

Arduino-Based Fire Alarm System with GSM Module

Ravinder Pal Singh

Assistant Professor, Department of Electronics & Comm. Engineering, RIMT University, Mandi Gobindgarh, Punjab, India

Correspondence should be addressed to Ravinder Pal Singh; rpsingh@rimt.ac.in

Copyright © 2022 Made Ravinder Pal Singh. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT- This paper outlines the creation of a house fire alarm using the Global System for Mobile Communications (GSM) Module with the Arduino system. The primary objective is to avoid fire in order to ensure safety at home Residents and buildings within the home also suffered mishaps. Arduino is used Uno board along with the chip ATmega328. The most important controller utilised is the Temperature sensor ATmega328 that regulates the house fire warning. LM35 Limited To detect fire heat, the temperature sensor is utilised. The user will receive an alert message SMS through GSM module Short Message Service When the system is detected at or above 400 C, an alarm notice will be shown on the LCD display and concurrently an SMS alert will be sent to people at the high temperature in the house. Test results will be documented and discussed. It can assist users enhance safety standards by immediately reacting to accident prevention using this method. In the case of a calamity, this will enable the users to protect life and property.

KEYWORDS- Arduino Uno, Alarm System, Fire Sensor, Global System for Mobile Communications (GSM).

I. INTRODUCTION

Fires have been known as a terrible catastrophe that may inflict devastation, property, and life losses among the disasters that have occurred in the local region. Fires have been involved in several tragedies [1]. When compared to other dangers, disasters have grown more frequent, destructive, and impactful. With the fast advancement of technology, the likelihood of a major fire or other exceptional calamity, as well as the growth of urban building likewise grew year after year. Early identification and warning of fires are two critical steps in putting out a fire quickly and avoiding major fatalities and material loss [2]. As a result, it is critical to install sophisticated fire alarm systems in buildings, particularly in those that are used for commercial purposes. include a large number of people or valuable items [3].

About 5500 fires were reported by the Japanese Firefighters and Emergency Service (JBPM). incidences were recorded in 2016, with homes being the most common, followed by transportation, leakage gasses and electric equipment Culinary utensils, indoor cigarettes, home equipment, lighting, inquisitive children, shoddy cable, etc variety of other variables are all studied as potential causes of house fires. If a fire breaks out while the inhabitants are there, the chances of putting it out are

slim [4]. It's because the locals can take care of themselves. Use a fire extinguisher or call the fire department right away to prevent the fire from spreading. The occupants of this initiative are more concerned when they are not at homes or are ignorant that here is a burning in the building. The house fire alert, on the other hand, is meant to inform individuals if there is a possibility of a wildfire catastrophe happening in their house [5].

The creation of a house The primary controlling chip for the fire warning systems is an Arduino chip, that communicates with a GSM unit [6]. The purpose of the interaction is for the user to learn about the present state of affairs in the house. This system is entirely based on wireless network connection, since the GSM module sends an SMS to the user [7]. The Arduino board's microcontroller serves as the circuit's genius, controlling circuit flow and executing all decisions [8]. The communication portion of the circuit is handled by the GSM Module. It receives instructions from the Arduino on where to send data and what data should be delivered. It communicates with the help of a GSM SIM card. It's essentially a modem that communicates with the Arduino through serial communication and requires Hayes compliant AT instructions to do so [9]. The user provides the alert message as well as the recipient's phone number using project codes. When a fire is detected in the residence, To convey data to the client, an SMS would be delivered via the SIM card inserted within the modules to the user's mobile contact. The design and execution of the program is divided into two main elements: physical design and computer specifics [10]. The circuit layout were created, and the program prototypes were implemented in the electronics structure. Throughout technology production, the whole prototypes were controlled by computerized programs [11].

A. Component Used

1) Arduino Uno

The Arduino Uno is a microprocessor board built on the ATmega328P. It contains a total of fourteen digital pins (6 of which are available as PWM outputs), six analogue entrances, a crystal 16 MHz quartz flask, a reset switch, an ICSP connector, and a charging connection It comes with everything you'll need to get started with the microprocessor; connect it to a desktop via USB connection or charge it using an AC converter or batteries. Without worrying too much about doing something incorrect you may play with your UNO, the worst possibility being that you can substitute for a few bucks for the chip and start over. Arduino is an open-source platform

used for building electronics projects [12]. Arduino is made up of a hardware customizable circuitry boards (also known as a microprocessor) and application, known as an IDE (Interactive Developer Environments), that operates on your laptop and is used to create and download computers programs to the physically platform [13]. The Arduino has grown in popularity among those who are just getting started with electrical, and for good cause. Unlike most prior programmed circuitry, the Arduino do not require a distinct pieces of equipment (known as a programmer) to install fresh software into the board; instead, a USB connection is all that is required [14].

As Arduino is the primary board, the ATmega 328's microcontroller is utilised for the management of the circuit as a major controller. It is a renowned microcontroller Open Source Kit to create Digital and interactive LEDs, LCD display, switches, buttons and engines interactive gadgets, interactive tools [15]. The speakers and many more [16]. And many more [17]. A set of analogue and digital pins may be incorporated in the Arduino system to numerous other boards and circuits that have completely different design functions A USB serial connection ports for loading the computer codes are provided on the Arduino board [18]. For code-making, Arduino has developed its own IDE software, which supports the programming languages of C and C++ entirely. The Arduino UNO board used for the entire project is shown in Figure 1.



Figure 1: Diagrammatic Representation of Arduino UNO Board [ELECTRONICSCOMP]

2) Flame Sensor

A flame-sensor is a kind of detector designed to identify and react to the presence of a burn or flame [19]. The manner the fire detectors is mounted may have an impact on its response. The package includes an alert equipment, a normal gasoline connection, lpg, and a flame suppression system. This sensor is used in commercial boiler. The main goal of this is to ensure that the boiler is in good working order. The response of these sensors is quicker and more exact than that of a heat/smoke detectors due to the technology utilized to monitor the flames [20].

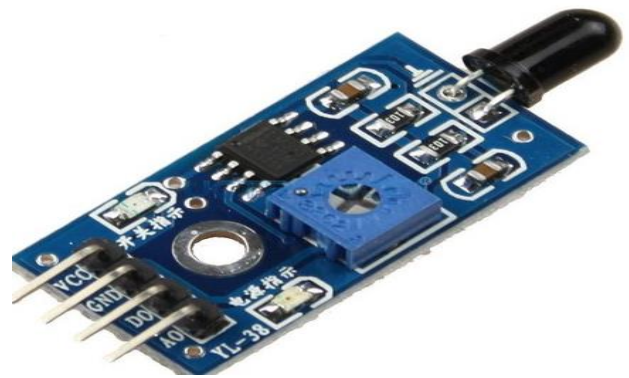


Figure 2: Diagrammatic Representation of Flame Sensor

3) Relay

A relays is a circuit that is activated or deactivated by electricity. The device is made up of a set of output terminal for a solitary or multiple controlling inputs, as much as a set of operating connection connections. We've all seen TV remotes where you can push one button to activate a feature; relays work in a similar way. Relays are used to safeguard humans from excessive voltages by removing the direct link between them and electrical equipment. If large industries are concentrated, larger capacity relays are utilised to optimise the functioning of motors and pumps [21].

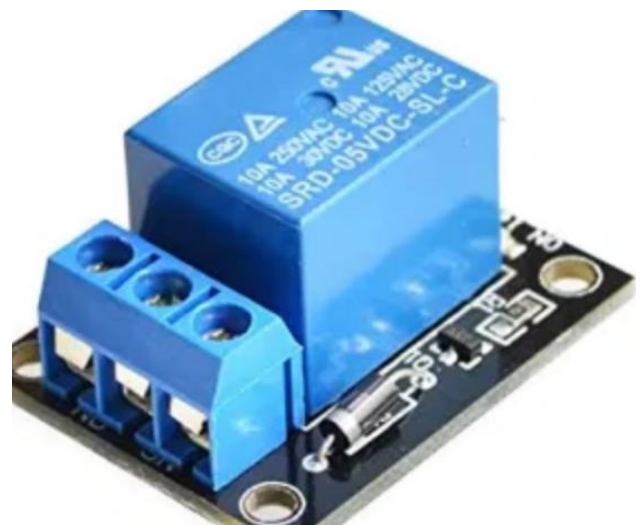


Figure 3: Diagrammatic Representation of Relay [STUDENTLESSON]

4) GSM Module

To carry out the work in the communication section of the GSM module, the GSM SIM900A type is used. It has a Dual-Band 900-1800 MHz frequency range and is only intended for use outside of Europe and the United States. It has a proven performance, an industrial interface standard, and an inbuilt TCP/IP protocol, making it attractive and ideal for electronics projects. It is believed to be Any reduced microprocessor may be connected to it. since it uses less power during operation. Many interfaces may be used to connect it, including I2C, SPI interface, PWM, antenna pad, two serial interfaces, and so on. Before connecting to the Arduino board, the GSM SIM900A device is seen.

5) LM 35 Senso

The LM35 is a thermometer that outputs a proportionate analog signal proportionate to temperatures. The maximum power is shown in degree Celsius (Celsius). It doesn't need any extra calibration electronics [22]. The LM35 has a 10 mV/degree Celsius sensibility. The discharge voltage increases as the temperatures increases.

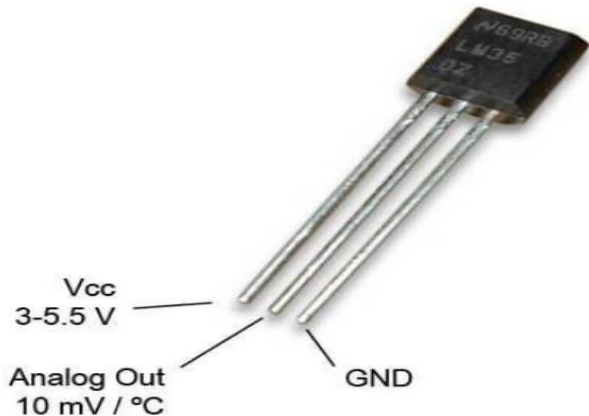


Figure 4: Diagrammatic Representation of LM 35 Sensor

B. Working of Project

The temperature at the start of the system is always felt by LM35. An increase in temperature occurs whenever a fire breaks out, even a little one. In this case, LM35 can immediately identify the value of the temperature. On the Arduino UNO microcontroller will inform When the temperatures reaches 40 degrees Celsius or more, the GSM module sends a caution signal to the client. The temperatures limit activated by LM35 in the program may be changed by the user upon request. With references to the temperatures spectrum, the LM35 detects any environmental warmth (-55°C to +150°C) it can count. Temperature in Malaysia may reach up to about 38°C during hot weather. Therefore, according to the weather conditions, the temperature limit to be detected is 40o C certainly convenient.

II. LITERATURE REVIEW

M. S. Bin [23] Propose that Fire alarm is a real-time monitoring device which detects fire smoke and records photos via a camera in a room if a fire arises. Raspberry Pi and Arduino Uno are the embedded systems for developing the fire alarm system. The system's primary feature is the ability to transmit an alarm remotely if a fire is detected. The technology will display a picture of the room condition on a website when the presence of smoke is detected. To report the occurrence to the Firefighter via Short Message service, the system needs user confirmation (SMS). This approach has the advantage of reducing the risk of the Firefighter receiving erroneous alerts. The camera merely captures a picture so that this system uses a little power and storage.

K. Muheden,[24] Propose that For the safety of these regions it is of essential relevance to monitor domestic and industrial sites through sensors and to avoid issue through prediction. This article illustrates how the Wireless Sensors (WSN) approaches may be increased via the development of new design strategies and the

improvement of low-cost systems for industrial and residential security. In this study, To assure and provide optimal solutions for the system, not only temperatures and moisture detectors, but also flames and gas detectors was used. Because of the construction of a basic electrical circuit, anybody may operate this wirelessly house protection systems. A notification was used as a method of informing people about the system. Signals from detectors like gas, flames, warmth, and humidity are received by the implant Arduino device, which were constructed using Android Studio. It will enable access to the WIFI networks and deliver a warning alert to smartphone customers if it finds that the obtained data has control levels over a specified threshold, in order to pre-monitor the potential of a fire.

W. H. Dong [25] Propose that The protection of garment workers' minimal rights and safety has suddenly become a hot issue. The employees of clothing manufacturers face several labyrinths and one of them is certainly broken out of fire. The investors lose interest and the industry's prominence becomes toneless. In this work, we have proposed a fire detecting system that can locate the damaged area. Multiple Arduino, connected with a number of sensors and camera, have been controlled using Raspberry Pi 3. The camera assembles a 360z relay motor, allowing the picture to flick at any angle of firing. To prevent any false alarms, we have included a validation of the fire suspicions systems. The method would deliver an automated email with a picture of the spot in question and the location of Arduino. An Administration may validate or deny the claim, and if the situation is confirmed as a fire breach, the systems would generate an alarm and an automatic response would be sent. The next fire department has been enlisted.

III. DISCUSSION

There have been few experiments to monitor the performance of the system. The experiments were conducted using heat in the vicinity of the LM35. Shows the ready mode state of the LM35 (prepared to detect but not to detect a fire). Shows a fire and alarm message detected by the LM35 on the LCD screen. When the fire has been removed, the condition is present. Reveals the user's SMS when the system notifies a fire alert. When a fire is detected, the LCD display simply indicates the LM35 sensor's readiness to detect fire. Whenever the LM35 senses a red, the LCD screen flashes "Fire alarm!" in time with the SMS delivered to the user through the GSM component. "Fire shut!" will appear on the LCD display when the blaze has being doused. Now you're safe."

IV. CONCLUSION

When the property owners is never there, to assist the owners in resolving a fire incident. Unexpected Circumstances or the Crisis It happens always without the resident's awareness in buildings or residential regions. On the basis of the findings, to safeguard their properties, the home alert system is feasible and practical for inhabitants. The system, indeed. The constructed value is less than other current on the market alarm systems and can be applied easily houses. Due to the employment of LM35 for the sensing of heat or high temperature, the ability to

system. Due to its versatility and ease of operation this gadget may be used in various sectors such as homes, hostels, the hotel industry, factories, car manufacturers and many more areas linked to crowds, people or goodwill. In order to safeguard the area against fire, the users may just put the gadget to their area of concern. Whenever the temperature exceeds the maximum (40oC), the gadget alerts consumers instantaneously through GSM. This allows users to understand and avert the harmful situation by quickly preventing it (using a fire extinguisher, calling firefighters, etc.).

REFERENCES

- [1]Goswami L, Kaushik MK, Sikka R, Anand V, Prasad Sharma K, Singh Solanki M. IOT Based Fault Detection of Underground Cables through Node MCU Module. In: 2020 International Conference on Computer Science, Engineering and Applications, ICCSEA 2020. 2020.
- [2]Solanki MS, Sharma DKP, Goswami L, Sikka R, Anand V. Automatic Identification of Temples in Digital Images through Scale Invariant Feature Transform. In: 2020 International Conference on Computer Science, Engineering and Applications, ICCSEA 2020. 2020.
- [3]Solanki MS, Goswami L, Sharma KP, Sikka R. Automatic Detection of Temples in consumer Images using histogram of Gradient. In: Proceedings of 2019 International Conference on Computational Intelligence and Knowledge Economy, ICCIKE 2019. 2019.
- [4]Anand V. Photovoltaic actuated induction motor for driving electric vehicle. *Int J Eng Adv Technol.* 2019;
- [5]Singh D. Robust controlling of thermal mixing procedure by means of sliding type controlling. *Int J Eng Adv Technol.* 2019;
- [6]Saraswat M, Tripathi RC. Cloud Computing: Comparison and Analysis of Cloud Service Providers-AWs, Microsoft and Google. In: Proceedings of the 2020 9th International Conference on System Modeling and Advancement in Research Trends, SMART 2020. 2020.
- [7]Saraswat M, Tripathi RC. Cloud Computing: Analysis of Top 5 CSPs in SaaS, PaaS and IaaS Platforms. In: Proceedings of the 2020 9th International Conference on System Modeling and Advancement in Research Trends, SMART 2020. 2020.
- [8]Jagtap MT, Tripathi RC, Jawalkar DK. Depth accuracy determination in 3-d stereoscopic image retargeting using DMA. In: Proceedings of the 2020 9th International Conference on System Modeling and Advancement in Research Trends, SMART 2020. 2020.
- [9]Tripathi S, Verma PK, Goswami G. A review on SMART GRID power system network. In: Proceedings of the 2020 9th International Conference on System Modeling and Advancement in Research Trends, SMART 2020. 2020.
- [10]Gupta B, Gola KK, Dhingra M. Wireless Sensor Networks: "A Review on Replica Detection Techniques." In: Proceedings of the 2019 8th International Conference on System Modeling and Advancement in Research Trends, SMART 2019. 2020.
- [11]Bala L, K. Vatsa A. Quality based Bottom-up-Detection and Prevention Techniques for DDOS in MANET. *Int J Comput Appl.* 2012;
- [12]Sood R, Kalia M. Cloudbank: A secure anonymous banking cloud. In: *Communications in Computer and Information Science.* 2010.
- [13]Singh P, Tyagi N. Radial Basis Function For Handwritten Devanagari Numeral Recognition. *Int J Adv Comput Sci Appl.* 2011;
- [14]Pradana GR. Smart Parking Berbasis Arduino Uno. *Univ Negeri Yogyakarta.* 2015;
- [15]Jee SW, Lee CH, Kim SK, Lee JJ, Kim PY. Development of a Traceable Fire Alarm System Based on the Conventional Fire Alarm System. *Fire Technol.* 2014;
- [16]Bansal N, Maurya A, Kumar T, Singh M, Bansal S. Cost performance of QoS Driven task scheduling in cloud computing. In: *Procedia Computer Science.* 2015.
- [17]Yao HW, Zhang P, Zheng YP, Liang D. Introduction for Code for Design of Automatic Fire Alarm System. In: *Procedia Engineering.* 2016.
- [18]Goel AR, Ranjan A, Wajid M. VLSI architecture and implementation of statistical multiplexer. In: *Proceedings of the International Conference on Innovative Applications of Computational Intelligence on Power, Energy and Controls with Their Impact on Humanity, CIPECH 2014.* 2014.
- [19]Al-Obaidy F, Yazdani F, Mohammadi FA. Intelligent testing for Arduino UNO based on thermal image. *Comput Electr Eng.* 2017;
- [20]Ferry DB, Pavan Kumar R, Reddy SK, Mukherjee A, Misra A. Graphene based multifunctional flame sensor. *Nanotechnology.* 2015;
- [21]Fossen H, Rotevatn A. Fault linkage and relay structures in extensional settings-A review. *Earth-Science Reviews.* 2016.
- [22]Indriani A, Johan J, Witanto Y, Hendra H. Pemanfaatan Sensor Suhu LM 35 Berbasis Microcontroller ATmega 8535 Pada Sistem Pengontrolan Temperatur Air Laut Skala Kecil. *Rekayasa Mesin.* 2014;
- [23]Bin Bahrudin MS, Kassim RA, Buniyamin N. Development of Fire alarm system using Raspberry Pi and Arduino Uno. In: 2013 International Conference on Electrical, Electronics and System Engineering, ICEESE 2013. 2013.
- [24]Muheden K, Erdem E, Vancin S. Design and implementation of the mobile fire alarm system using wireless sensor networks. In: *CINTI 2016 - 17th IEEE International Symposium on Computational Intelligence and Informatics: Proceedings.* 2017.
- [25]Dong WH, Wang L, Yu GZ, Mei Z Bin. Design of Wireless Automatic Fire Alarm System. In: *Procedia Engineering.* 2016.