provides 5V or 3.3V voltage output as per the requirement
- CTS – Enable or disable the programming mode of the device
- GND – Ground pin

Uploading program using FTDI USB to TTL Serial Converter in Arduino IDE

- Connect the FTDI Cable to USB Port (Sometimes connecting FTDI Cable to USB 3.0 port may cause an issue)
- In Boards Manager select the appropriate Board
- In Ports select COM port
- Select Programmer as “AVRISP mkll”

2.3.8 Piezo Buzzer

A piezo buzzer is a type of electronic device that’s used to produce a tone, alarm or sound. It’s lightweight with a simple construction, and it’s typically a low-cost product. Yet at the same time, depending on the piezo ceramic buzzer specifications, it’s also reliable and can be constructed in a wide range of sizes that work across varying frequencies to produce different sound outputs.

Fig 2.3.8 Piezo Buzzer

2.3.9 Jumper Wire

A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

There are 3 types of jumper wires:

- Male to Male
- Male to Female
- Female to Female

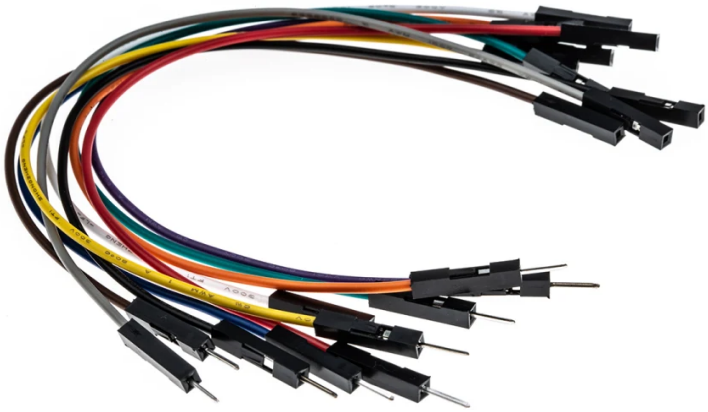

Fig 2.3.9 Jumper Wires

2.3.10 Power Supply

All Arduino boards need electric power to function. A power supply is what is used to provide electric power to the boards and typically can be a battery, USB cable, AC adapter or a regulated power source device.

Fig 2.3.10(i) Power Adaptor

There are different ways to power your Arduino board. The most common way is through the USB connector available on every board, but there are a few other possibilities to power your board. If you like to know more about this, the different ways to supply power to your board are listed below:

USB

Arduino boards can operate satisfactorily on power that is available from the USB port. It provides 5V DC voltage and can be sourced from the port from a PC, wall socket adapter or portable power bank.

Battery

Some boards come with a Li-Po (Lithium-ion Polymer) battery socket that fits this kind of battery. For example, MKR boards (except MKR FOX and WAN 1300) come with this feature. These types of batteries supply 3.7V, are rechargeable and they can provide higher energy than other lithium batteries.

VIN

Another way to power your board is by supplying voltage from a regulated power source directly to the VIN pin. Just need to connect the positive wire from your power supply to VIN and the negative to GND. Follow your board power specifications to figure out the voltage range that your board can handle.
VIN pin is an INPUT only.

Fig 2.3.10(ii) USB Nano Cable

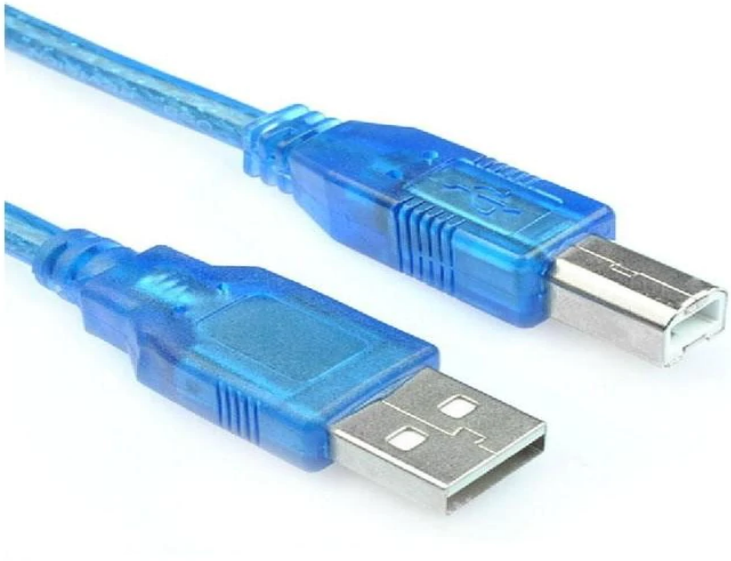

Fig 2.3.10(iii) Arduino USB Cable

2.3.11 BC547 Transistor

BC547 is a NPN transistor hence the collector and emitter will be left open (Reverse biased) when the base pin is held at ground and will be closed (Forward biased) when a signal is provided to the base pin.

BC547 as Switch

When a transistor is used as a switch it is operated in the Saturation and Cut-Off Region as explained above. As discussed a transistor will act as an Open switch during Forward Bias and as a Closed switch during Reverse Bias, this biasing can be achieved by supplying the required amount of current to the base pin. As mentioned the biasing current should maximum of 5mA. Anything more than 5mA will kill the Transistor; hence a resistor is always added in series with base pin.

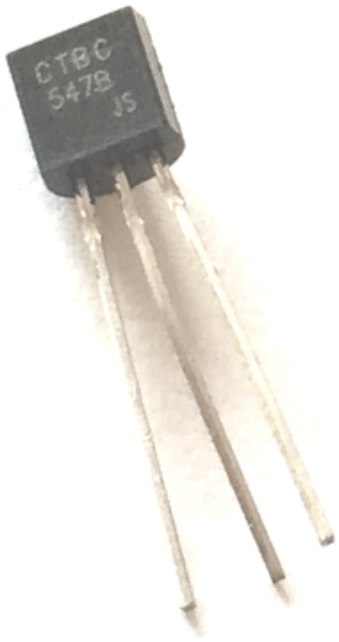

Fig 2.3.11 BC547 Transistor

BC547 Transistor Features

- Bi-Polar NPN Transistor
- DC Current Gain (hFE) is 800 maximum
- Continuous Collector current (IC) is 100mA
- Emitter Base Voltage (VBE) is 6V
- Base Current(IB) is 5mA maximum
- Available in To-92 Package

2.3.12 Laser Diode

A laser diode is a semiconductor device similar to a light-emitting diode in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction. Driven by voltage, the doped p–n-transition allows for recombination of an electron with a hole.

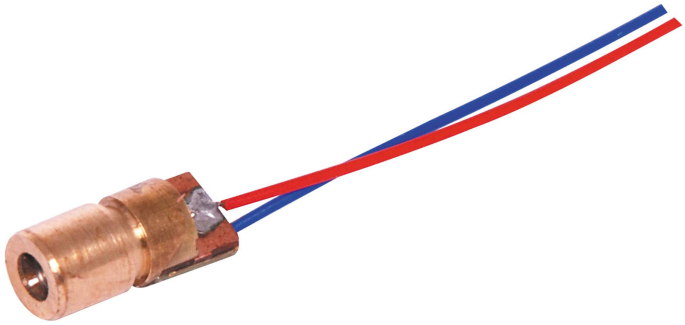

Fig 2.3.12 Laser Diode

2.3.13 LDR(Light Dependent Resistors)

Light Dependent Resistors, LDRs or photoresistors are electronic components that are often used in electronic circuit designs where it is necessary to detect the presence or the level of light.

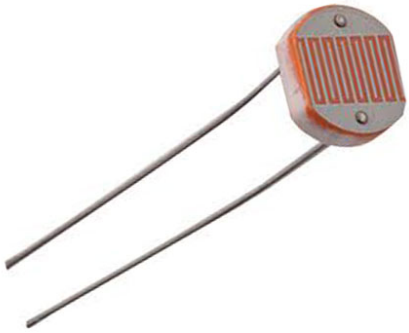

Fig 2.3.13 LDR(Light Dependent Resistors)

An LDR or photoresistor is made of any semiconductor material with a high resistance. It has a high resistance because there are very few electrons that are free and able to move - the vast majority of the electrons are locked into the crystal lattice and unable to move. Therefore in this state there is a high LDR resistance.

2.3.14 Resistor

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.

Fig 2.3.14 Resistor

3. System Design

3.1 Design Approach

The design approach used in this project is IOT based. The thorough study of components before implementing is done. Each component is tested separately before combining into the whole system.

3.2 Detail Design

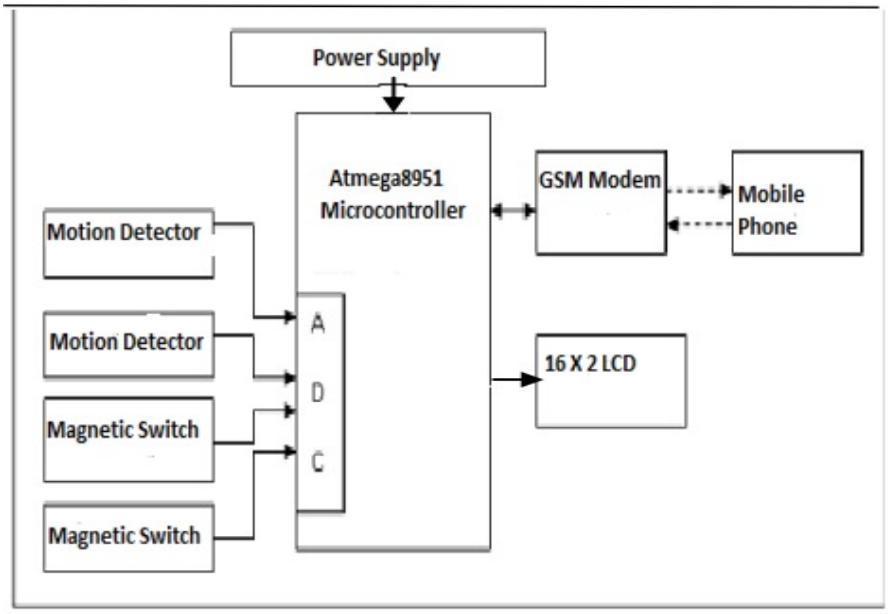

Fig 3.2 Detail Design

3.3 Methodology

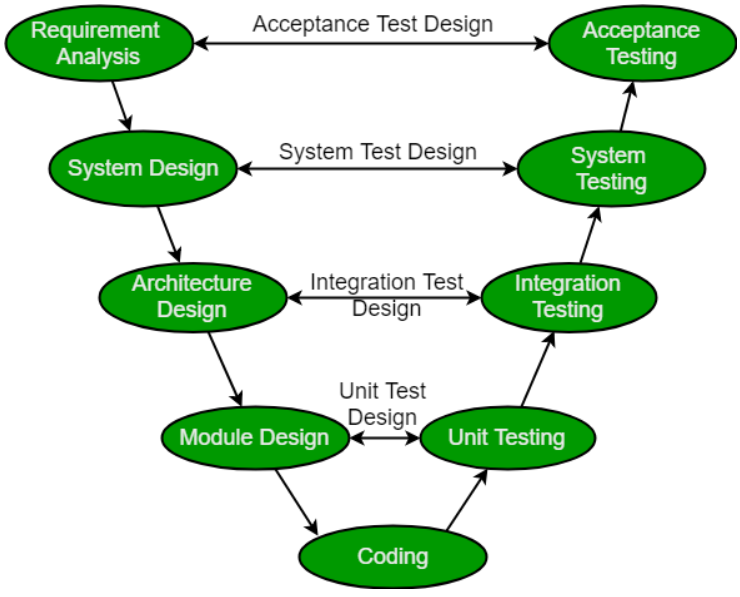

Fig3.3 V-Model

The V-model technique was used to acquire the project. This technique is very easy to apprehend and utilize. The simplicity of this technique also makes it simpler to accomplish. The 18 V-Model is based on the relationship of a testing stage for each

corresponding improvement level. This means that for every single segment in the improvement drive, there is a directly correlated testing phase. This is a highly-restricted model and the next stage starts only after the end of the previous phase.

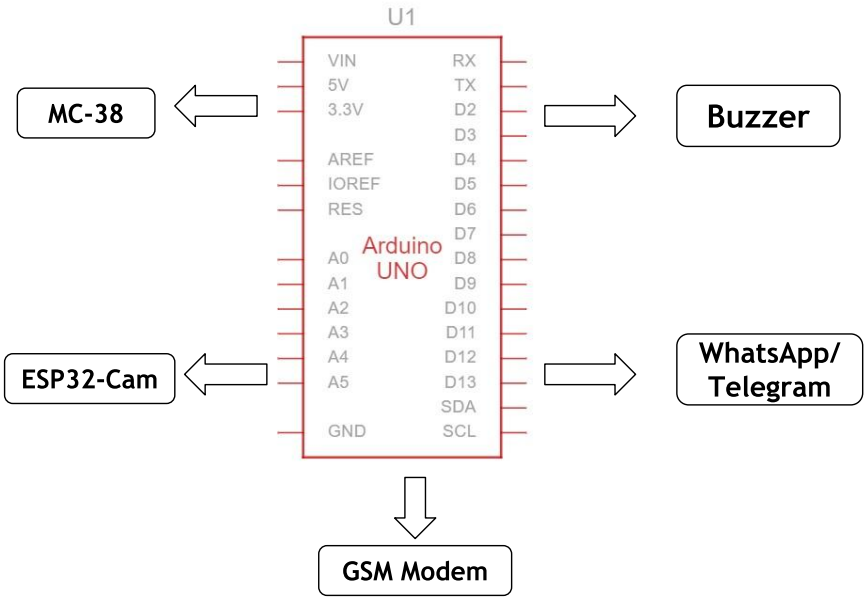

Fig 3.3 (i) Circuit Model

The methodology used in the proposed model is to develop a prototype model of a house, in the prototype an interface of motion detectors, and GSM modules are being developed with an arduino. The communication between the arduino and other components of the system takes place serially. The proposed system contains PIR sensors in the monitored rooms and connected camera modules to the ESP32 microcontroller.

The main aspects of the whole system are the following:

- In this circuit we are using LDR (Light Dependent Resistor) which is actually a variable resistor. Normally LDR has high resistance and when light falls on its surface , its resistance decreases and this allows the transistor to conduct and as a result of this change in resistance the buzzer will be turned on. We are using a 9V to 12V DC battery for this circuit.n Sensitivity of this circuit will be adjusted by 50K resistor.

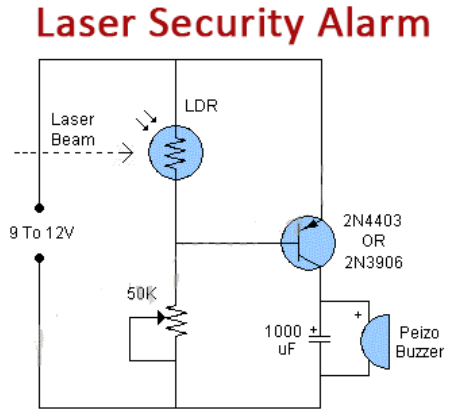

Fig 3.3 (ii) Laser Security Alarm Working

- Pir motion detector and magnetic door switch sends their respective status to arduino. Arduino then decides what to do next with the inputs from the pir and door sensor. If the arduino finds both the sensors transmitted the positive status. It alerts the gsm module to activate and send a text sms on hard coded single sim number.

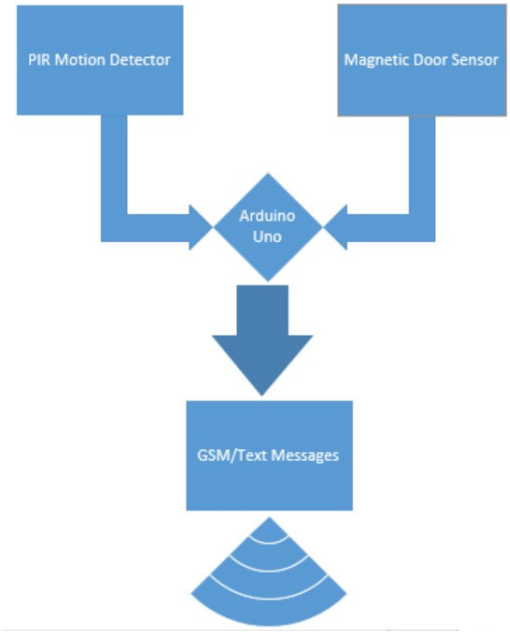

Fig 3.3 (iii)PIR working

- If PIR detects the motion then ESP32 Cam sends a picture of intruder or trespassing to the house owner.

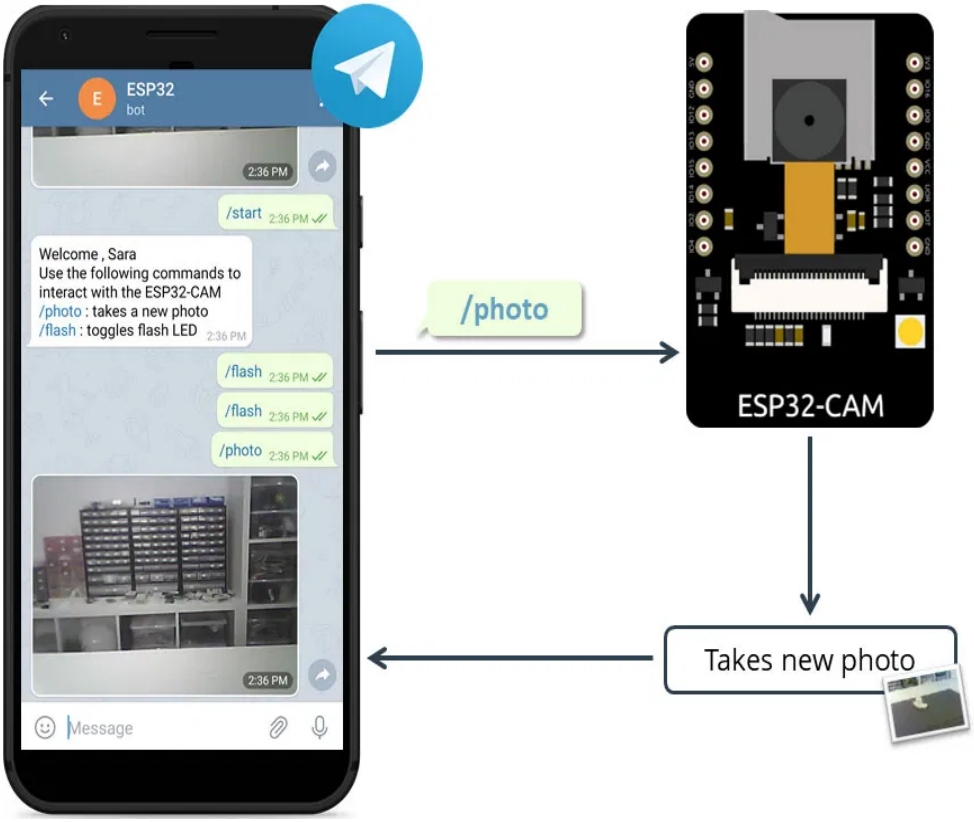

Fig 3.3 (iv) ESP32-CAM working

4. Implementations and Testing

4.1 Import Different Libraries

4.1.1 Universal Telegram Bot Library

To interact with the Telegram bot, we'll use the Universal Telegram Bot Library created by Brian Lough that provides an easy interface for the Telegram Bot API.

- Click here to download the Universal Arduino Telegram Bot library.
- Go to Sketch > Include Library > Add .ZIP Library...
- Add the library you've just downloaded.

4.1.2 ArduinoJson Library

We have to install the ArduinoJson library. Follow the next steps to install the library.

- Go to Sketch > Include Library > Manage Libraries.
- Search for "ArduinoJson".
- Install the library.

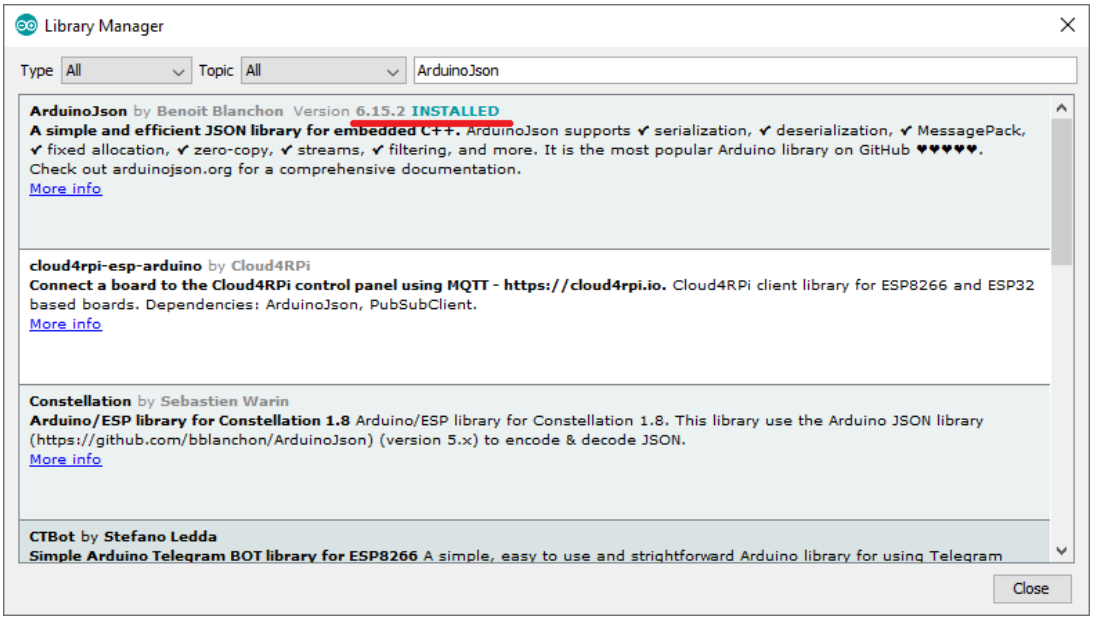

Fig 4.1.2 ArduinoJson Library

4.1.3 ESP32-CAM Module

4.1.3.1 Required Library

```
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include "soc/soc.h"
#include "soc/rtc_cntl_reg.h"
#include "esp_camera.h"
#include <UniversalTelegramBot.h>
#include <ArduinoJson.h>
#include <Wire.h>
```

4.1.3.2 Network Credentials

```
const char* ssid = "PKP";
const char* password = "112234455";
```

4.1.3.3 Telegram User ID

Insert your Telegram chat ID on the **chatId** variable. The one we've got from the IDBot.

```
String chatId = "998857744";
```

4.1.3.4 Telegram Bot Token

Insert Telegram Bot token we've got from **Botfather** on the *BOTtoken* variable.

```
String BOTtoken =
"5351269776:AAFr5gTRW7WlnJgclasvogucEWhicHpx1Dk";
```

4.1.3.5 Camera Pins

Define the pins used by the ESP32-CAM

```
//CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27
#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22
```

4.1.3.6 Flash LED

Create a variable to hold the flash LED pin (FLASH_LED_PIN). In the ESP32-CAM AI-Thinker, the flash is connected to **GPIO 4**. By default, set it to LOW.

```
#define FLASH_LED_PIN 4
bool flashState = LOW;
```

4.1.3.7 Motion Sensor

The motionDetected variable indicates whether motion has been detected. It is set to false by default.

```
bool motionDetected = false;
```

Finally, if it receives the **`/start`** message, we'll send the valid commands to control the ESP. This is useful if you happen to forget what the commands to control your board are.

```
if (text == "/start"){
  String welcome = "Welcome to the ESP32-CAM Telegram
bot.\n";
  welcome += "/photo : takes a new photo\n";
  welcome += "/flash : toggle flash LED\n";
  welcome += "You'll receive a photo whenever motion
is detected.\n";
  bot.sendMessage(chatId, welcome, "Markdown");
}
```

4.1.3.8 sendPhotoTelegram()

The sendPhotoTelegram() function takes a photo with the ESP32-CAM.

```
camera_fb_t * fb = NULL;
fb = esp_camera_fb_get();
if(!fb) {
  Serial.println("Camera capture failed");
  delay(1000);
  ESP.restart();
  return "Camera capture failed";
}
```

4.2 Upload Code to the ESP32-CAM

After making the necessary changes, upload the code to your ESP32-CAM (before connecting the shield). Follow the next steps to upload code or follow this tutorial: How to upload code to ESP32-CAM.

- Wire the ESP32-CAM to the FTDI programmer as shown in the following diagram.
- Go to Tools > Board and select AI-Thinker ESP32-CAM. You must have the ESP32 add-on installed. Otherwise, this board won't show up on the Boards menu.
- Go to Tools > Port and select the COM port the ESP32-CAM is connected to.
- Then, click the Upload button in the Arduino IDE.
- Start to see some dots on the debugging window, press the ESP32-CAM on-board RST button.
- After a few seconds, the code should be successfully uploaded to your board.

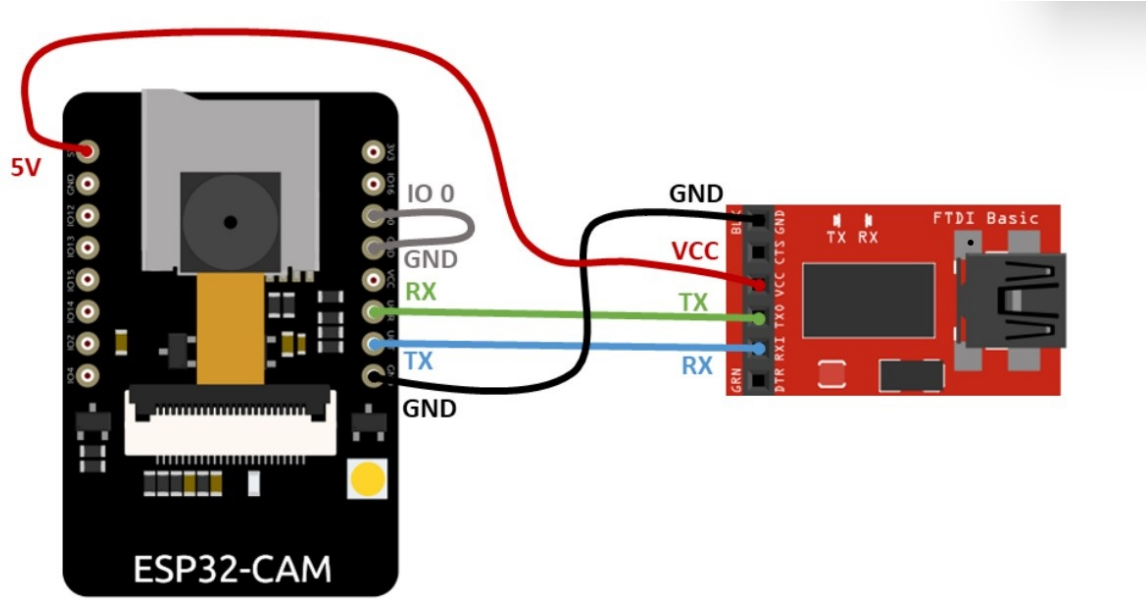

Fig 4.2 ESP32-Cam Circuit Diagram with FTDI

- 6) When you see the "Done uploading" message, remove GPIO 0 from GND.
- Open the Serial Monitor, press the on-board RST button, and check that the ESP32-CAM is connecting to your network without any problems.

4.3 Create Telegram Bot

The ESP32-CAM will interact with a Telegram bot to receive and handle the messages, and send responses to your Telegram account (sensor readings and photos). Follow the next steps to create a Telegram bot.

- Go to Google Play or App Store, download and install Telegram.

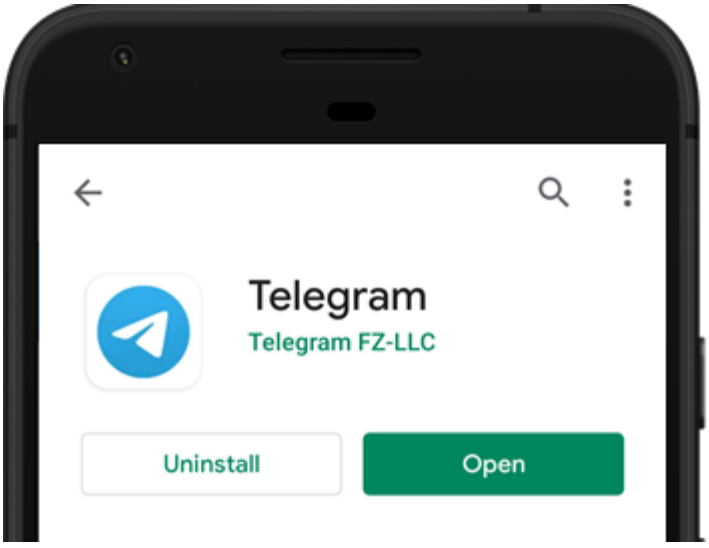

Fig 4.3(i) Telegram App On App Store

- Open Telegram and search for "**botfather**" and click the BotFather as shown below. Or open this link **`t.me/botfather`** in your smartphone.

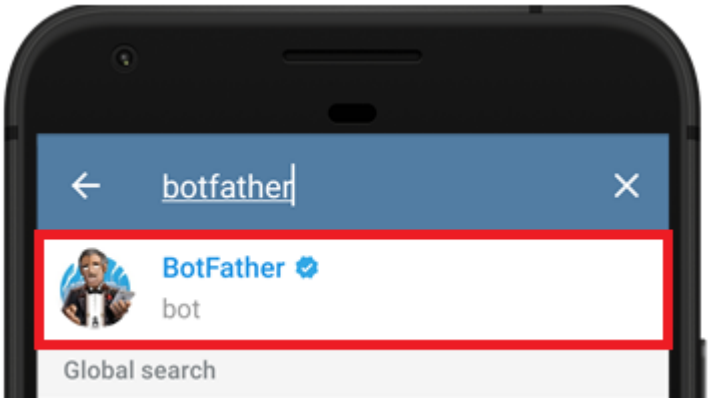

Fig 4.3(ii) Search BotFather

- The following window should open and you'll be prompted to click the start button.

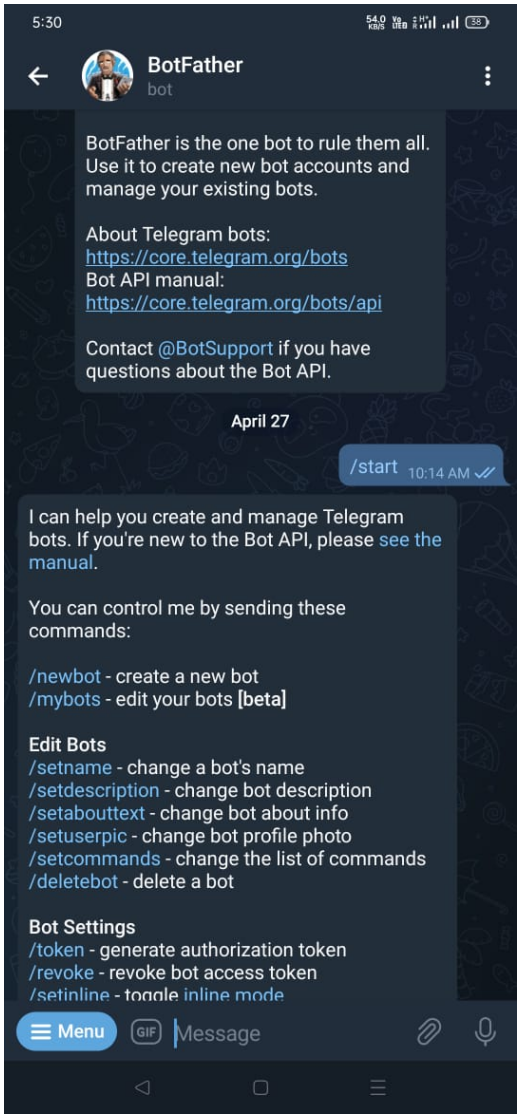

Fig 4.3(iii) Create Bot in BotFather

- Type **`/newbot`** and follow the instructions to create your bot. Give it a name and username.

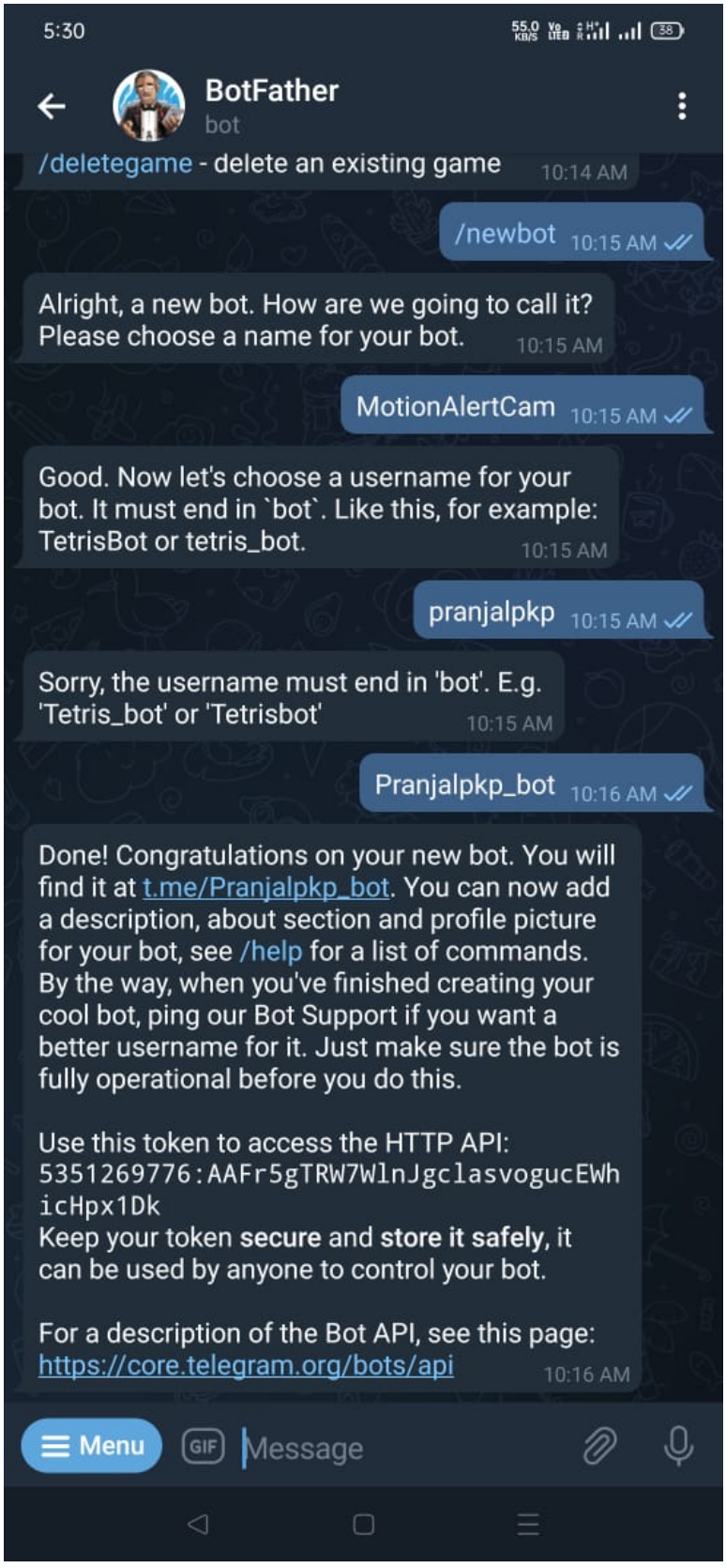

Fig 4.3 (iv) Create Bot Name

- If our bot is successfully created, we'll receive a message with a link to access the bot and the bot token. Save the bot token because you'll need it so that the ESP32 can interact with the bot.

Get our Telegram User ID

Anyone that knows our bot username can interact with it. To make sure that we ignore messages that are not from our Telegram account (or any authorized users), wecan get our Telegram User ID. Then, when your telegram bot receives a message, the ESP can check whether the sender ID corresponds to your User ID and handle the message or ignore it.

- In our Telegram account, search for "**`IDBot`**" or open this link **`t.me/myidbot`** in your smartphone.

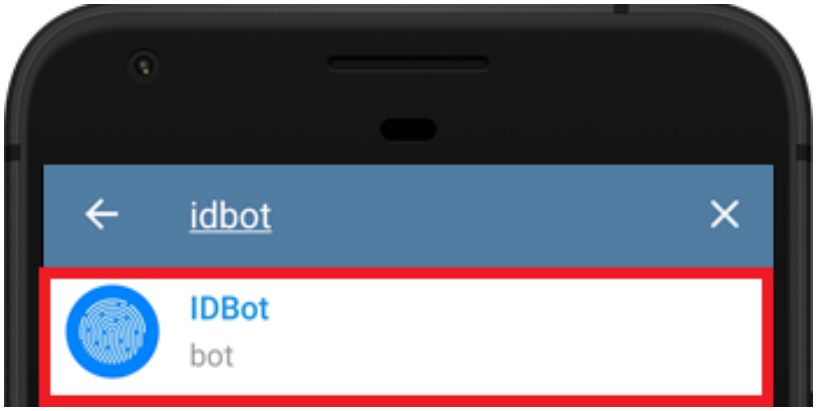

Fig 4.3(v) Search IDBot

- Start a conversation with that bot and type **`/getid`**. You will get a reply back with your user ID. Save that user ID.

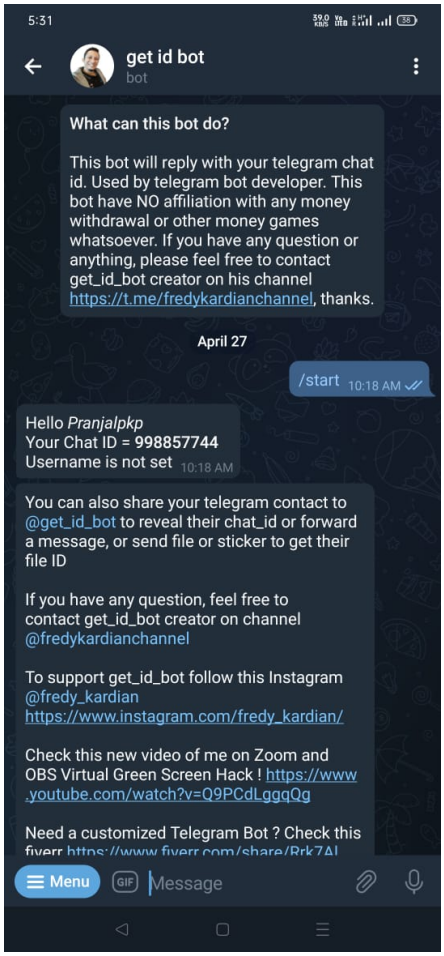

Fig 4.3(vi) Get Bot Id

4.4 Import for Door Security

The SoftwareSerial library to communicate with the SIM900 GSM module.

```
#include <SoftwareSerial.h>
```

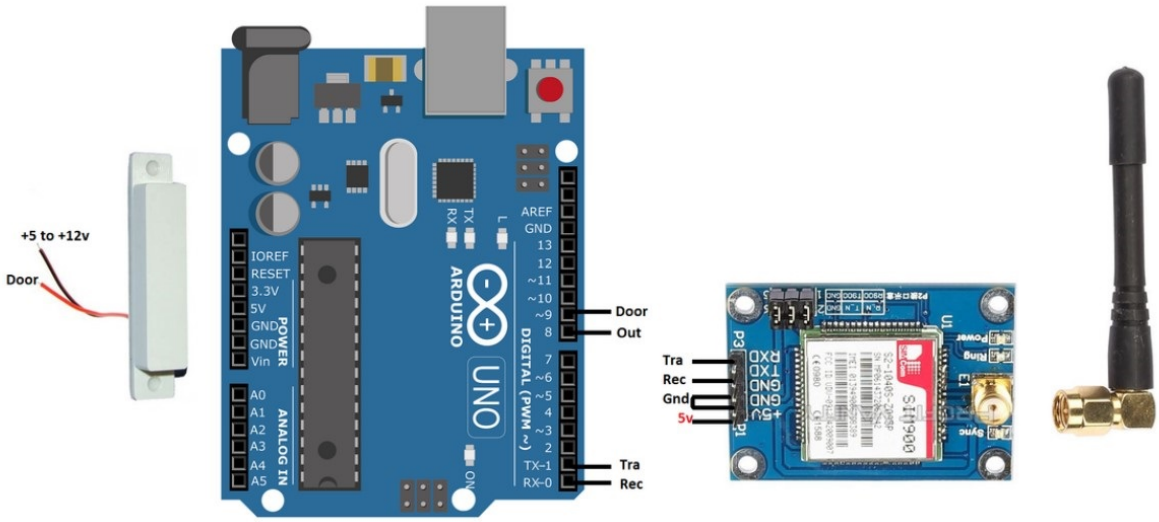

Fig 4.4 Connection Circuit GSM with Reed

When the door is open or closed it always updates status with alert sms.

4.4.1 GSM shield

The following line configures the software serial on pins 9 and 10. Pin 9 is being configured as RX and pin 10 as TX.

4.4.2 setup()

```
myserial.print("AT+CMGF=1\r");
myserial.print("AT+CNMI=2,2,0,0,0\r");
```

4.4.3 loop()

In the loop(), we check if there was an SMS request with the SMSRequest() function – we check if the Arduino STATE message.

```
myserial.println("AT + CMGS = \"+916204390422\"");
```

5. Results and Discussions

5.1 Laser Security

In fig 5.1(i) We have assembled and made a proper circuit for the laser security system.

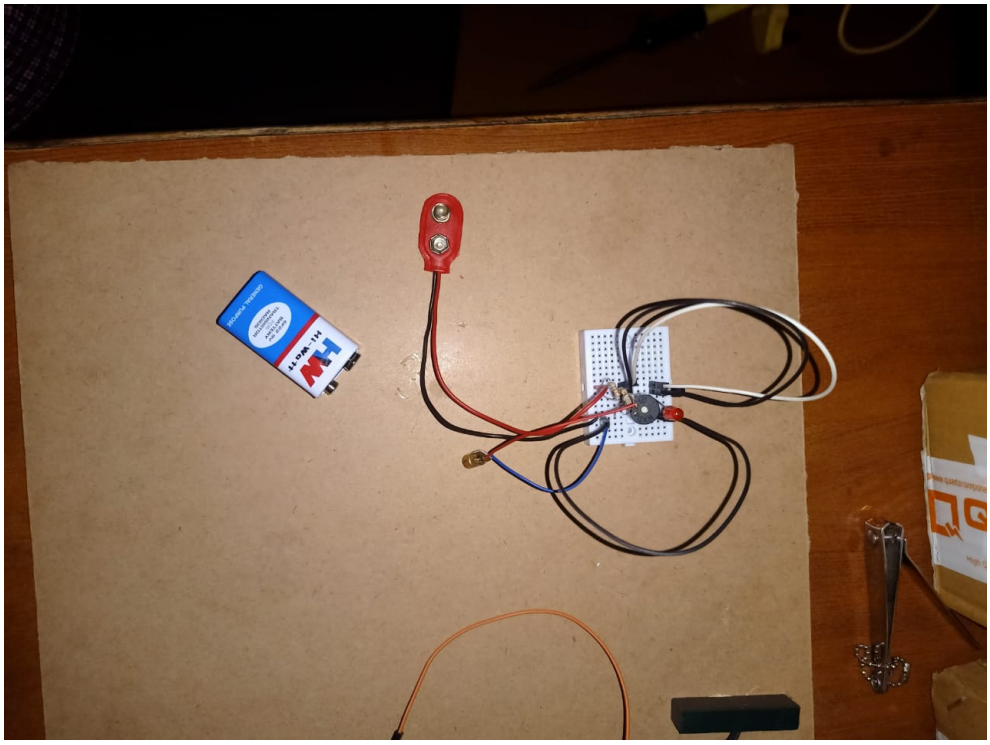

Fig 5.1(i) Laser Security Complete Circuit

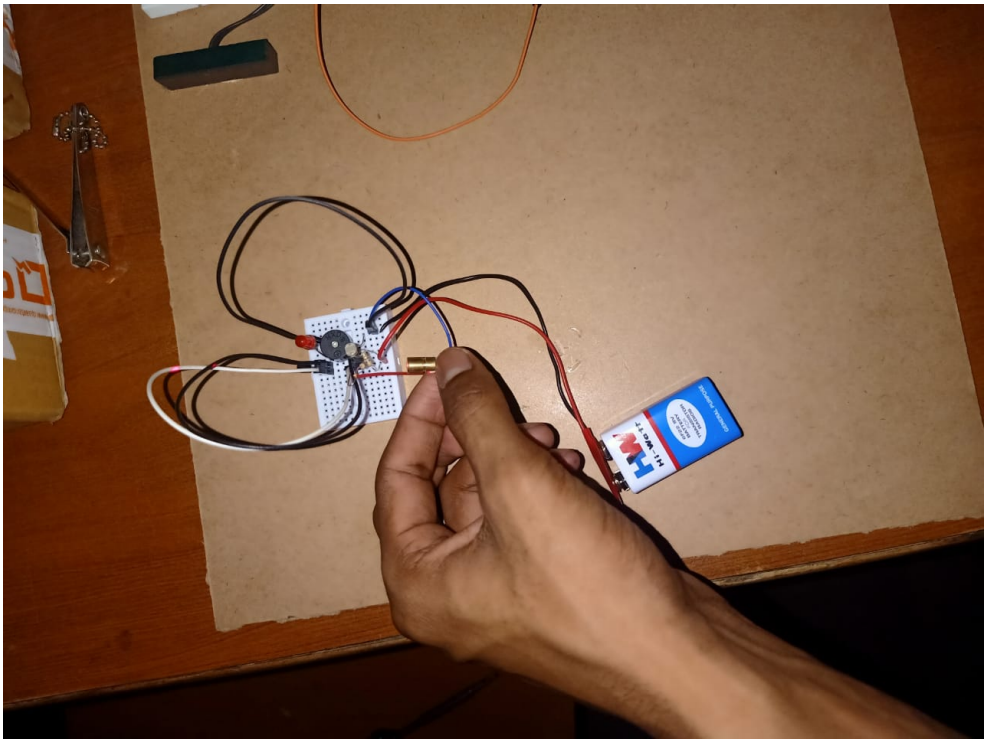

Fig 5.1(ii) Beep Sound On Interruption

In LSAS(Laser Security Alarm System) laser light ray falls directly over the LDR which makes a complete connection. When any interruptions happen due to any reason the buzzer starts beeping until interruptions move. Buzzer will not beep until any intruder interrupts the path of laser light.

5.2 GSM Based Door Alert System

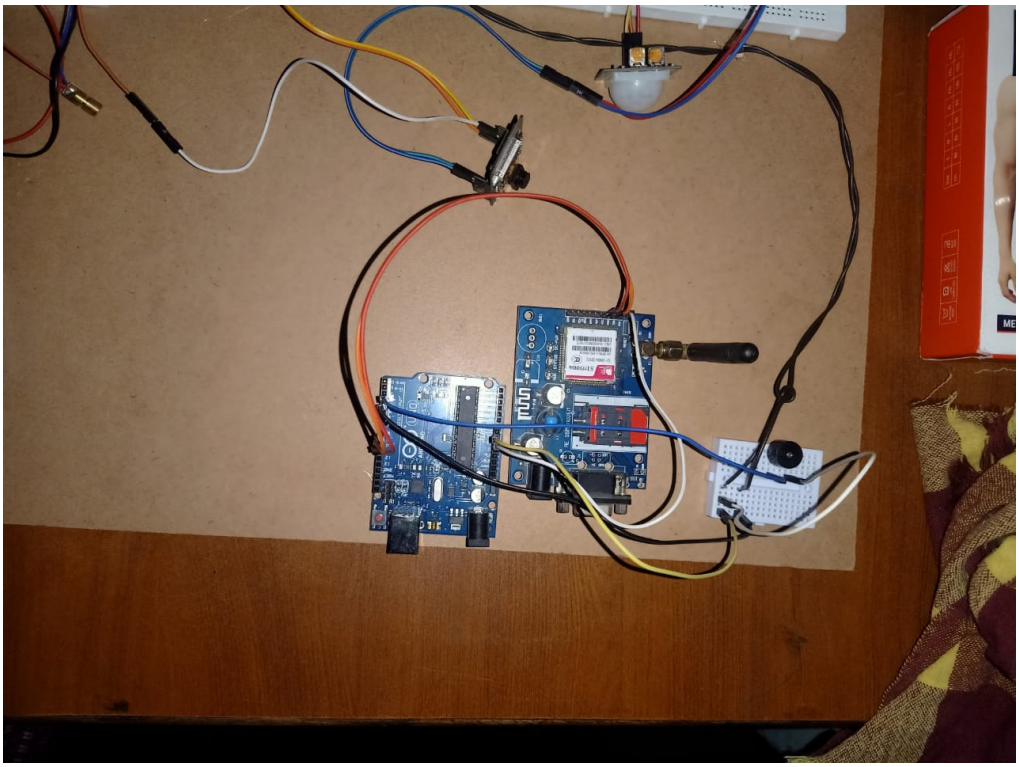

Fig 5.2(i) Connection Circuit with Reed Switch, GSM & Arduino

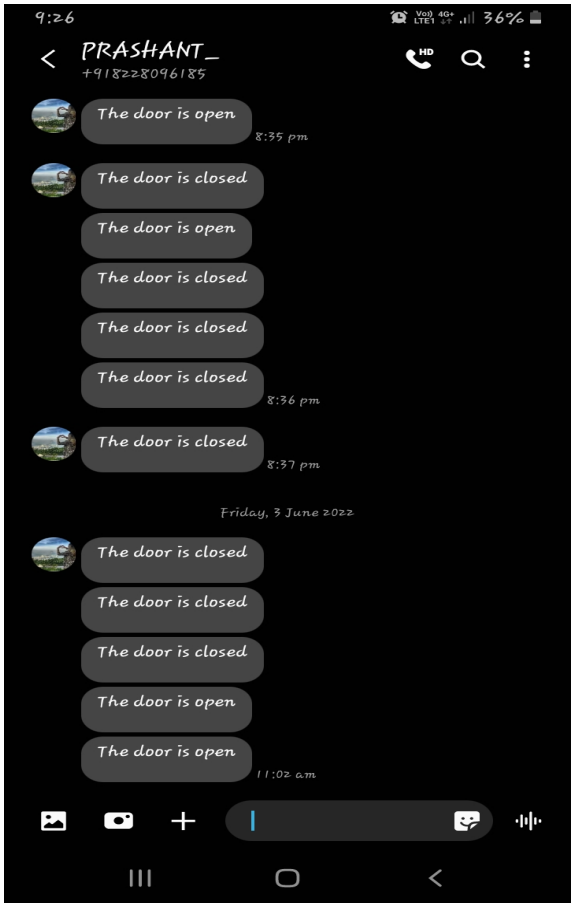

Fig 5.2(ii) Alert SMS

The GSM Based Door Alert System has been developed for the safety of individuals and it is achieving its goals among individuals. If any one opens/closes the door, the notification will be sent to the authenticated person's mobile and the "`The door is open`" and "`The door is closed`" respectively the status of the door. The development of this technology is useful and it will be implemented in the developing technologies. Hence the system is safe and secure.

5.3 ESP32-CAM with Telegram and PIR

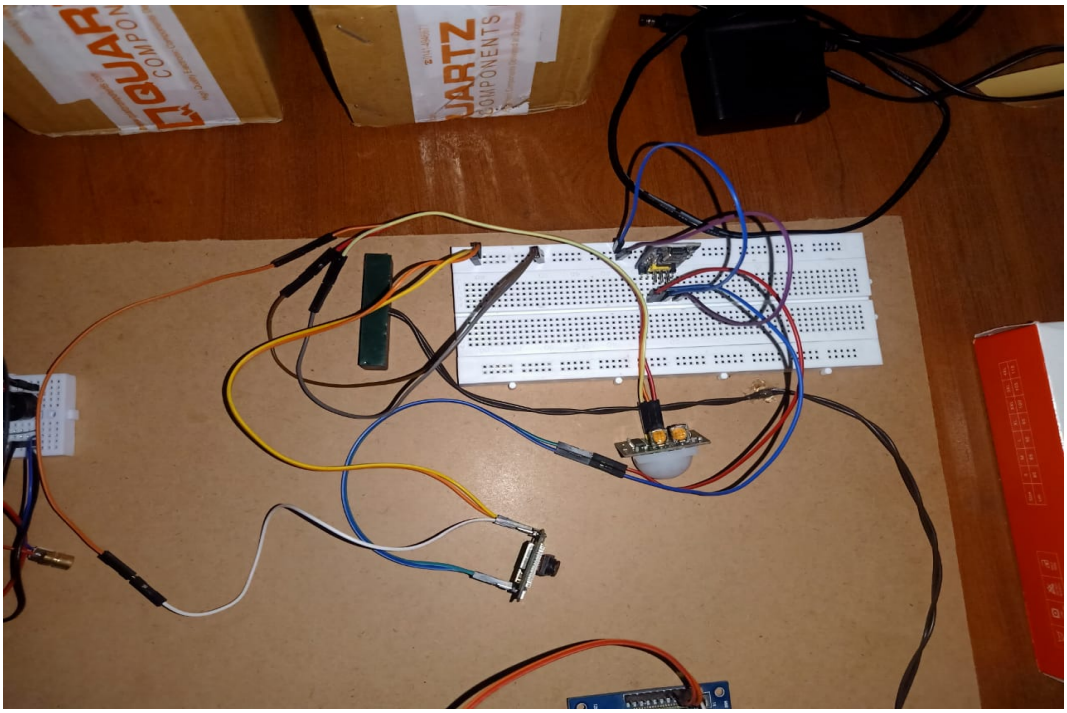

Fig 5.3 ESP32-CAM Connection with PIR

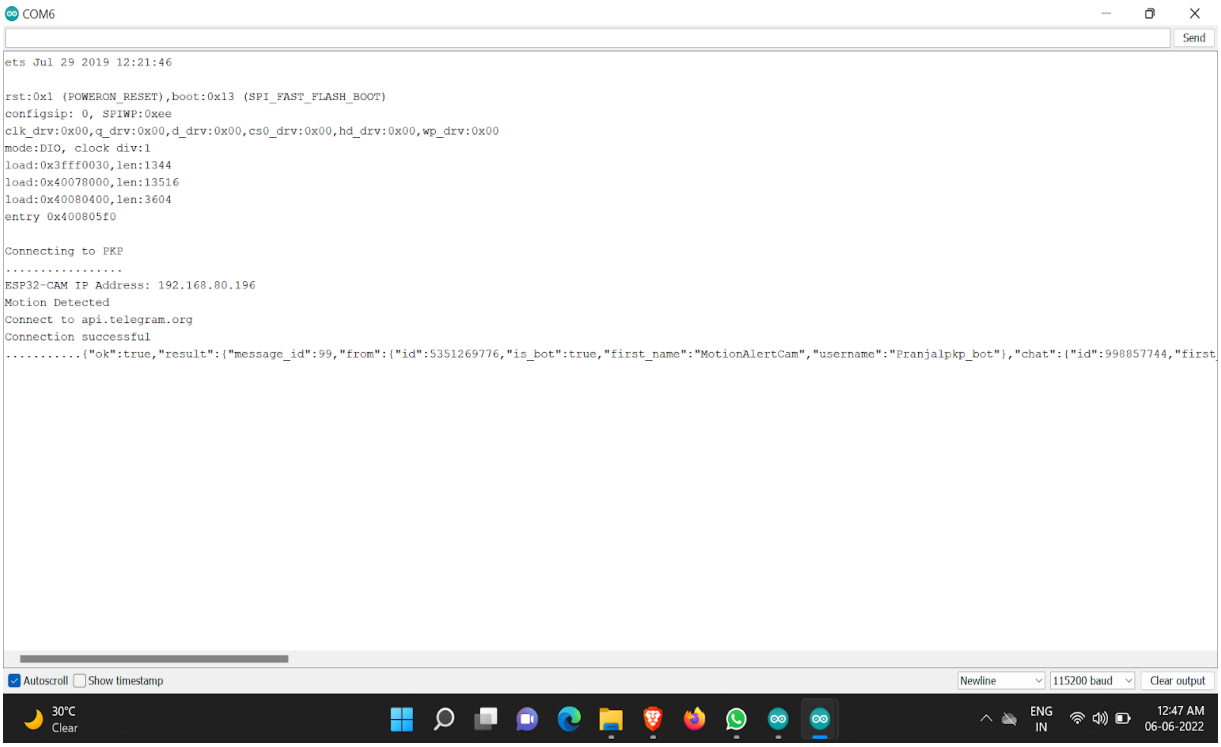

Fig 5.2 Open Serial Monitor

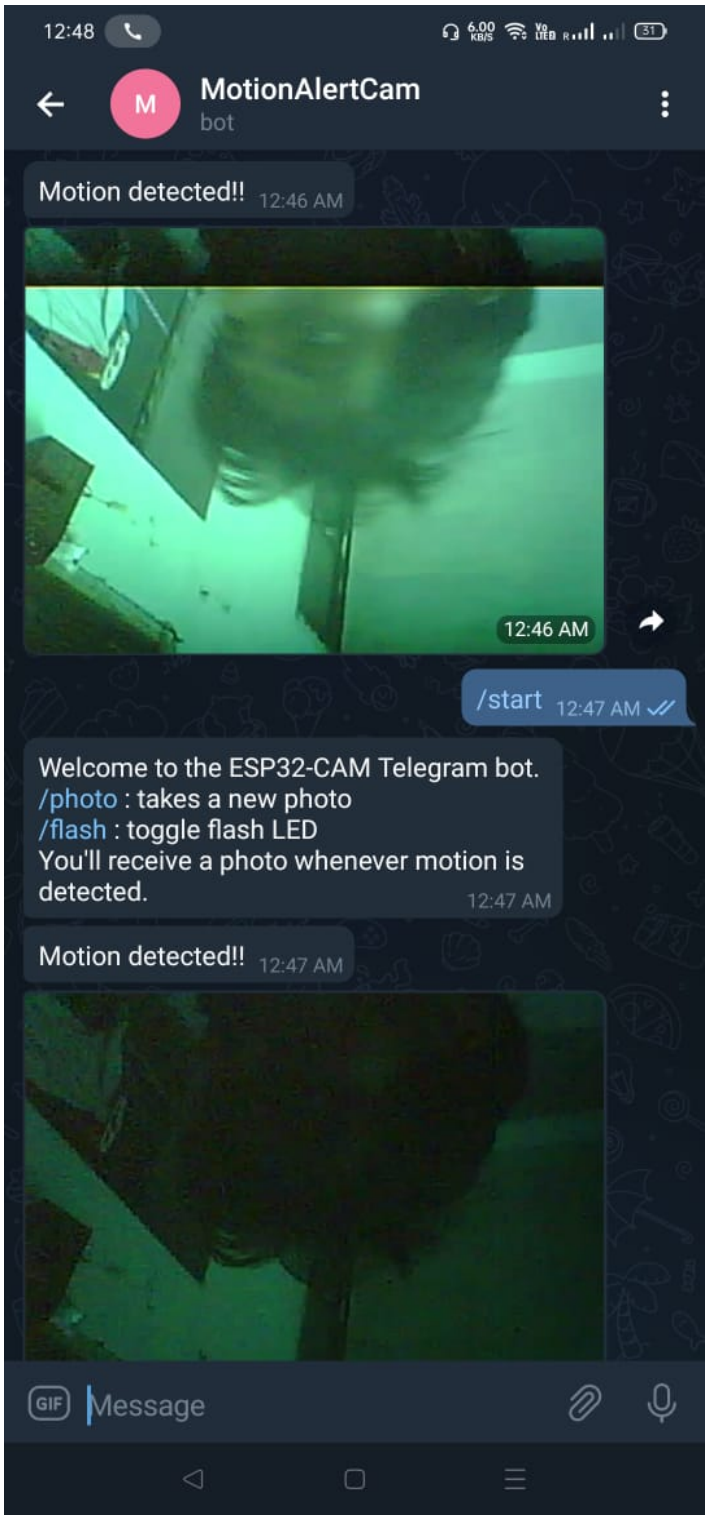

Fig 5.3(iii) Motion Detected Intruder's Photo

The ESP32-CAM module makes connection with wifi and takes pictures by manual and motion detection. After any motion detected inside the room PIR senses and triggers ESP32-CAM & it clicks the picture with a wide angle lens with a viewing angle of 160 ˚ Every time when PIR senses any motion it gets an alert Message "*Motion detected!!*" and after that the picture was sent to telegram. Images sent to telegram chat in JPEG format.

6. Conclusion and Future Scope

6.1 Conclusion

Security is of essential importance in today's world, traditional systems have attempted to provide the same using technologies such as microcontrollers and updated versions of the same. The Proposed System provides Security to the house by detecting the presence of any intruder. If any intruder is detected, an alarm is raised and the owner and law enforcements are notified via message. The proposed work eliminates the overhead associated with traditional systems such as high down time during repair and maintenance and any kind of device tampering that an intruder or hacker can do to the system. The door sensor is fixed on to the door frame and the magnet is fixed on to the door, the sensor gets active when the door movement takes place and the alert message is sent to the user by using third party services. The next phase for the home.

The security and automation market will occur based on a few key improvements in the technology available in automation and security, such as improvement in Wireless Automation solutions as well as lowering of price points as the market begins to accept Home automation and security usage in larger volumes.

6.2 Future Scope

The design can be used for security based systems and procedures. It is a safe and secure system. The system can be used in residential and commercial development. The following improvements can be suggested for further improvements of system:-

- Face Detection:

  Only Alert SMS and Picture will be sent to the authenticated person's mobile if a person does not belong to a family member.
- Designing based on the individual need
- Integrating with CCTV network

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[2.] *ICAE 2096*, Internet of Things (IoT) Security Alarms on ESP32-CAM
R B Salikhov[1], V Kh Abdrakhmanov[1], I N Safargalin[1], Bashkir State University[1], Zaki Validi 32a, Ufa, Russia

[3.] *IJCSMC, Vol. 4*, Enhancing Home Security Using SMS-based Intruder Detection System, Nwalozie G. C[1], Aniedu A. N[2], Nwokoye C. S[3], Abazuonu I.E[4], Department of Electronic and Computer Engineering, Nnamdi Azikiwe University Awka, Anambra State

[4] *IJCOT Journal*, Secure Home Using Magnetic Reed Switch Dr. Avinash Kaur[1], Kypu Naga Naveen[2], Pabbisetti Venkata Kishore[3], Matam Chandrakanth[4], Maddala Mohan Reddy[5], Masimukku Vasu Muralidhar[6] Associate[1] Professor, School of Computer Science[2,3,4,5,6] Lovely Professional University, Delhi-Jalandhar