

Original Article

# Home Automation and Control using Hand Gestures and GSM with Smoke Sensor

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**Abstract** - Home automation is the recent technology that is helping to make the usage of gadgets as simple as instructing another human being to do our tasks. The control of these gadgets can be done through hand gestures and GSM. Controlling home appliances through gestures makes life easier and more comfortable. The hand gesture can be detected by a controller containing an accelerometer attached to the glove. It used to sense tilting and acceleration of movement. Home applications also can operate with GSM by sending SMS to users. We also used a smoke detector alert system with a beep sound and message service to the authorized user. We can do bidirectional on/off with GSM/MEMS.

**Keywords** - Hand Gestures, GSM, Accelerometer, SMS, MEMS.

## I. INTRODUCTION

This project uses hand gestures and a GSM controller to use a home application system. We also used a smoke detector alert system with a beep sound and message service to the authenticated user. When the hand gestures can move to the right/left side, the AC bulb is turned ON/OFF and the hand gestures move to the front /down, and the DC fan can be turned ON/OFF. Using the GSM control app, The user sends SMS #S.bulbon\*/#S.bulloff\* to GSM then the bulb is turned ON/OFF. And the user sends SMS #S.fanon\*/#S.fanoff\* to GSM, and then a fan is turned ON/OFF.

### Components requirements:

1. Arduino Uno R3
2. GSM
3. MQ2 smoke sensor
4. Power supply
5. LM358 op-Amp
6. 16\*2 LCD
7. ADXL 335 MEMS Accelerometer

### A. Arduino Uno R3

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package

(DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded onto it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, making it a very easy way to start working with embedded electronics. The R3 is the third and latest revision of the Arduino Uno.

### B. GSM:

GSM is a digital cellular communication system. Global System for Mobile Communications (GSM) is a technology used to establish a wireless cellular connection between two or more devices. It is used for transmitting mobile voice and data services. GSM operates in the 900MHz and 1.8GHz bands; GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.

### C. MQ2 smoke sensor

The MQ-2 smoke sensor is sensitive to smoke and the following flammable gases:

- LPG
- Butane
- Propane
- Methane
- Alcohol
- Hydrogen

The sensor's resistance is different depending on the type of gas. The smoke sensor has a built-in potentiometer that allows you to adjust the sensor's digital output (D0) threshold. This threshold sets the value above which the digital pin will output a HIGH signal.

### D. Power supply:

The Arduino Uno can be powered via a USB connection or an external power supply. The power source is selected automatically. External (non-USB) power can come from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be



inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. However, if supplied with less than 7V, the 5V pin may supply less than five volts, and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin or access it through this pin if it is supplied via the power jack.
- **5V.** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator and can damage your board. We don't advise it.
- **3V3.** The onboard regulator generates a 3.3 volt supply. The maximum current draw is 50 mA.
- **GND.** Ground pins.

#### **E. LM358 op-Amp:**

The IC or integrated circuit is a little black chip, and it is a root of modern electronics and an essential component in many electronic circuits. The applications of integrated circuits involve every electronic circuit board, embedded systems, and various electronic projects. An integrated circuit is a set of various electrical and electronic components like resistors, capacitors, and transistors. All these components are integrated onto a single chip. They are available in various forms like 555 timers, single-circuit logic gates, microprocessors, microcontrollers, voltage regulators, and op-amps like IC 741, LM324 IC, and LM358 IC, and LM339 IC. And many more.

#### **F. 16\*2 LCD**

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD is a 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 are: LCDs are economical, easily programmable, and 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 a 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to an LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling the display, etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about the internal structure of an LCD.

#### **G. ADXL 335 MEMS Accelerometer**

An accelerometer is a device that measures non-gravitational accelerations. The former provides information on taps and other handset motions, allowing the development of 'gesture' user interfaces, while the latter provides information on the accelerometer orientation. Accelerometers are used in tablet computers and digital cameras so that images on screens are always displayed upright. Also used in airplanes.

## **II. EXISTING SYSTEM**

In this project, we have referred to 2 controlling application methods.

#### **A. Controlling Home applications using Hand Gestures:**

The home applications can be controlled using hand movements. We can use our hands as a medium to operate home applications. For example, if we consider lights/fans, the OFF and ON states of these things can be controlled by moving our hands left/right.

#### **B. Controlling by the GSM**

In this procedure, the GSM module can control the home applications from any place in the house.  
Ex: Mobile phones.

#### **DISADVANTAGES:-**

- The hand Gesture module can be controlled from within
- Range
- GSM module is Network dependent. Network congestion can reduce the reliability of the system.

## **III. PROPOSED SYSTEM**

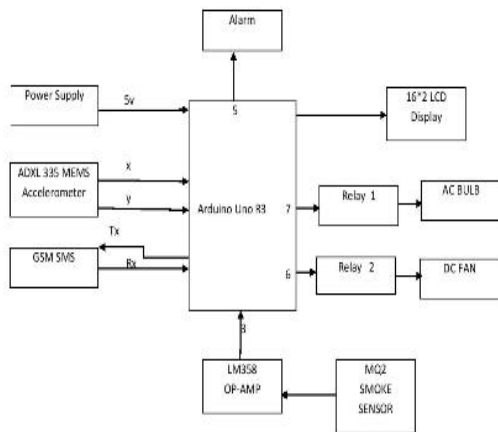
- In this project, we use both GSM and hand gestures at a time to control home applications.
- Therefore, if we want to switch on the light/fan, we can use either GSM or hand gesture, and if we want to switch off these things, it can be done either way.
- A smoke detector is a device that senses smoke, typically as an indicator of fire. And it sends

SMS to the user's mobile phone and makes a beep sound to the user.

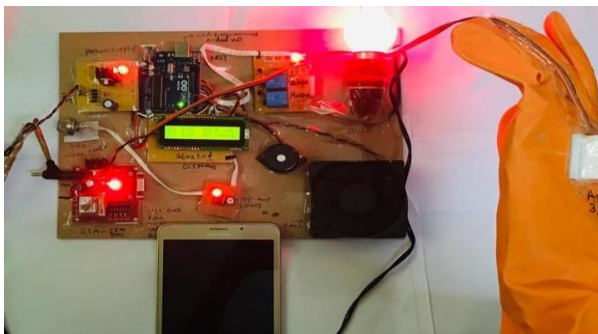
**Advantages:-**

- GSM module can be controlled from long distances.
- GSM module can be used anywhere.
- Hand movements can operate Hand Gestures.
- Hand Gestures can be easy to use.
- We can use bidirectional ON/OFF simultaneously with hand gestures and GSM.

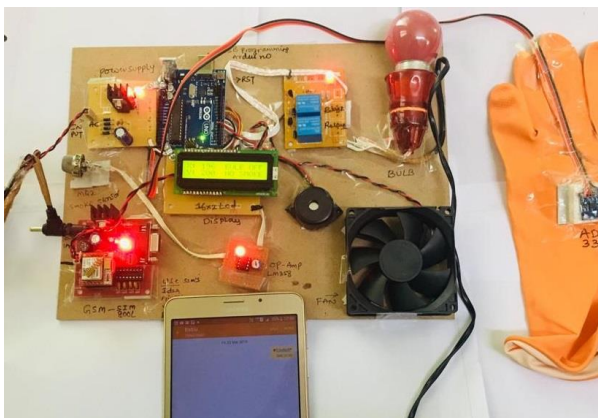
**IV. BLOCK DIAGRAM**



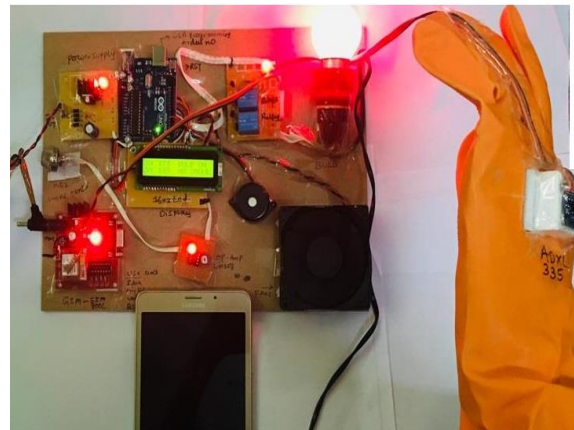
**V. RESULTS**



**Fig. 1** Operating with hand gestures to turn on the bulb.



**Fig. 2** Operating with GSM to turn off bulb.



**Fig. 3** Operating with hand gestures to simultaneously turn on the bulb and fan.

**VI. CONCLUSION**

The advent of this project platform is based mainly on the GSM and HAND GESTURES services along with MEMS Accelerometer. So we can operate in a bidirectional way. Either by using hand gestures or by GSM.

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