

IoT Based Monitoring and Control System for Enhancing Security in Home Automation Using Raspberry Pi

Ishwarya.S, Rajarajeswari.K, Rampriya.R
Under graduate student's
Department of Electronics and Communication
Engineering
N.S.N College of Engineering and Technology
Karur-03
rrampriyaece@gmail.com

Dinesh Kumar.S
Assistant professor
Department of Electronics and Communication
Engineering
N.S.N College of engineering and Technology
Karur-03
Sd3kumar@gmail.com

Abstract—Home automation is quite common in developed nations. In smart home automation technique with Raspberry Pi using IoT and it is done by integrating cameras and sensor into a web application and automation plays an important role in the world economy and in daily life. Raspberry Pi operates and controls sensors and video cameras for sensing and surveillance then relay circuit is used to avoid gas leakage in our home. In proposed system an IOT based home automation system using raspberry pi that automates home appliances. When Person has arrived the camera capture image then the door is automatically open after getting the confirmation from the user through IoT. Thus we automate home appliances over the internet using a raspberry pi. Different login is used to control our home through IoT. The first login is used to control and monitor our whole home from anywhere. The second login is used to control the particular chamber in our house .whenever custodian isn't arrived at home .some person come to our home the custodian can check he is a right person and enter login id password to open the door. The person can access only certain chamber of that house. The third login is used to control the gas leakage in our house. When gas leakage detected and it is turned off using solenoid valve.

I. INTRODUCTION

Home automation is the control of any electrical devices in our home or office. There are

many different types home automation systems are available in our nation. The home automation systems are typically designed for different purposes. In fact, one of the major problems in the area is different systems are neither interoperable nor interconnected. There is a number of issues were designing a home automation system. It should also provide a user-friendly interface on the host side so that the devices can be easily set up, monitor, and control. In smart home systems, the internet is also used to control. For years, the internet has been widely used for the processes such as surfing the pages, searching information, downloading and installation. The rapid developments in new technologies, monitoring and controlling services have been started to be served along with the internet.

Home automation system is an ability to connect different electronic devices to the purpose of monitoring and controlling the home appliances. It is an area that has caught several attentions by both the academic and business fields. The earliest effort of home security system was believe on wired home networks, however, due to the appropriate planning and construction works required to offer a wired home, such effort tend to be insufficient. The solution for this problem, wireless communication has been emerged to provide a more flexible platform.

II.LITERATURE REVIEW

The proposed system consists of three panels: Admin and User. The users will first have to go the mobile application and log in it to their mobile devices. The user will have to register into

the application for the first time. On registering, the user will receive a username and password. The user can use this username and password for log-in into the mobile application each time he/she uses it. After logging in, the user can monitor his/her current home status. The status measured by three parameters: switch on and switch off of application and control temperature [1]. Bluetooth module HC-06 is interfaced with arduino board and home appliances are connected to arduino board via a relay. A Smartphone application is used for serial communication between the smartphone and a blue tooth module which is further connected to arduino board. In this method has the ability to not only remotely control the appliances but it also monitors the sensors [2].

Gas leakage is detected by the gas sensor which is sensitive to certain inflammable gases. In the event of a gas leakage, there is a notable change in the sensor's electrical conductivity which forms an analog input. This change in conductivity is identified by the sensor [3]. In Wi-Fi- based home automation system is presented. It uses a PC (with built- in Wi Fi card) based web server that manages the connected home devices. The system supports a wide range of home automation devices like fans, lights, other home appliances. With the help of this system, we can monitor and controlled the various equipment that is connected to the relay circuit the input from raspberry pi model as well as from the Wi-Fi network. Whenever the system is turned on, the current lighting data of the home are read and written to the data base and then transferred to the user interface. So, one can easily know the current situation of rooms and change in the state of the lights [4].

Microcontroller cannot run multiple programs at a time. With the use of microcontroller it is difficult to control both the appliances and surveillance at a time i.e., it is very complex to perform the multiple functions simultaneously. We can achieve this with the computer, but using the computer is very expensive for this purpose and consumes more power. The Raspberry Pi is a single board computer and it can be used to overcome these problems. Simply, the Raspberry Pi system functions like a computer with small setup. It contains GPIO and USB ports. Using these ports we can control the appliances with the sensors as well as interface the camera for surveillance. Raspberry Pi can be used for multiple purposes based on our requirement [5]. Smart homes contain multiple, connected devices such as home entertainment consoles, security systems, lighting, access control systems and surveillance. The intelligent home automation system is incorporated into smart homes to provide

comfort, convenience, and security to home owners. Home automation system represents and reports the status of the connected devices in an intuitive, user-friendly interface allowing the user to interact and control various devices with the touch of a few buttons [6].

Internet- based home automation systems become the most popular home automation system in international markets. The remote controlling and monitoring of a house using internet requires a computer, which is large in size and heavy to carry around .The most available home automation systems use different wireless communication standard to exchange data and signaling between their components, like Bluetooth, Zigbee, Wi-Fi, and finally the Global System for Mobile Communication (GSM). Wireless based home automation systems decrease installation cost and effort, and enhance system flexibility and scalability [7].The Database equipment built around this Microcontroller and a GSM controller facilitate the heart of the proposed system. This device is connected to a ZigBee transceiver and it communicates with each and every node present inside our home. The GSM Controller facilitates for the data follow between user and microcontroller. The GSM Controller uses mobile phone technology to communicate. From the mobile phone, command can be send via SMS to the Controller, which in turn interprets the command and then activates the required 'switch' to control the electrical item. As long as there is GSM mobile phone signal coverage, it is possible to control all electrical items from anywhere in the world. The system is easy to operate, and is secure in that only pre-determined mobile numbers can operate the GSM Controller [8].

The combination of ZigBee and GSM. Zigbee offers wireless connectivity of the sensors with control panel while GSM provides wide coverage as GSM association estimates 90% of the global mobile market using GSM standard. The proposed system provides reliable security, effortless installation, and portability. Sensors and actuators use wireless ZigBee communication for sending information to the control panel which makes the system easy to install. Control panel, acting as a home gateway, controls the operation of the system. In this work neither computer nor internet connection is required, once programmed, thus ensuring easy installation and portability [9].The home security system is needed for occupants' convenience and safety. The system is a wireless home network which contains a GSM/GPRS gateway and three kinds of wireless security sensor nodes that are door security nodes, infrared security nodes and fire alarm nodes. The nodes are easy

installing. The system can respond rapidly to alarm incidents and has a friendly user interface including an LCD (liquid crystal display) and a capacitive sensor keyboard. The wireless communication protocol between the gateway and the nodes is also suitable for other home appliances. Furthermore, some more methods are taken to ensure the security of system information. [10].

GSM is a digital mobile communication network which develops rapidly in recent years. Short Message Service of GSM is a value-added service based on data packet switching provided by mobile communication company using GSM network besides of all sorts of telecommunication services and bearer services based on the circuit-switched. Because the GSM network can be interconnected and roamed all over the country, it has strong network ability; the users have no need to organize another network. The coverage of the network is improved and the expensive network building and maintenance cost can be saved for users. At the same time, the number of its users is not limited. GSM network provides a strong platform for remote data transmission and monitoring the communication of equipment [11].

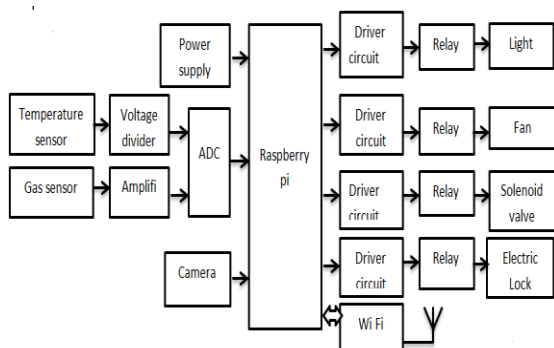


Figure1. Block diagram of home automation

III. DESIGN OF HOME AUTOMATION TECHNIQUE

In this proposed system consist of several sensors like temperature and gas sensors. The sensors are connected to processor. The processor are accessing the sensor values and processing them to transfer the data through Wi-Fi. Raspberry pi is used as a processor. The sensor data can be viewed on the mobile phone or laptop. In this proposed block diagram consist of several sensors like temperature, gas sensors. The sensors are connected to processor.

The processor is accessing the sensor values and processing them to transfer the data

through Wi-Fi. Raspberry pi is used as a processor. The sensor data can be viewed on the mobile phone or laptop. This proposed home automation monitoring and control system prototype is presented. The system consists of a Raspberry pi processor, a set of sensors, and a network connection module. It measures the parameters such as temperature and gas.

The experimental results showed that the system has great prospect and can be used to operate in real world environment for monitoring and control. Considering the previously proposed systems, the proposed prototype provides software module that allow users to visualize the data from the WSN without installing specific software.

The ultimate purpose of the proposed WSN system prototype is to automate the monitoring of home automation. The WSN sensor is the main building block of the developed WSN system prototype. It is equipped with sensor and processor, ADC, camera, power supply and relay. The sensor unit essentially consists of several sensors used for detection of gas and temperature parameters. In this sensors are connected to raspberry pi board for gathering the parameters. The Raspberry pi board will gather the data from sensors and convert that data into digital form and send that data to the users.

The WSN system gateway is one of the most important in the proposed system. It collects all the information received from multiple sensors. The developed gateway is equipped with processor and it has an in-built connection of Wi-Fi and memory card and connected power supply relay board.

Raspberry pi processor is used to acquire and process received sensor data from WSN sensor .Raspberry pi can sense the environment by receiving input from a different sensor (temperature, gas) and send the data. The processor on the board is programmed using python programming language based on processing.

In home automation system is used to control the home appliances and it improves the security of our house through IoT. The concept of Internet of Things is very much helpful to achieve real time monitoring of sensor data. Internet of Things (IOT) is a kind of network technology, which is based on information sensing equipment's such as temperature sensors, gas sensors and so on, can make anything join the Internet to exchange information, according to the protocol, which gives monitoring and management. Different type of sensor is used such as gas sensor and temperature sensor. The mq2 gas sensor is used for sensing the gas level. They are sensitive for range of gasses and are used indoors at room temperature .the analog signal to digital value using raspberry pi3.The mq2

gas sensor module is useful for gas leakage detecting in home and industry .It can detect LPG and smoke. Some modules have a built-in variable resistor to adjust the sensitivity of the sensor.

The temperature sensor is used to sensing the temperature level is increased /decreased. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μ A from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a -55°C to 150°C temperature range. The camera is used for monitoring our home and it con troll the door locking system .The door is automatically open after getting the confirmation from the user through IoT.The person has arrived the c amera start to capture the image.

The captured image sent to the custodian and he verifies that image and then unlocking the door. In this home automation technique ,different login is used such as Admin login, Guest login. The first login is used to control and monitor our whole home from anywhere.whenever custodian isn't arrived at home .some person come to our home the custodian can check he is a right person and enter login id password to open the door.In this system indicate the mischief in unlocking the door from unauthorized person.

IV.EXPERIMENTAL SETUP OF HOME AUTOMATION TECHNIQUE

In proposed system of home automation technique ,using raspberry pi connected with sensor's and camera for improving the security level of home and industries then gas sensor connected to amplifier and temperature sensor connected to voltage regulator then both sensor connect with analog to digital converter as well as camera and power supply. The processor have a in-built connection of Wi-Fi module and driver circuit connected with processor and then relay board and it controls the electrical appliances.

Raspberry Pi

Processor speed ranges from 700 MHz to 1.2 GHz for the Pi 3; on board, memory ranges from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or micro SDHC sizes and the boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm phono jack for audio output. The Lower level output is provided by a number of

GPIO pins which support common protocols like I²C. The Raspberry Pi 3, with a quad-core ARM Cortex-A53 processor, is described as 10 times the performance of a Raspberry Pi 1. This was suggested to be highly dependent upon task threading and instruction set use. Benchmarks showed the Raspberry Pi 3 to be approximately 80% faster than the Raspberry Pi 2 .

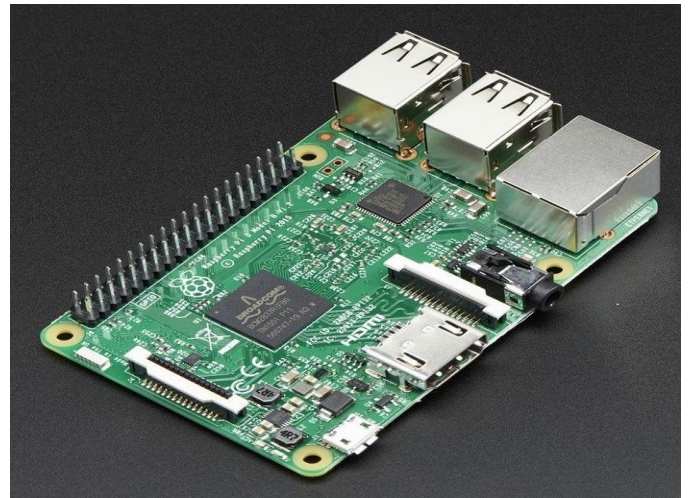


Figure2)Raspberry Pi 3

Relay Circuit

A Relay is electrically operated switches, which allow low power circuits to switch a relatively high voltage or current on/off. For a relay to operate a suitable pull in and holding current should be passed through its coil. Relay coils are designed to operate from a particular voltage often its 5V or 12V. The function of relay driver circuit is to provide the necessary current energizes the relay coil when a LOGIC 1 is written on the PORT PIN thus turning on the relay. The relay is turning off by writing LOGIC 0 on the port pin. In our system relay is used for device control.

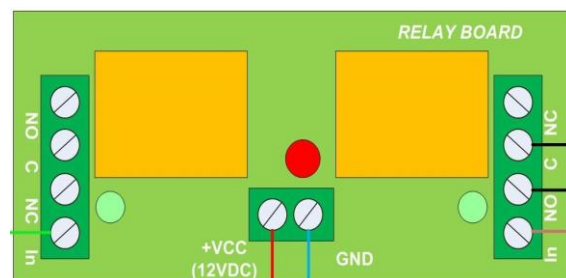


Figure 3)Relay board

Gas Sensor

Gas leakage is detected by the MQ2 gas sensor which is sensitive to certain inflammable

gases. In the event of a gas leakage, there is a notable change in the sensor's electrical conductivity which forms an analog input to the respective μC . This change in conductivity is identified by the sensor. It is suitable for detecting H_2 , LPG, CH_4 , CO, Alcohol, Smoke or Propane. It has high sensitivity, fast response time.



Figure 4) Gas sensor

Temperature sensor

The LM35 ICs are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 thus has an advantage over linear temperature sensors calibrated in $^{\circ}$ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^{\circ}\text{C}$ at room temperature and $\pm 3/4^{\circ}\text{C}$ over a full -55 to $+150^{\circ}\text{C}$ temperature range.

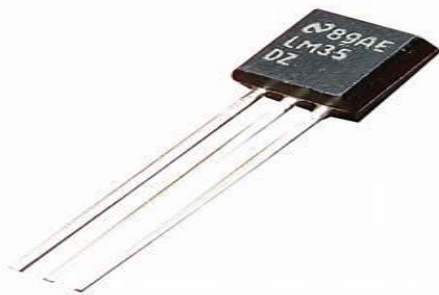


Figure 5) Temperature sensor

Camera

A camera is an optical instrument for recording or capturing images, which may be stored locally, transmitted to another location, or both. The images may be individual still photographs or sequences of images constituting videos or movies. The camera is a remote sensing device as it senses subjects without any contact. The word camera comes from camera obscura, which means "dark chamber" and is the Latin name of the original device for projecting an image of external reality onto a flat surface. The modern photographic

camera evolved from the camera obscura. The functioning of the camera is very similar to the functioning of the human eye.



Figure 6) Camera

Solenoid valve

A solenoid valve is a combination of two basic functional units:

A solenoid (electromagnet) with its core

A valve body containing one or more orifices

Flow through an orifice is shut off or allowed by the movement of the core when the solenoid is energized or de-energized. ASCO valves have a solenoid mounted directly on the valve body. The core is enclosed in a sealed tube, providing a compact, leak tight assembly.

The direct acting plunger solenoid valve is the most common and utilizes a rugged, proven working principle. When no electrical power is applied to coil the core spring, assisted by the fluid pressure, forces the plunger and the attached seal onto the valve seat and the path from the inlet to the outlet is blocked. When power is applied the solenoid coil generates enough magnetic force to pull the plunger and seal upwards against the spring and fluid pressure, the path from inlet to outlet is opened and flow begins.



Figure7) Solenoid valve

This type of valve has a broad field of application but should be restricted to neutral and clean fluids, as there is no separation of the media from the magnetic actuation and the fine tolerances make operation with dirty liquids difficult. Flow direction is usually from above the seat and these types of valves are available in both normally open and normally closed variants.

The maximum pressure the valve can open against depends directly on the nominal diameter, the spring force and the power of the coil. All of these valves employ quite weak springs and therefore have only low backpressure tightness. Impulse coils are also available which require only a brief current pulse to switch. The plunger is then held by an integrated permanent magnet. A second release coil is used to push the plunger away from the permanent magnet. No electrical power is required for holding the switched position and no heat is transferred during this time. Burkett offers this type of valve from orifice diameters from 0.05 mm to 6 mm. Both AC and DC voltages are available as well as a variety of body materials and connections.

Python

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library. Python interpreters are available for many operating systems. C Python, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations.

Python works on a core philosophy and follows its main principles in all seriousness. The

language was designed with the aim of making it highly extensible. This means that the language can easily be incorporated or embedded in existing application.

```
File Edit Format Run Options Window Help
Python 3.6.2
import GPIO as GPIO
import os
import time
from time import sleep, strftime
import sys
import python_sbc

GPIO.setwarnings(False)
GPIO.setmode(GPIO.BOARD)

relay0=01
relay0=02
relay0=04
relay0=05
relay0=06
relay0=07
relay0=08
relay0=09

GPIO.setup(relay0, GPIO.OUT)
GPIO.setup(relay1, GPIO.OUT)
GPIO.setup(relay2, GPIO.OUT)
GPIO.setup(relay3, GPIO.OUT)
GPIO.setup(relay4, GPIO.OUT)
GPIO.setup(relay5, GPIO.OUT)
GPIO.setup(relay6, GPIO.OUT)
GPIO.setup(relay7, GPIO.OUT)
GPIO.setup(relay8, GPIO.OUT)

GPIO.output(relay0, True)
GPIO.output(relay1, True)
GPIO.output(relay2, True)
GPIO.output(relay3, True)
GPIO.output(relay4, True)
GPIO.output(relay5, True)
GPIO.output(relay6, True)
GPIO.output(relay7, True)
GPIO.output(relay8, True)

s=0
s=0
s=0
s=0
s=0
s=0
s=0
s=0
s=0
s=0
```

V. RESULT AND DISCUSSION

The proposed model can control all electrical items from anywhere in the world and IoT technology has provide the information about electrical appliances. With reference to guidelines the relay board along with the Wi-Fi module is designed and implemented. Here IoT is used to send the information to user. The information are processed by the processor and monitoring and controlling of home appliances takes place. The status of home appliances can also be known by the user. The user enter the login id and password and can control the door locking system. Whenever, person arrived the user can check the status and then open the door to enter into the home and access the electrical appliances in the purticular chamber.

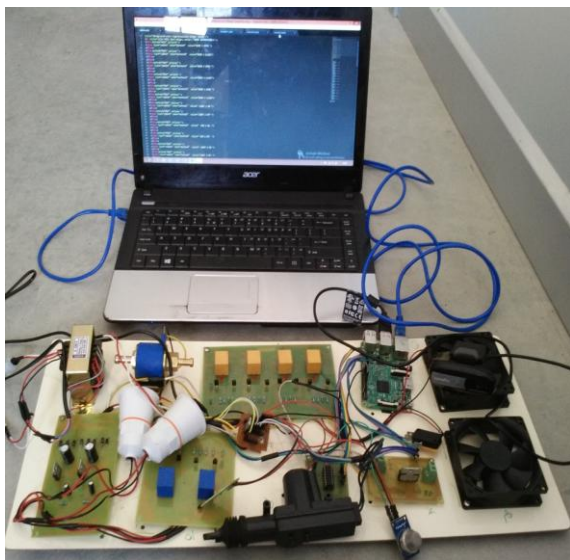


Figure 8) proposed system of home automation

VI. CONCLUSION

In this paper, a flexible home automation system is presented. Recently, the home automation market is very promising field that is growing very fast and needs vast range of developments that can be carried out in the concept of smart home. In this project design and implementation of smart IoT based house was considered. Raspberry Pi microprocessor with the cooperation of IoT provides the smart automated house system. A wide range of sensors are used to capture the readings of temperature and gas leakage the sensing devices making it an efficient system for security as well as for monitoring. In this system indicate the mischief in unlocking the door from unauthorized person.

VII. FUTURE ENHANCEMENT

In this system is used to improve living performance in the home. It controls the electronic house equipment from anywhere in the world. It is useful for daily busy peoples. Also, this system is very useful in smart cities project. This is very usefully in digital life. Some of the improvements that could be brought to the design of the smart home, both in terms of security and its features are as follows:

- A fingerprint authentication system could be implemented on the main user interface to achieve high security levels.
- Solar panels can be used to power the automation system.

In future, the system should display support in controlling more doors, windows and basic home electronic appliances. An auto trigger report of the attempt to theft can be sent to nearest police station along with domestic address.

VIII. REFERENCES

- [1] Shubham Magar, Varsha Saste, Ashwini Lahane, Sangram Konde, Supriya Madne. "Smart Home Automation by GSM Using Android Application", International Conference on Information, Communication & Embedded Systems (ICICES 2017)
- [2] Muhammad Asadullah, Khalil Ullah. "Smart Home Automation System Using Bluetooth Technology", National University of Computer and Emerging Sciences. Peshawar, Pakistan.
- [3] Vikram.N, Harish K., Nihaal.M, Raksha sUmesh, Shetty Aashik Ashok Kumar. "A Low- Cost Home Automation System Using Wi-Fi Based Wireless Sensor Network Incorporating Internet of Things (IoT)", 7th International Advance Computing Conference (IEEE 2017).
- [4] H. Bharathi, U Srivani, M.D. Azharudhin, M. Srikanth, M Sukumarline. "Home Automation by Using Raspberry Pi and Android Application", International Conference on Electronics, Communication and Aerospace Technology (ICECA 2017)
- [5] Vamsikrishna Patchava, Hari Babu Kandala, P. Ravi Babu "A Smart Home Automation Technique with Raspberry Pi using IoT", International Conference on Smart Sensors and Systems (IC-SSS 2015)
- [6] Rozit Teymourzadeh, Salah Addin Ahmed, Kok Wai Chan and Mok Vee Hoong. "Smart GSM Based Home Automation System", 2013 IEEE Conference on Systems, Process & Control (ICSPC2013), 13 - 15 December 2013, Kuala Lumpur, Malaysia.
- [7] H. ElKamchouchi, Ahmed ElShafee. "Design and Prototype Implementation of SMS Based Home Automation System" 2012 IEEE International Conference on Electronics Design, Systems and Applications (ICEDSA)
- [8] Carelin Felix, I. Jacob Raglend. "Home Automation Using GSM", Proceedings of 2011 International Conference on Signal Processing, Communication, Computing and Networking Technologies (ICSCCN 2011)

[9] Arbab Waheed Ahmad, Naeem Jan, Saeed Iqbal, Chankil Lee, "Implementation of ZigBee-GSM based Home Security Monitoring and Remote Control system"(IEEE 2011)

[10] B. Srinivasa Rao, S.D.V. Prasad and, R. Madan Mohan, "A Proto-Type for Home Automation Using GSM Technology"(IEEE 2010)

[11] Chen Peijiang, Jiang Xuehua, "Design and Implementation of Remote Monitoring System Based on GSM", 2008 IEEE Pacific-Asia Workshop on Computational Intelligence and Industrial Application.