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IOT based Home Automation using Raspberry pi

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Abstract*: Automation is the process of monitoring the home that can transform the home from being manual and static to a smart and dynamic one [1]. Life is getting simpler and more comfortable in all spheres with the use of technology and innovation. This paper proposes the Internet of Things (IoT) based home automation using raspberry pi 3 b. This system consists of a smart phone with a mobile application called Blynk which is having home appliances details with switches to ON and OFF the home appliances. We also included Garden irrigation and Gas detection system for less human effort, more convenience and more comfortable to the user for complete home automation. We used MQ-2 gas sensors for gas leakage detection and FC-28 for garden irrigation. In this paper home appliances are controlled through Wi-Fi technology [2].

Keywords* : IoT, Home Automation, WI-Fi, Blynk, Raspberrypi, MQ-2 gas sensor, Soil Moisture Sensor, Smart Phone, Cloud.

I. INTRODUCTION

In the 21st century the homes are becoming self controlled, more comfortable and convenient due to the advancement in technology. Home automation is the electronic control of household features activity and appliances. The concept of the internet of things first became popular in 1999. In 2015 there were 15.41 billion IoT users and now in 2020 there are 30.73 billion users. These statistics are enough to prove the importance of IoT. IoT is the internetworking of devices, vehicles, buildings, sensors, actuators, software and embedded systems to collect and exchange data. IoT is a system of computing devices, mechanical and digital machines with unique identifiers (UIDs) and the able to transfer data over a network without any human involvement in the process [3].

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Fig1: Internet of Things

IoT can sense the objects and control them using infrastructure. Because of all the above features of IoT we choose it as our main platform. Raspberry pi is a mini computer on single circuit board. We choose raspberry pi to implement our project because it is also useful to extend our project in future. In our experiment setup we integrated home automation, gas leakage detection and garden irrigation. Home automation controls the home appliances, gas leakage detection detects the LPG gas in the home and alerts the user through a message and garden irrigation system waters the garden whenever it is necessary. The operation of the project will be clearly explained in the methodology.

II. LITERATURE SURVEY

An efficient survey on home automation using IoT is very useful for perfect implementation of IoT systems for monitoring the home appliances. The home appliances will communicate with the home automation system through the internet. The internet will be connected to the system in many ways through wifi,zigbee,bluetooth..etc [4][5]. In this type of system the user roams all over the world and can control the home appliances from any part of the world using the internet. A home can be made smart by using various platforms and protocols. This paper contains information about how to make the environment smart using sensors like gas sensor and soil moisture sensor to collect the data from the environment and for updating to the network. In this paper "IoT based smart home automation using Rpi" we used the services of the BLYNK application which is helpful to control the appliances. We also used the services of twilio cloud services for sending a sms alert to the user. We worked on implementation of home automation because of its huge importance in the future. In the future home automation value in the market will be about US$10 billion.

III. METHODOLOGY

In our experiment we have integrated three different applications and made a single multipurpose system. The three parts are home automation, gas detection and garden irrigation.In our project, Raspberry Pi 3B is used to control relays and collect data from the sensors and act according to the data collected. We have connected two AC bulbs to the output. We can also connect a DC bulb or any other AC device at the output of these Relays. Raspberry Pi in this circuit receives IOT commands sent by the user using a personal mobile application called Blynk. Then the Raspberry Pi gives commands to the output devices using the Relay interface. Raspberry is very small computer with capability of doing many tasks. The relays are connected to the raspberry pi for controlling the appliances. In this way, we have completed home
appliances over the internet using Raspberry Pi. Python programming language is used in this Raspberry Pi project.

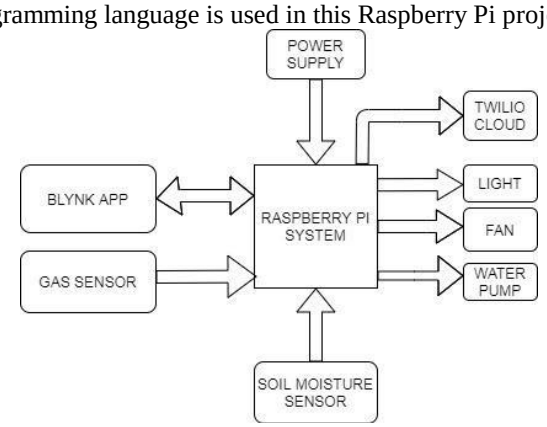

Fig2: Block diagram of IoT home automation

In the gas detection system we can detect the LPG gas in the home using the MQ-2 gas sensor. MQ2 is one of the commonly used gas sensors in MQ sensor series. The sensing material of the gas sensor has a variable resistance in different gas concentrations based on it we can detect the presence of the gas [6]. It can detect methane, hydrogen, propane, alcohol, smoke, LPG,CO from 200 to 10000ppm. This detection can be achieved by using the gas sensor MQ-2 which is interfaced to the Raspberry pi. Whenever the sensor detects gas, a voltage is generated in it and is given as input to raspberry pi. We are using a python code to read the output from the gas sensor and react according to the output from the gas sensor. Based on the amount of gas detected the voltage will be generated and given to the raspberry pi. If the gas leakage is greater than the threshold value of the gas sensor then an SMS is sent to the user using the twilio cloud communication platform [7]. We need to place our twilio account SID and account TOKEN in our python code. We will get SID and TOKEN while account creation in twilio platform. We can also add a buzzer to the circuit to alert the surroundings.While coming to garden irrigation the soil moisture sensor is placed in the garden in a position that the two pads of the sensor are dipped in the soil [8]. Sensor collects the data and update the data to the Rpi. Rpi receives the data and act according to the received data. If soil is not wet i.e. the sensor isn't detecting moisture it will send a signal to raspberry pi and the submersible pump will start pumping the water into the garden [9].

IV. SOFTWARE AND HARDWARE

Software Requirement

1. Raspberry pi operating system
2. BLYNK application
3. Twilio cloud services

Hardware Requirement

1. Raspberry pi
2. Relays
3. Gas sensor (MQ-2)
4. Soil moisture sensor (FC-28)
5. Submersible water pump
6. AC bulb
7. Smart phone
8. Connecting cables
9. Breadboard

V. EXPERIMENTAL RESULTS

Home Automation

Two different LEDs are used in this system instead of connecting home appliances. Lights, buzzer and motor are among the appliances that can be used in this system. Smart homes are useful to control and monitor the houses [10]. It can perform in several ways. In this system, Wi-Fi is used in order to control the devices in a small coverage area. Raspberry Pi is used as the board controller to connect the appliances via input and output port. Smart phone and Rpi are connected by a medium called wifi. In our project lights, submersible water pump, buzzer are connected to the relays i.e. they are indirectly connected to the Raspberry pi. Home appliances voltage is 230V, but the Raspberry Pi voltage is 5V. So, in this system, a relay circuit is used to cover the high voltage to low voltage, low voltage to high voltage which also act as a switch [11]. In this system, we are using two bulbs, a dc motor and a buzzer as home appliances. Here two-way relay is used in order to connect a zero watts bulb in 230 V. Next device is a DC motor. The DC motor needs the two 5V supply. But the Raspberry Pi board has only three 5V pins. So, the male header pins are used to connect the motor. Buzzer is connected to the Raspberry Pi in the assigned pin.

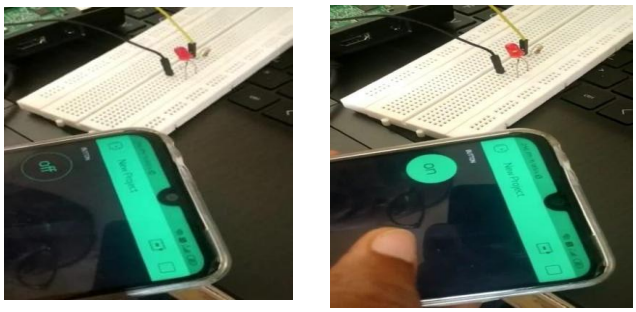

Fig3: ON/OFF of LED using BLYNK

Soil Moisture Detection

In this we collected the output of soil moisture sensor for monitoring the garden. We placed the sensor in the soil in a way that the two pads of moisture sensor are completely into the soil.

Whenever the soil is dry the resistance value is high so the sensor will send a signal to the raspberry pi so that the motor will be turned on. If the moisture in the soil is high the resistance around the sensor will be low, so due to the low resistance the motor will be turned off.

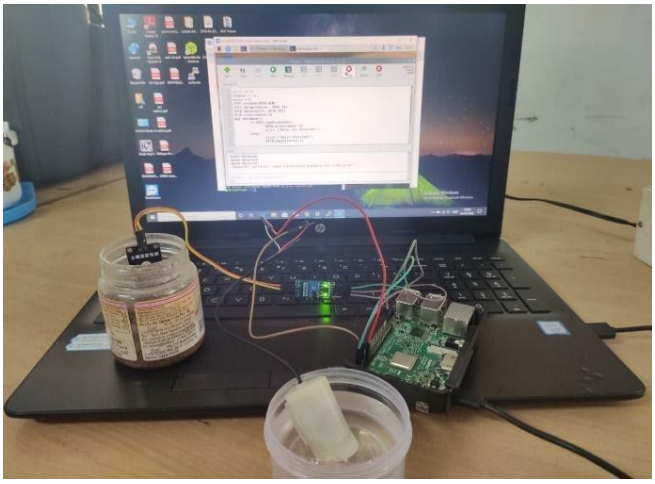

Fig4: Soil moisture detection

Gas leakage detection

In this part, an MQ-2 gas sensor is used to detect the gas in the house. Here the sensor is placed near the gas cylinder, in cases of leakage of gas the gas leakage detection system immediately send a sms to the house owner using twilio cloud services [12][13].

Fig5: Gas leakage detection

VI. CONCLUSION

In previous research we have seen all the above three parts of our project individually, this leads to the increase in cost and complexity. In this project we tried to integrate the above three parts so that the user can feel easy and comfortable while using them. We connected all the relays and sensors to the gpio pins of a single raspberry pi system. Here the home appliances require a 230V power supply but the raspberry pi gpio pins will support only for 5V, so relays are used to connect the home appliances to the raspberry pi. Raspberry pi can run a number of programs at a time so using that feature we integrated different applications to that system. The advantage of our project is that users can monitor the home and garden at a time. As this project is able to monitor and control the operations of home and garden, it can be called as complete home automation.

REFERENCES

1. Dhiraj Sunehra, M.Veena, “Implementation of interactive home automation systems based on Email and Bluetooth technologies”, 2015 International Conference on Information Processing”, VishwakarmaInstitute of Technology, [Dec 16-19, 2015].
2. Home Automation Using Internet of Things Vinay sagar K N1, Kusuma SM2 1Student IV SEM, M.Tech, Digital Communication. Engg, MSRIT,Bangalore, India 2Assistant Professor, Department of Telecommunication, MSRIT, Bangalore, India
3. Rajeev Piyare “Internet of Things: Ubiquitous Home Control andMonitoring System using Android based Smart Phone”InternationalJournal of Internet of Things 2013, 2(1): 5-11DOI:10.5923/j.ijit.20130201.02.
4. Weimei Zhang,"Study about IOT's application in Digital Agriculturеconstruction", Electrical and Control Engineering (ICECE) 2011International Conference, [pp. 2578-2581], 2011.
5. N. Sriskanthan, F. Tan and A. Karande, "Bluetooth based homeautomation system", Microprocessors and Microsystems, Vol. 26, no. 6,pp. 281-289, 2002.
6. Mahesh P Potadar, Pranav S Salvi, Ravindra B Sathe, Poonam SChavan.LPG Detection and Automatic Gas cylinder Booking System.IJERMTMay-2015 Volume 2, Issue-3.
7. An IOT Based LPG Leakage Sensing and Alerting System P. KanakaMaha Lakshmi, P.S.G. Aruna Sri, P.Gopi Krishna ISSN: 2278-3075,Volume-8 Issue-6, April 2019.
8. ChandankumarSahu, PramiteeBehera, “A Low Cost Smart IrrigationControl System”, IEEE Sponsored 2nd International Conference onElectronics and Communication System (ICECS 2015).
9. N. Agrawal and S. Singhal, "Smart drip irrigation system using raspberrypi and Arduino," International Conference on Computing,Communication & Automation, Noida, 2015, [pp. 928-932].
10. Rakesh k. Deore et.al (2015), “Internet of Things Based Home Appliances Control”, International Conference on Intelligence Communication Networks, 2015.
11. Jasmeet chhbra, Punita Gupta, “IoT based smart home design using power and security management system”,2016 1st International Conference on Innovation and challenges in cybersecurity(ICICCS)2016.
12. Mircea Murar, Stelian Brad, "Monitoring and controlling of smartequipment using Android compatible devices towards IoT applicationsand services in manufacturing industry", Automation Quality andTesting Robotics 2014 IEEE International Conference,[pp. 1-5].
13. E.A.Elkamchouchi,H.,“Design and prototype implementation of smsbased home automation system,”[pp.162–167],november2012.

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