International Journal of Engineering, Management and Humanities (IJEMH)
Volume 3 , Issue 3 , pp: 195-202 ww.ijemh.com

IoT based Home Automation and LPG Leakage Detection with Artificial Intelligence

Bimba Prasad[1], Dr. Suma V[2]
[1]*Student, M.Tech. in CNE, Dept. of Information Science and Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, INDIA*
[2]*Professor &Head, Dept. of CSD, Dayananda Sagar College of Engineering, Bangalore, Karnataka, INDIA*

Date of Submission: 01-08-2022 Date of Acceptance: 13-08-2022

ABSTRACT: In today's world, automated systems are favoured to non-automated methods. The capacity to plan and schedule events for the network's devices is referred to as automation. Home automation enables remote control of your home's appliances from any location using a mobile smartphone. These gadgets have the ability to communicate with one another and transfer data through networks. LPG is a readily available energy source that is portable, clean, and efficient for users all around the world. Typically composed of propane, butane, and propylene, LPG is a combustible mixture of hydrocarbon gases. Heating appliances, kitchenware, and automobiles all use LPG as fuel. A crucial component of these systems are the gas sensors. Gas sensors are tiny, simulating a nose, and respond impulsively to the gases they detect, notifying the system of any changes in the concentration of molecules in the gaseous state. The goal here is to find the leak and notify the user, who can then use a smartphone to control and shut off the regulator using an IoT cloud application. Server and control functions are performed by Raspberry Pi. The Raspberry Pi has the responsibility of authenticating users, regulating electrical equipment, and supplying security.

Keywords: Home Automation, Artificial Intelligence, Raspberry Pi, Gas sensor, DC motor, Relay, Ubidots

I. INTRODUCTION

Automation now plays a significant part in every workplace and household. At the moment, automation approaches are implemented either using a microprocessor or a microcontroller. Multiple programs cannot be run simultaneously by a microcontroller. These issues can be solved with the single-board computer known as the Raspberry Pi. It efficiently performs computer-like operations. LPG gas is essentially a mixture of the extremely combustible gases propane and butane. It is an odorless gas in its natural condition, but Ethyl Mercaptan is added to it as a potent smelling ingredient to help detect leaks. Using an ideal gas sensor, we can find LPG leaks in vehicles, commercial spaces, and residential places. As soon as the LPG sensor detects any gas leaking, the sensor's output changes to LOW. The processor notices this and activates the buzzer and LED. A "GAS LEAKAGE" message is delivered through GSM Module to a pre-defined mobile number after a brief delay and the exhaust fan is also turned ON to vent the gas.

1.1 Embedded Systems

A computer hardware system with software embedded in it is an example of an embedded system. Embedded systems can either be standalone systems or they can be included into a big system. A microcontroller or other embedded system microprocessor-based system created with a specific function in mind. An embedded system, such as a fire alarm, will only detect smoke.

A real-time operating system (RTOS), which supervises the application software and provides a mechanism to let the processor run a process in accordance with scheduling by adhering to a plan to control the latencies, is one of three components that make up an embedded system. The other two components are hardware and application software. The RTOS specifies how the system operates.

1.2 IoT

The Internet of Things (IoT) is a network of actual physical things, or "things," that are equipped with sensors, electronics, networks, software, and other components to collect and share data. With IoT, conventional items like computers, smartphones, and tablets will be connected to the internet as well as relatively simple appliances like

home appliances. By enhancing parts of our lives with the power of data collecting, AI algorithms, and networks, IoT makes almost everything "smart."

Home automation is a concept that intends to give users access to affordable lighting options, improved energy efficiency, and efficient use of energy by bringing control of operating common household electrical appliances to the tip of your finger. In addition to lighting solutions, the idea goes much farther and includes building a centralised home entertainment system, having overall control over your security, and much more. The Internet of Things (also known as IoT) based Home Automation system intends to use internet protocols or cloud computing to control any gadget in your smart home, as the name suggests. The IoT-based home automation system has many advantages over wired systems, including greater flexibility.

1.3 Artificial Intelligence

Artificial intelligence (AI), which stands for systems or machines that resemble human intelligence to complete tasks and can iteratively improve themselves based on the information they acquire, is most commonly used to describe such systems or machines. AI can appear in a variety of ways. Several cases are: Chatbots employ AI to comprehend consumer issues more quickly and offer more effective solutions. To improve scheduling, intelligent assistants employ AI to extract crucial information from massive free-text datasets. On the basis of users' viewing patterns, recommendation engines can automatically suggest TV shows to them.

In contrast to any specific format or function, AI is much more about the process and the capacity for superhuman thought and data processing. AI isn't meant to replace people, despite the stereotype that high-functioning, human-like robots will eventually rule the world. It aims to greatly improve human skills and contributions. As a result, it is a very important commercial asset.

Speech to Text

Speech-to-text technology is built on intricate algorithms that link phonemes to words. The software will then translate the audio recordings of the speaker's vibrations into text. These computer applications translate speech impulses into text using sophisticated algorithms. To accomplish this, the signal is divided into several components known as phonemes. The speech-to-text system then processes each phoneme. Each vibration will be compared by the computer to a pre-programmed list of phonemes.

The software will convert the speech recordings into a text document after they have been recorded. A single audio file or a number of audio files can be processed using this method. The final transcripts will then be kept by the software in a file. The recognition engine for speech-to-text uses a variety of machine learning models and can recognise many different languages. It has been trained on a number of audio formats by Google. The software will have its own unique model for a particular language and will use the BCP-47 identifier for the language to be processed. Each time a word is identified, the software will additionally output time offset values, which each stand for 100 milliseconds. this displays the precise time since the audio began.

Transcribing refers to the outcomes that the Speech-to-Text API returns. The recognition of audio produces the final text. A Text-to-Speech API typically produces a number of transcripts that visually depict the audio. You can listen to and review the audio files.

II. LITERATURE SURVEY

Improvement in dual-layer occlusion handling provides progressive association for tracking occluded targets, which overcomes most of the fragments in theframes of the input video stream [1].

Vamsikrishna Patchava, P Ravi Babu,Hari Babu Kandala, developed a system where cameras and motion sensors are incorporated into a web application to create the system for Smart Home Automation approach using Raspberry Pi using IoT. Motion sensors and cameras are operated and managed by Raspberry Pi for sensing and surveillance. For instance, it uses a straightforward computer vision technique to identify and locate intruders.

Satyendra k Vishwakarma, Prashant Upadhyaya, Babita Kumari, Arun Kumar Mishra proposed a system with a primary controller unit (main switching of the home circuit) connected to a Wi-Fi network that is always available, a smart home can be constructed. The primary controller is set to automatically connect to the available network and be connected to the auto power backup in order to prevent the Wi-Fi connection from disconnecting.Additionally, the sub-units are linked to the main controller so that non-smart devices (in this case, the outdated home appliance

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 3 , Issue 3 , pp: 195-202 ww.ijemh.com

system) can be transformed into smart appliances. With Google Assistant and a webbased service powered by an IoT application that leverages Adafruit and IFTTT to maintain the communication relationship, consumers can access and operate their smart homes.

Shantini M, Vidya G, Arun R proposed a paper where the major goal is to make the door locking system more secure. After sufficient identification is achieved using the database, the mobile device will transmit a signal over Bluetooth to the Arduino circuit that serves as a connection between the smartphone and the servo motor. Smartphones that use Bluetooth offer easier access with greater security than traditional keys.

K Gavaskar, D Malathi, G Ravivarma, A Arulmurugan proposed a system on the handle of the gas oven is where the gas sensor is located.Regarding time, the use is recognised. If the gas level drops below the established edge level, GSM notifies the owner (buyer) and, naturally, schedules a message for the new chamber. If the client is at home, the system can detect gas leaks and send a ready SMS to the client through a GSM module, together with a signal sound, to alert the customer.

Arijit Banik, Bodhayan Aich, Suman Ghosh proposed a model that is used to detect gas leaks of any petroleum-based gaseous substance that the MQ-5 Sensor can detect, such as LPG, Butane, and Methane. To configure an SMS-based Send 3 SMS (3 alert messages) to two specific mobile numbers using an alert mechanism (input inside the Arduino Program).To sound an alarm following a gas leak and turn off the alarm once the gas leak has been contained. Status will be shown on an LCD utilizing 16 by 2 LCD module.

III. SYSTEM REQUIREMENTS

3.1 Hardware Requirements

i. Raspberry Pi

The Raspberry Pi is a reasonably priced, credit-card-sized computer that connects to a computer monitor or television and makes use of a regular keyboard and mouse. It's a capable small gadget that lets users of all ages learn about computing and how to code in languages like Scratch and Python. It can perform all of the tasks you'd expect a desktop computer to perform, including playing high-definition video games, creating spreadsheets, word editing, and browsing the internet.

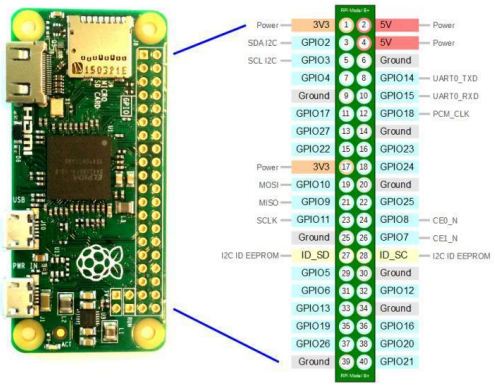

Fig 3.1:Raspberry Pi

Specifications:

- Single-core BCM2835 CPU with a 1GHz ARM11 core and 512MB of LPDDR2 SDRAM
- Slot for a micro-SD card
- An output mini-HDMI port for 1080p60 video
- Micro-USB ports for power and data
- A 40-pin GPIO header with no people on it
- A composite video header with no content
- Size: 65 mm by 30 mm by 5 mm
- CSI camera connector, reset headers, and composite video (v1.3 only)

ii. Gas Sensor

The MQ2 gas sensor module is used to find gas leaks. It can identify gases like hydrogen, smoke, alcohol, and LPG. The sensor module's analogue pin can be used to monitor the gas concentration in ppm. Both analogue and digital sensors can be used with the 5v operating voltage. The potentiometer can be used to change the sensitivity, and the preheating time is 20 seconds.

Fig 3.2:MQ-2 Gas Sensor

Specifications:

- Recommended voltage: 5V
- Utilization of less than 800 mw for heating
- Storage range: -20 to 70 degrees Celsius
- LPG concentration detection range: 200-5000 Ppm

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 3 , Issue 3 , pp: 195-202 ww.ijemh.com

iii. DC Motor

Electrical energy is transformed into mechanical (rotational) energy by DC motors, which are electro-mechanical devices. Motor rotational speed is inversely proportional to input voltage. The motor will rotate at a faster rate the higher the input voltage. But the voltage ought to fall within the acceptable range.

Fig 3.3:DC Motor

A motor's operational voltage range is 3 to 6 volts. The motor will operate at its lowest rated speed if we input 3 volts. Similar to this, the DC motor will operate at its maximum rated speed when 6 volts are applied. In essence, by providing a DC motor with a changeable input voltage, we may regulate the speed of rotation. Typically, a constant dc voltage source is used to generate a variable dc voltage using a pulse width modulation approach

iv. L293D Motor Driver

A motor driver is known as L293D IC. Like other ICs, it operates at low voltage. The Motor receives a constant, bidirectional direct current from L293D. Without affecting the entire IC or any other component in the circuit, the polarity of the current can change at any time. L293D has two motors and an inbuilt H-bridge fitted.

Fig 3.4:L293D Motor Driver

The two motors might be controlled simultaneously via L293D. By using the enable pin, it has the capacity to regulate the speed. It's also simple to modify the direction. The voltage supply range is wider than that of other ICs. The IC can readily manage a voltage range of 4.5 to 36 volts for the motor. The motor's highest continuous current range is close to 600 mA, however its maximum peak current range is 1.2 A. It has an automatic shutdown system based on heat conditions. Its operating temperature range is substantially higher than that of any small-sized IC, at 0 to 70 degrees.

v. GSM Module

The Global System for Mobile Communications, or GSM, technology is utilised in numerous communication devices. A computer is utilised to communicate with the GSM network. The GSM module can only comprehend and respond to AT commands. The simplest basic command is "AT," and if GSM responds "OK" then everything is running smoothly. If not, GSM will respond "ERROR." Numerous AT commands are available, such ATA to answer the phone, ATD to place a call, AT+CMGR to read the message, AT+CMGS to send an SMS, etc. Carriage return, or r (0D in hex), should come after AT commands, thus "AT+CMGSr" would be the syntax.

Fig 3.5:GSM Module

The SIM900 is a comprehensive quad-band GSM/GPRS module that offers voice, SMS, and data capabilities for GSM/GPRS 850/900/1800/1900MHz with minimal power consumption.

vi. Relay

An automatic control mechanism called a relay adjusts the output when the input quantity reaches a predetermined level. An electronic control device known as a relay has a controlled system and a control system. It is typically

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 3 , Issue 3 , pp: 195-202 ww.ijemh.com

employed in a circuit for automatic control. Actually, it controls the bigger current with a smaller current, a current switch that is automated. As a result, it functions as the circuit's automated adjustment, safety protection, and conversion circuit.

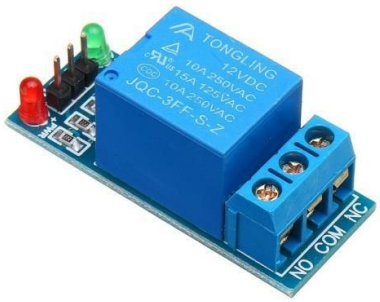

Fig 3.6: Relay

3.2 Software Requirements

i. Ubidots

IoT Application Development Platform Ubidots (ubidots.com) streamlines the process of developing IoT applications for businesses and individuals, enabling them to easily and widely deploy any IoT solution. The Ubidots platform is a user-focused point-and-click IoT App builder with data analytics and cloud function tools, dashboard visualisations, device management tools, BI events and alarm engine, and end-user authentication/access to provide end-users and operators with the data they require and nothing more. Users can gather, improve, and disseminate sensor, actuator, and beacon data using the Ubidots platform, enabling organisations and users to make data-driven decisions that increase effectiveness and efficiency.

Fig 4.1:Ubidots Interface

Through this Ubidots application the user creates a dashboard first for handling the home automation. Inside the dashboard, virtual switches are created for controlling different devices for eg, Bulb, Fan, Geyser and so on.

ii. VNC Viewer

VNC is a software for remotely accessing the graphical desktop of your Raspberry Pi. VNC is quite simple to set up, but it often only allows access from a different computer that is connected to the same network as your Raspberry Pi.

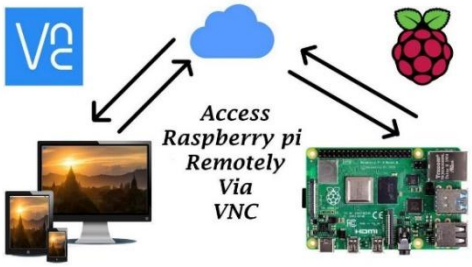

Fig 4.2:VNC Viewer connected to Raspian OS

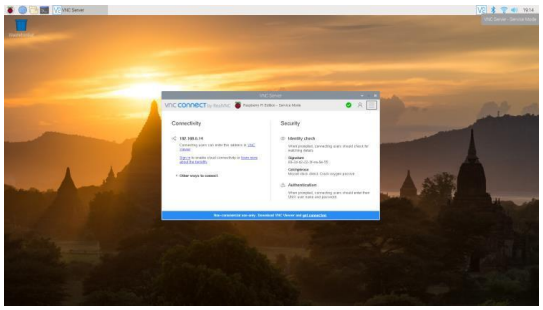

Fig 4.3:Terminal

iii. Raspian OS

Raspberry Pi OS is a free, open-source operating system built on Debian Linux and designed for use with Pi boards. The first version, known as Raspbian, emerged in 2013, and from 2015 forward the Raspberry Pi Foundation released it as an officially-sanctioned Pi distro. Additionally, Raspberry Pi OS is also supported by a number of ARM-based single-board computers. Raspbian was developed by developers Peter Green and Mike Thompson and was initially an unaffiliated project.

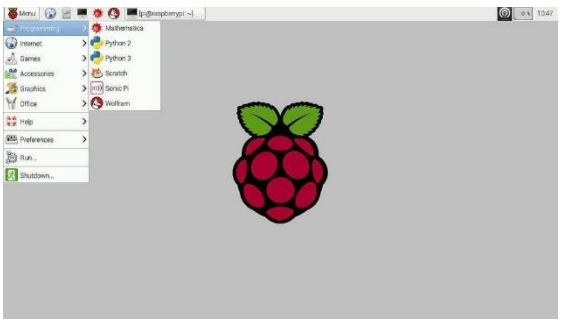

Fig 4.4: RPi Window

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 3 , Issue 3 , pp: 195-202 ww.ijemh.com

iv. SPYDER

Spyder is a Python-based integrated development environment (IDE) that is open-source and cross-platform.

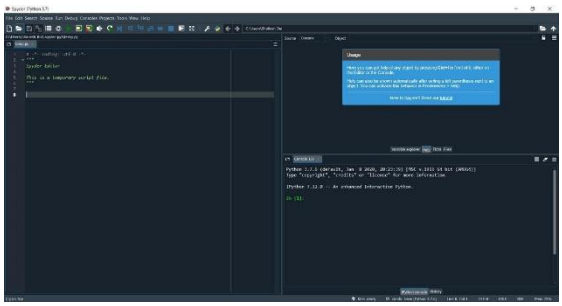

Fig 4.5: Anaconda Spyder

Features

- Individualized Syntax Highlighting
- The presence of breakpoints (debugging and conditional breakpoints)
- Execution that is interactive and lets you run lines, files, cells, etc.
- Run configurations for the current/dedicated/external console, command-line parameters, working directory choices, etc.
- Can automatically clear variables (or enter debugging)
- The Outline Explorer allows for navigation between cells, functions, blocks, and other elements.
- It offers immediate code inspection (The ability to examine what functions, keywords, and classes are, what they are doing and what information they contain) automatic addition of a colon following if, while, etc

IV. IMPLEMENTATION SETUP

The main agenda of this proposed project is make the users have control over the home appliances through cellphone or PC or desktop having internet connectivity using Raspberry Pi. A program is written to control the home appliances remotely and even detect the leakage of gas. A smart door is embedded with the DC motor incorporating the motor driver which rotates in clockwise and anti-clockwise direction performing open and close operations. The Ubidots IoT platform sends alert call to the owner of the house as soon as the gas leakage is detected and the regulator can be turned off.

Along with this artificial intelligence speech to text is also incorporated in the proposed system where the home appliances can be controlled via voice commands.

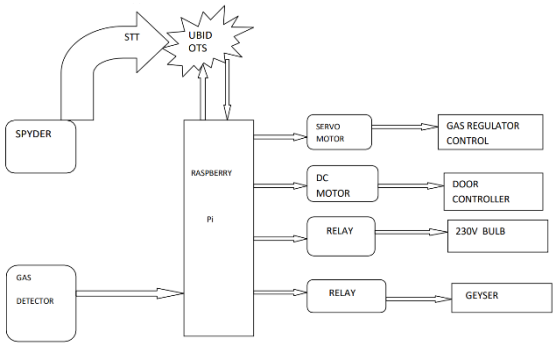

Fig 4.1: Proposed Block Diagram for Smart Home

V. RESULTS

Satisfying all the required conditions for implementing the proposed model and then being implemented, the results are obtained from the model.

The owner of the house can remotely control the smart home devices from any location with internet connectivity. In our proposed system, all the electronic gadgets are embedded either with sensors or relay which receives the data from the microprocessor and turns ON/OFF. Here Raspberry Pi processor acts as the gateway between the electronic devices and IoT-platform that is Ubidots. The following figure 5.1 shows the hardware implementation setup of the proposed model.

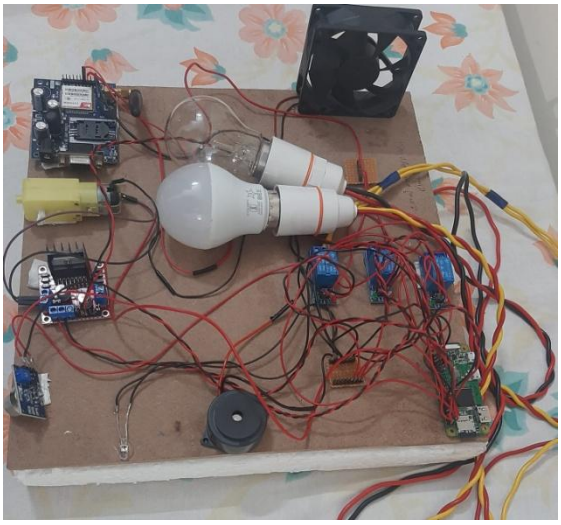

Fig 5.1**:** Hardware board built for smart home automation

We can see all the sensors and actuators being connected to Raspberry Pi board. As we all know, this Raspberry Pi itself is a mini computer, to have the graphical interface for the Raspberry Pi

board we use the VNC Viewer as an interface, this can be seen in figure 5.2.

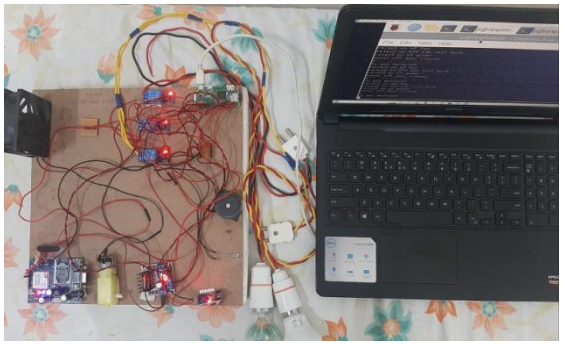

Fig5.2: Hardware board interfaced with Desktop.

Now, when the gas sensor detects the gas in atmosphere of the room, then it sends te signal to the Raspberry Pi, and then the system takes the corresponding measures. This process is displayed in stepwise on the output screen as shown in figure 5.3.

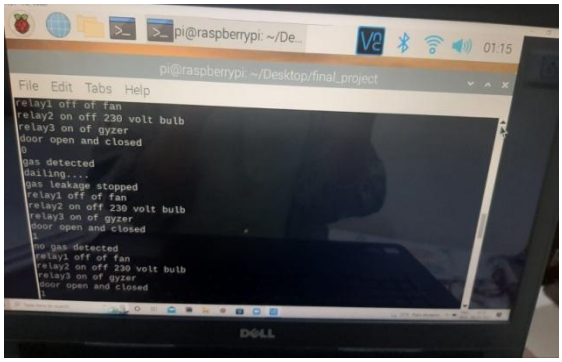

Fig 5.3: Code running shows gas leak detected and alert call dialed

The Fig 5.3 clearly shows when the gas is detected by the sensor, the output is displayed as “gas detected”, and then it dails a call to the user. And once the gas leakage stops, it shows as “gas leakage stopped” on the screen. We can also see the status of all the devices in the system.

Fig 5.4: Gas being detected.

In the figure 5.4, we can see the buzzer being turned ON, and along with that a Red Indicator being turned ON in the Gas Sensor to indicate the leak of gas. The figure also shows the fan being turned ON to clear the atmosphere by thrushing out the air from inside of the home, this fan is controlled by the user remotely once he/she is alerted for a gas leakage.

With the help of Ubidots, the user can control the devices in the system through a web browser. This remote-control screen for controlling the system is shown in the figure 5.5. Here, we can see 5 switches for each device in the system by which they can be turned ON & OFF. The status of each device is determined by the color of the Switch, the device which are ON are displayed in Orange color, and the devices which are OFF are displayed in Gray color.

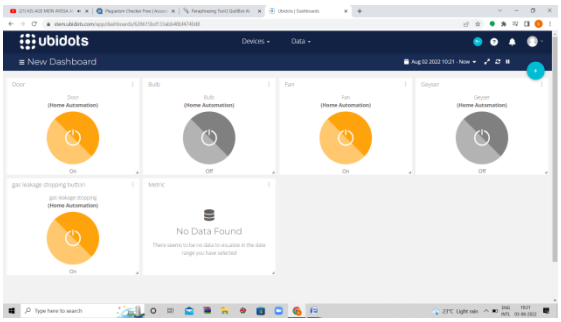

Fig 5.5: Virtual switches built for Smart Home Automation

VI. CONCLUSION

We can effortlessly monitor and access our smart home from anywhere with the aid of IoT connectivity, which will unquestionably prove to be energy-efficient. It can also provide assistance to the elderly and those with impairments. Future work will include the addition of more controlling components that will augment the intelligence of our smart house and enabling real-world application. Leaking LPG is a serious problem in both households and firms.

In case of a gas leak, this framework contains automatic alarming and indication, which is crucial in an emergency. The next big thing in gas leak detection is supposedly a hardwarebased method with excellent localization accuracy.

REFERENCES

[1]. Banik, B. Aich and S. Ghosh, "Microcontroller based low cost gas leakage detector with SMS alert," 2018 Emerging Trends in Electronic Devices and Computational Techniques (EDCT), 2018, pp. 1-3, doi: 10.1109/EDCT.2018.8405094.

[2]. R. K. Kodali, T. Devi B. and S. C. Rajanarayanan, "IOT Based Automatic LPG Gas Booking And Leakage Detection System," 2019 11th International Conference on Advanced Computing (ICoAC), 2019, pp. 338-341, doi: 10.1109/ICoAC48765.2019.246863.

[3]. M. S. Hadis, E. Palantei, A. A. Ilham and A. Hendra, "Design of smart lock system for doors with special features using bluetooth technology," 2018 International Conference on Information and Communications Technology (ICOIACT), 2018, pp. 396-400, doi: 10.1109/ICOIACT.2018.8350767.

[4]. M. Shanthini, G. Vidya and R. Arun, "IoT Enhanced Smart Door Locking System," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020, pp. 92-96, doi: 10.1109/ICSSIT48917.2020.9214288.

[5]. S. K. Vishwakarma, P. Upadhyaya, B. Kumari and A. K. Mishra, "Smart Energy Efficient Home Automation System Using IoT," 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU), 2019, pp. 1-4, doi: 10.1109/IoTSIU.2019.8777607.

[6]. S. Somani, P. Solunke, S. Oke, P. Medhi and P. P. Laturkar, "IoT Based Smart Security and Home Automation," 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), 2018, pp. 1-4, doi: 10.1109/ICCUBEA.2018.8697610.

[7]. Anandhakrishnan S, Deepesh Nair, Rakesh K, Sampath K,Gayathri S Nair " IOT Based Smart Gas Monitoring System " IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) 2018

[8]. R.Naresh Naik 1, P.Siva Nagendra Reddy 2,S.Nanda Kishore3, K.Tharun Kumar Reddy4 "Arduino Based LPG gas Monitoring & Automatic Cylinder booking with Alert System" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,pISSN: 2278-8735.Volume 11, Issue 4, Ver. I (Jul.-Aug .2016), PP 06-12 www.iosrjournals.org

[9]. P. Bhuvaneshwari , S. Kavipriya, S. Priya , A. Porselvi, "L-Leakage Detection and Prevention of its Threats Using IoT in Smart Home Automation Systems", International Journal of Research in Engineering, Science and Management Volume-3, Issue-3, March-2020

[10]. V. Patchava, H. B. Kandala and P. R. Babu, "A Smart Home Automation technique with Raspberry Pi using IoT," 2015 International Conference on Smart Sensors and Systems (IC-SSS), 2015, pp. 1-4, doi: 10.1109/SMARTSENS.2015.7873584.

[11]. K. Gavaskar, D. Malathi, G. Ravivarma and A. Arulmurugan, "Development of LPG Leakage Detection Alert and Auto Exhaust System using IoT," 2021 7th International Conference on Electrical Energy Systems (ICEES), 2021, pp. 558-563, doi: 10.1109/ICEES51510.2021.9383633.

[12]. R.SUDHA ,S.ARUN PRASAD," GAS LEAKAGE DETECTION AND ALERTING SYSTEM USING IOT FOR HOME AND INDUSTRIAL SAFETY", 2020 IJCRT | Volume 8, Issue 9 September 2020 | ISSN: 2320-2882

[13]. Rohith Naidu V, Rakshith S Gowda, Prathapa, Ashwini D S, "Smart LPG Gas Level Detection and Safety System using IoT", International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org NCCDS - 2020 Conference Proceedings

[14]. https://www.etechnophiles.com/raspberry-pi-zero-gpio-pinout-specificationsprogramming-language

[15]. https://microcontrollerslab.com/dc-motor-l293d-motor-driver-ic-arduino-tutoria