

# HOME AUTOMATION USING GSM FOR SAFETY AND SECURITY PURPOSES

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**Abstract**—In this paper, These days, a lot of people forget to turn off electrical items like fans, TVs, motors, etc., which wastes water and electricity. According to data from 74 nations, the average theft rate in 2016 was 783 per 100,000 inhabitants. Between 2012 and 2016, local fire departments responded to 125,000 natural gas or LP-gas leaks annually on average that did not result in residential fires. Between 2016 and 2020, residences accounted for more than 25% of all recorded fires. We can use GSM to safely and securely design and deploy home automation to prevent these issues.

In today's quickly changing technology environment, home automation has become a very popular notion. This project explores the field of home automation and uses the Global System for Mobile Communications (GSM) technology to improve home security and safety. Discuss how to use GSM technology to operate home appliances, security systems, and mobile applications using Android applications on Android phones in this project. We'll also demonstrate how sending a standard SMS can operate the appliances even if we don't have an Android phone. One benefit of employing GSM technology is the ability to operate household appliances from distant locations throughout the globe. By sending commands via SMS and an Android application, this method enables the owner to operate the appliances and get feedback on their condition.

**Keywords**— Micro controller, GSM modem, sensors, appliance control, android app.

## I. INTRODUCTION

One of the most crucial things in the modern world is home security. The most effective way to discourage burglars is to install home protection. It is crucial that the privacy of a home is constantly maintained and that no outsider may in any way violate it. The goal of this research project is to design a home security system using Micro Controllers. This project makes use of different kinds of sensors: gas sensors with a GSM module interfaced with a micro controller, and a diffused line of sight infrared sensor. With the goal of

safeguarding our homes and belongings, we installed a security system. When an intruder approaches the IR sensors' transmit and receive sections and the sensors detect a shock, the system automatically locks, a GSM module sends a message, and the intruder is locked. The MCU microcontroller is Utilized. This paper describes a basic GSM SMS (Short Messaging Service) and Bluetooth remote home appliance control system.

## II LITERATURE REVIEW

Piyare,R.[1].et.al (2011) suggested the implementation of a Bluetooth-based home automation system. Relays are used to connect electrical appliances to an Arduino Bluetooth (BT) board. To operate the appliances, a Bluetooth-enabled cell phone and the Arduino BT board communicate wirelessly. The system's functionality was tested to travel a maximum of 100 meters in an open area and less than 50 meters in a concrete building.

S.BenjaminAru[2].et.al.(2014) developed a Wireless Home Automation System Using Zigbee technology... A microcontroller on the transmitter side uses a microphone to provide voice commands via a ZigBee transmitter. The sent signal is received by a ZigBee receiver at the receiver side, where it is then fed into another microcontroller for processing and relay-based control of the linked appliances. Additionally, when smoke is detected, the system notifies the user's mobile device. Due to ZigBee technology, this system's narrow communication range (around 10 meters) is a disadvantage.

Jandial,A[3] et al(2017) proposed a system for controlling home appliances based on IR technology. At the transmitter part, an IR remote is utilized to communicate orders to an IR receiver. An Arduino Nano ATmega 328 microcontroller receives the signal from the IR receiver and processes it at the receiver section. After then, relays and triacs are used by the microcontroller to operate the appliances. Additionally, the 10 meter communication range of this technology is poor.

Azn[4]i et al. (2016) presented a wireless home automation system using Wi-Fi. The end user can control and monitor the home devices by using a web server or android application. It uses Restful Application Programming Interface (API) framework and other functions to use Hypertext Transfer Protocol (HTTP) request to control the General-purpose input/output (GPIO) of Raspberry PI. This system used to turn on/off the electrical appliances of home wirelessly through a Wi-Fi connection. .

In 2017 P.N.Arathi[5] proposed a model named gesture based home automation. Where the hand gesture sigh are captured by camera module and the processed with MATLAB algorithms. Practically common people cannot remember the sign of different switches this approach will not work effectively in public applications.

Jenal[6] et al. (2022) described by Smart Home Controlling system Using IOT. The proposed home automation prototype enables users to control the operation of any electrical appliance in the house through the internet.

### III. EXISTING METHODOLOGY

In the existing home automation methodology detailed in the project paper, Bluetooth, Zigbee, and IR technologies are employed, facing limitations such as restricted range, local network dependency, and susceptibility to interference.

#### Drawbacks:

a. These technologies often have a small coverage area. The range of Bluetooth is approximately 10 meters, the range of Zigbee is between 10 and 100 meters (depending on the particular Zigbee profile), and infrared communication needs to be in line of sight.

b. For device-to-device communication, these technologies depend on the existence of a local infrastructure (such as routers and gateways).

### II. PROPOSED METHODOLOGY

The project flow is depicted in the block diagram. The electrical equipment and gadgets in the house are connected to the relays. The user sets commands for the appliances' operation via the mobile application. The mobile application helps the microcontroller communicate with a device via Bluetooth and GSM, analyzes user-inputted command forms in switch mode, and transmits a signal to the Arduino unit. It also receives commands from an application via a wireless network. After further receiving the signal, the Arduino uses a relay to

switch the appliance on or off. The final appliances, relay, and Arduino are physically linked. The microprocessor, the relay, and the final appliances are all powered by a power supply unit.

The database will receive an ON or OFF command from a mobile application. The microcontroller, being connected to the database as well, will then retrieve this command. The microcontroller will turn the relay module on or off

based on this 0 or 1, which will eventually cause the electrical appliances to change.

Three sensors—a gas sensor, an LM35 sensor, an infrared sensor, a vibration sensor, a seismometer, and an Arduino module—make up the system. An alert message and buzzer alert were delivered when the values were being monitored. The Arduino sends orders to the Bluetooth app via Bluetooth. The commands will be received by the Bluetooth App app and mobile communication via GSM, which will then display the response.

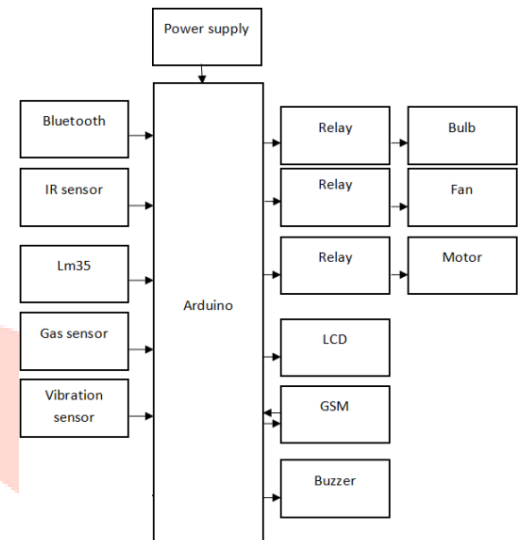


Fig.a. Block Diagram of Proposed System

### V. REQUIRED COMPONENTS

#### A. HARDWARE USED

The following hardware is used in the project which is explained as follows:-

##### 1. MOBILE PHONE

Unlike a fixed-location phone (landline phone), a mobile phone (or cellphone[a]) is a portable phone that can make and receive calls over a radio frequency link while the user is traveling within a telephone service area. By connecting to a mobile phone operator's switching equipment, a radio frequency link gives users access to the public switched telephone network (PSTN). It sends the commands to GSM through Message

##### 2. GSM

A GSM modem is a gadget that can be used as a modem or a mobile phone to enable network communication between computers and other processors. In order to function, a GSM modem needs a SIM card and can connect to a network within the range that the network operator has subscribed to. It

can be linked via Bluetooth, USB, or serial connection to a computer. If you have the right cable and software driver, you can use a regular GSM phone as a GSM modem by connecting it to your computer's USB or serial interface. A GSM mobile phone is typically not as good as a GSM modem. There are several uses for the GSM modem in transaction terminals, supply chain management, weather stations, and security applications. In the existing home automation Methodology, Bluetooth, Zigbee and IR technologies are employed facing limitations such as restricted range, local network dependency, and susceptibility to interference.

### 3. ARDUINO UNO

The Arduino Micro Controller is a popular hobby and professional single board computer that is simple to use and powerful. Because the Arduino is open-source, development software is free and hardware is competitively priced. This tutorial is intended for students enrolled in ME 2011 or any other course who is unfamiliar with Arduino. The system's primary module is this one. The appliances are turned on or off based on the predefined format of the SMS text that is examined upon receipt. The predetermined format contains directives to control the appliances. The owner will receive an SMS from the Micro Controller in case of any discrepancy when it comes to home security. The Micro Controller is connected to sensors. When reading a message, the Micro Controller instructs the receiver GSM modem via the relevant AT instruction. Similarly, when sending the owner a feedback message, it follows the same procedure.

### 4. RELAY MODULE

Relays are electromagnetic switches that are used in situations when multiple circuits need to be controlled by a single signal or to turn a circuit on and off using a low power signal. The majority of high-end industrial application equipment rely on relays to function properly. Relays are basic switches that can be turned on and off physically or electrically. An electromagnet and a set of contacts make up a relay. The electromagnet facilitates the operation of the switching mechanism. Its operation is also based on additional operating principles. However, the ways in which they are applied vary. Relays are used in the majority of electronics.

### 5. SENSORS

A sensor is a transducer used to identify an attribute in the surrounding environment. It generates an output in response to events or changes in quantity, usually in the form of an electrical or optical signal; for example, in our project we are using Gas sensor (MQ135), Fire Sensor, Vibration Sensor and IR Sensor which sense the gas, fire, vibration and motions occurred in the home it can be detected and send the SMS alert and buzzer sound.

#### a. MQ-132 GAS SENSOR

The MQ-135 gas sensor is a useful tool for identifying hazardous gases such as smoke. It can identify a variety of dangerous gases, such as CO<sub>2</sub>, NH<sub>3</sub>, NO<sub>x</sub>, alcohol, benzene, smoking, and so on. The MQ135 gas sensor is extremely sensitive to fumes and other dangerous gases, as well as to ammonia, sulfur, and benzene steam. The MQ-135 air quality detector and hazardous gas detector chip are used in this module. It is simple to incorporate this module into a project that can detect dangerous gases thanks to other circuit components like the LM393 analog comparator chip on this module. The module has an analog level output (0–4V) and a digital logic output (1 or 0), and it needs a 5V power source.

#### b. LM35 TEMPERATURE SENSOR

A temperature sensor called the LM35 produces an analog signal that is proportionate to the current temperature. It is simple to interpret the output voltage and get a temperature reading in Celsius. LM35 has one advantage over thermistor: it doesn't need to be calibrated externally. It is additionally shielded from self-heating by the covering. Due to their lower cost, higher accuracy, and use of the LM35, many low-end goods. We must comprehend the linear scale factor in order to comprehend the LM35 temperature sensor's operation. It is specified as +10 millivolts per degree Celsius in the LM35's characteristics. This indicates that the temperature value increases by one when the sensor's output pin output increases by 10 millivolts.

#### c. INFRARED SENSOR

An infrared (IR) gadget is an electrical apparatus that produces light to detect certain elements of its environment. In addition to detecting motion, an infrared sensor may measure an object's heat. Known as passive infrared sensors, these particular types of sensors do not emit infrared radiation; instead, they merely measure it. All items typically radiate some kind of thermal radiation in the infrared range. These radiations are undetectable to human vision, but an infrared sensor can identify them. An IR LED serves as the emitter, and an IR photodiode that is sensitive to IR light with the same wavelength as the IR LED serves as the detector.

#### d. VIBRATION SENSOR

Another name for the vibration sensor is a piezoelectric sensor. These flexible sensors are employed in a variety of process measurements. This sensor converts to an electrical charge in order to measure changes in force, temperature, acceleration, pressure, and strain via piezoelectric phenomena. This sensor immediately measures capacitance and quality, which is also used to determine scents in the air. The basis of a vibration sensor's operation is its ability to detect system vibrations through various optical or mechanical principles.

## 6. BLUETOOTH

A Bluetooth module called HC-05 is intended for wireless communication. It is possible to use this module as a slave or master configuration. Numerous consumer applications, including wireless headsets, game controllers, mice, keyboards, and many more, make use of it. Depending on the transmitter and receiver, atmosphere, geographic location, and urban settings, its range can reach less than 100 meters. The established IEEE 802.15.1 protocol is what allows one to create a wireless Personal Area Network (PAN). It transmits data over their using frequency-hopping spread spectrum (FHSS) radio technology.

For device communication, it employs serial communication. It uses the serial port (USART) to connect with the microcontroller.

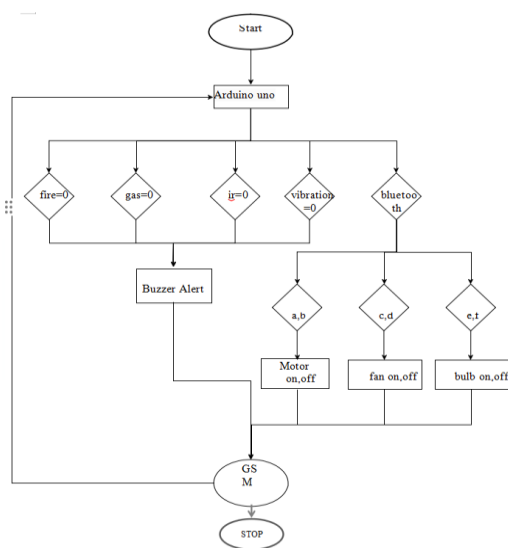


Fig.b. Flow chart of Proposed system

## B. SOFTWARE USED

### a. ARDUINO IDE

The primary function of the open-source Arduino IDE software is to write and compile code for the Arduino Module. Because it is official Arduino software, code generation is so simple that even a layperson without any technical experience can begin learning the basics. It works on the Java Platform, which has built-in functions and commands that are essential for debugging, editing, and compiling code in the environment. It is readily available for operating systems including MAC, Windows, and Linux. A variety of Arduino modules are available, such as the Uno, Mega, Leonardo, Micro, and many others. On the board of each of them is a microcontroller that has been programmed to accept data in the form of code. The core code, sometimes referred to as a sketch, written on the IDE platform will eventually produce a Hex File that must be uploaded and sent to the board's controller.

The two primary components of the IDE environment are the Editor and the Compiler, the former of which is used to write the necessary code and the latter of which is used to compile and upload the code into the specified Arduino Module. The languages C and C++ are supported in this environment.

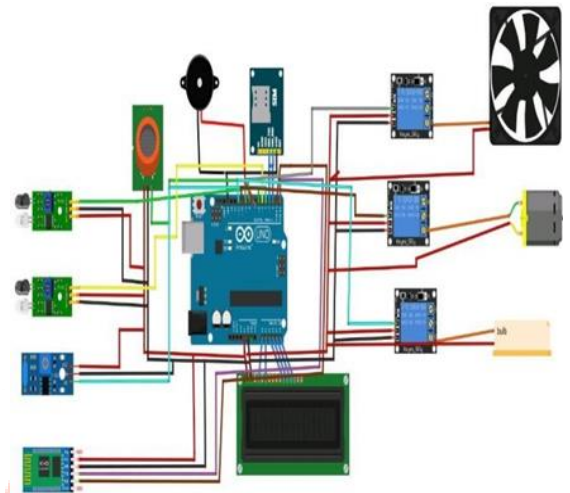
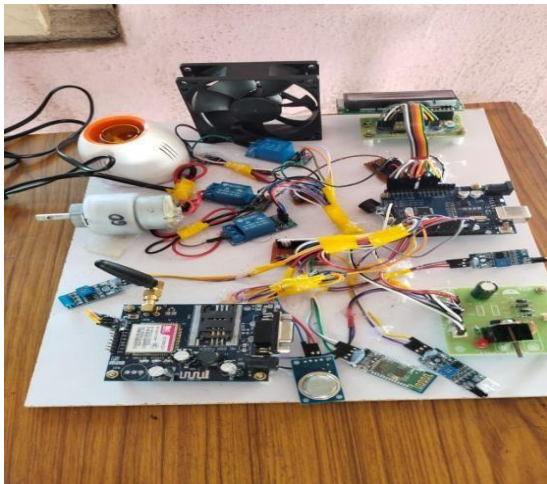


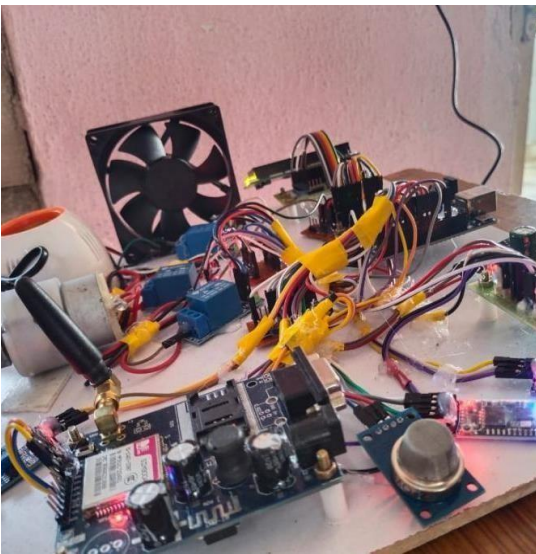
Fig.c. CIRCUIT DIAGRAM

## VI. RESULT

The integration of GSM with home automation for security and safety has produced a complete solution that improves homes' overall security. We have effectively developed remote monitoring capabilities with this project, enabling users to watch and manage their home security systems in real time using mobile devices. In the case of a security breach or other unusual activity, home owners will be notified right away thanks to the integration of SMS alerts. An extra line of protection is offered by automation features, which make it possible to operate windows, doors, and other security elements. Additionally, by managing consumption based on occupancy, the technology helps to reduce energy use. Homeowners' overall safety and comfort are increased by the intuitive interface and integrated emergency response system. The dependability and efficacy of this GSM-based home automation system have been greatly enhanced by extensive testing and careful evaluation of user input.



**Fig.d.Hardware Set up of Kit(ON)**



**Fig.d.Hardware Set up of Kit(ON)**

## VII. FUTURE SCOPE

Future advancements in the GSM-based home automation project could be possible without relying on the Internet of Things. The incorporation of machine learning algorithms and sophisticated security protocols may improve the system's capacity to identify and react intelligently to security threats. Investigating decentralized technologies can enable the system to handle data locally, minimizing latency and reliance on outside networks. One such technology is edge computing. Incorporating modern encryption techniques and biometric authentication can further strengthen security measures without depending on IoT devices. Cloud-based options continue to be viable for data storage and remote access, guaranteeing scalability and flexibility. With continued advancements in these fields, a more reliable and self-sufficient GSM-based home automation system that prioritizes ease and security can be created without requiring a high level of IOT connectivity.

## VIII. CONCLUSION

For a residential use, this project is effective and reasonably priced. Additionally, this project is reasonably priced and has a straightforward, user-friendly interface for decoding. With the help of this technique, consumers can conveniently operate home appliances without running the risk of electric shock. Through the notification of detected smoke or gas leaks, it can help make a home more secure. This project can produce home automation system items on a commercial scale with a few improvements and tweaks. Future updates will allow us to upgrade the communication system with Internet web base technology and add temperature sensors to monitor various temperature parameters throughout the house. In order to integrate additional security features of a smart home automation system, this project can also be promoted with wireless cameras. To enhance house security, alarms are installed on windows and doors to deter potential intruders or sabotage attempts.

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