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IOT Based Home Security and Automation System

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Abstract—In our research paper we represent a system that uses the internet networking to provide an easy path to our user to control the different appliances at home. The data that is provided from sensors will be saved in network cloud and it will automatically update according to condition. There are many researches relevant to our research. But the difference is the way of control of the system. Our system is too human friendly that a common man can easily understand it that how to operate. The other thing is the price which less than some other such products in the market. And one more thing is that our control system has its unique IP address to connect to its home, which is a unique addition and resultantly decreases the response time of the sensors or commands from the person. Moreover, if we just concern our project with an application installed on the cell phone, then it consumes more energy and there will be security constraints with reference to portable device present as well. Our system allow easy and quick access of information. It enables user to access file by computer anywhere in the world. It extends internet productivity gain to things not just to people as more data is generated by things than just by people.

Keywords— IOT(Internet of things); HAS(Home Automation System); Relays; RasperryPi; Appliances; GPIO (General purpose input output); Application Layyer Gateway(ALG); USB(Universal Serial Bus); Radio Frequency Identification(RFID); Integrated Circuit(IC); Liquid Crystal Display(LCD); Direct Current(DC)

I. INTRODUCTION

As we know that today world is progressing very fast, things are becoming easy then before. People are considering the automatic devices instead of manual devices. They just want an easier approach to some device. This field of automation is growing very fast. Internet is the basic part of the world's communication. It is also being used to communicate between the devices to operate accordingly. For the last few decades the use of internet has enormously increased. Internet of things is a field in which you can share all your required information from your specified file even when you are busy. It can access every information from a mini gadget to complete industry. Internet of things based home automation and security system is a system in which you can control the each and every object of your home form any part of the world by using internet through your mobile phone or your personal computer and you can also collect the

information related to atmospheric condition from your home like temperature, humidity etc. And with this there is another application to secure your home from any theft or hazard.

We are living in 21st century where we are automating our things for our comfort form a little room to the whole industry. Yet there is a existence of technologies for home automation in which the communication between the devices is controlled through the wired communication. It is too much costly if it is not installed while the home is under construction. So the easier way to access the easiness of home automation is by using internet of things based home automation. [1]

Internet of things based home automation is too much beneficial due to some reasons.

It is less costly for installation.

It had a wide range of control of appliances.

It is also an energy saving system.

It is better for the security of your home.

Control is easily access able to your cell phone or PC.

The main focus of the paper to address applications of internet by implementing IOTs based home security and automation system. It is basically a system in which the user will login to his personal account relative to his own house and he will control the appliances in his home through that website by using internet [2].

Our system is too human friendly that a common man can easily understand it that how to operate. The other thing is the price which less than some other such products in the market. And one more thing is that our control system has its unique IP address to connect to its home, which is a unique addition and resultantly decreases the response time of the sensors or commands from the person. Moreover, if we just concern our project with an application installed on the cell phone, then it consumes more energy and there will be security constraints with reference to portable device present as well. Our system allow easy and quick access of information. It enables user to access file by computer anywhere in the world. It extends internet productivity gain to things not just to people as more data is generated by things than just by people.

The paper is organized in such a way that literature survey is discussed in Section II. Section III is based on system description. Test-bed description and system evaluation are expressed in Section IV with conclusions and future work discussed at the end.

II. LITERATURE SURVEY

A. Home Automation System

The basic definition of home automation system is to create a networking between home appliance and devices so that all the appliances in a house can be controlled through a single machine [3]. There is another term for this and that is smart home. Just imagine the time when you move into your house and turn the light ON with not touching the light board switch. Imagine the moment when you are out of house and don't have any tension about the safety of your home. All these integrated system makes a home known as smart home.

B. Device To Device Communication

In device-to-device communication as mentioned in the Figure 1, there are two or more devices, which are directly, connect with each other. These devices are connected with each other with many types of sources like Wi-Fi or ZigBee etc, which are helpful to establish a direct communication between two or more devices [4].

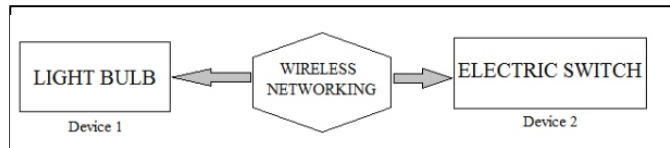


Fig. 1. Device-To-Device Communication

This device-to-device communication is used where the communication between devices holds small data packets of information. Its best example is home automation where different devices like light bulb, light switches, thermostat, and door lock etc [5]. This shares a small amount of data with each other. But these protocols of existing device-to-device communication are not compatible with each other. It means that you are not able to communicate between two devices with Bluetooth if your protocol is based on ZigBee.

C. Device To Cloud Communication

In this communication network as mentioned in Figure 2, our IOT device is connected with the cloud network, which is an application to exchange data. For device to cloud communication we use our existing sources like wired Ethernet and internet.

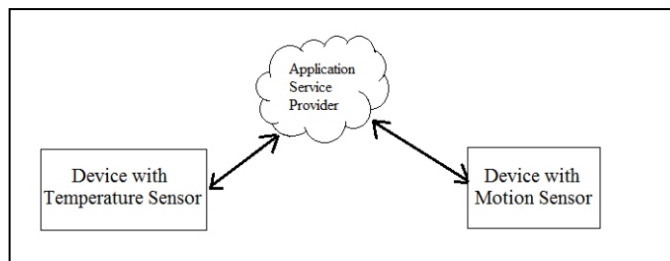


Fig. 2. Device to Cloud Communication

Some popular consumer of IOT devices like Home Nest uses this communication model. For example, in case of nest

learning thermostat, a device which is used to maintain the temperature at a specific point, that device transmit its data to the cloud through internet and that data is used to evaluate the consumption of energy in a home. Further that this application, user can also access to that thermostat data for evaluation. But there is a limitation in this field that you can just use the device and cloud of the same manufacturer only [6].

D. Device To Gateway Model

In this model as mentioned in Figure 3, our IOT device is connected with cloud through an application layer gateway (ALG). That ALG act as an intermediary source between cloud and IOT device [7].

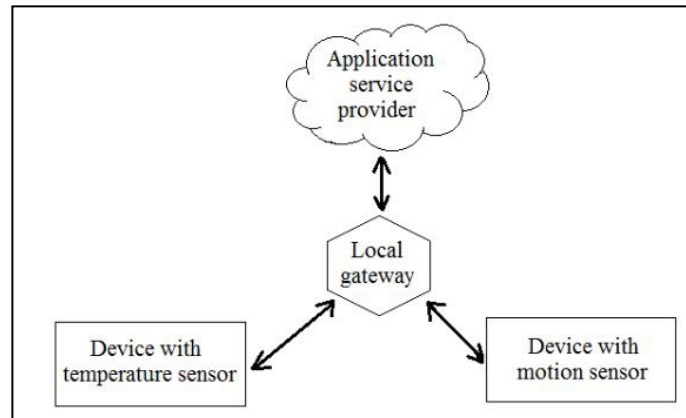


Fig. 3. Device to Gate Way Communication

There are many kinds of this model that is found in user devices. In many cases the ALG is the smart phone of user from which he runs the app in his smart phone and starts to communicate with their devices with relay via cloud networking. Basically it is a form of local software application, which is an intermediate source of communication between IOTs device and cloud network. This is for such devices, which are not able to connect directly with the cloud network but with some auxiliary source or application, like for example our fitness tracker that uses a mobile application to communicate between cloud network and IOT device [8].

E. IOT Issues

Issues related to the IOT consist of security and reliability. To ensure that our IOT product and its connected devices are secure or not is the first priority of every vendor. As today's the trend towards connecting the devices with internet has enormously increased. So the poorly secured IOT device can easily be attacked by cybercrime and then it allows to an individual to re-program or to cause malfunction. And these should be reliable [9].

F. Smart Home Today

The trend of people towards smart home is increasing day by day. People are trying to adopt automation for their convenience and security. According to a research, by 2022 a typical family could contain more than 500 smart devices in their home [10]. It creates convenience for them. Smart home just makes your life easier and with the advancement of

technology there are new application arises in the field of smart home.

III. SYSTEM DESCRIPTION

In our research paper, the complete structure consists of different devices. Raspberry pi is a credit card sized single board computer basically a microcontroller that is used in our project. That is used to interface different devices with it. Linux is its operating system. Out of 20 pins, 15 pins of raspberry pi are GPIO pins used to connect the devices with it.

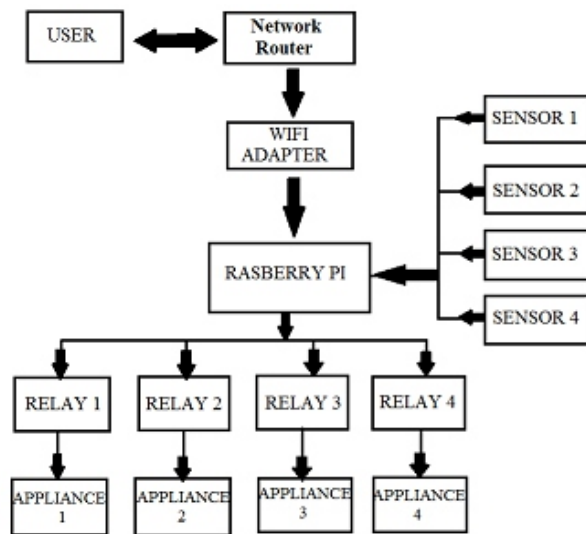


Fig. 4. Block Diagram

Microcontroller is connected with Wi-Fi adapter to access to the networking cloud. The user will connect his specific device to the internet and login to his respective home automation site. He will send the command, which will be received by microcontroller through internet. According to the command the microcontroller will perform his action on the appliances, which are connected to the relays. Microcontroller give signal to the relay and it will switch ON or OFF the respective device according to user command.

The mechanism of operation is the following:

User enters IP address at remote location through his Personal Computer (PC) or cell phone.

Access Graphical User Interface (GUI).

There are buttons related to the IOT devices to give command to microcontroller.

Sends the command to switch the specific device.

Command will be received by microcontroller through internet.

Microcontroller will take action according to the command and switch the relay connected to respective device.

With the operation of that relay, device will operate according to the command.

User monitors automation and security system parameters frequently.

User originates control command to the modem

Our whole system is divided into different section and each section is described individually here. These different sections are kits relative to specific functions. Our main kit, which is most important, is our microcontroller. It is raspberry pi microcontroller as shown in Figure 5, which is the mind control of our project, our whole specs are controlled by our microcontroller by sending command to it or receiving information through it. It has general purpose input output (GPIO) pins through different peripherals are connected with it. It has built in universal serial bus (USB) ports through which we can connect our Bluetooth device to access internet to our microcontroller and it also have Ethernet port to connect internet with it.

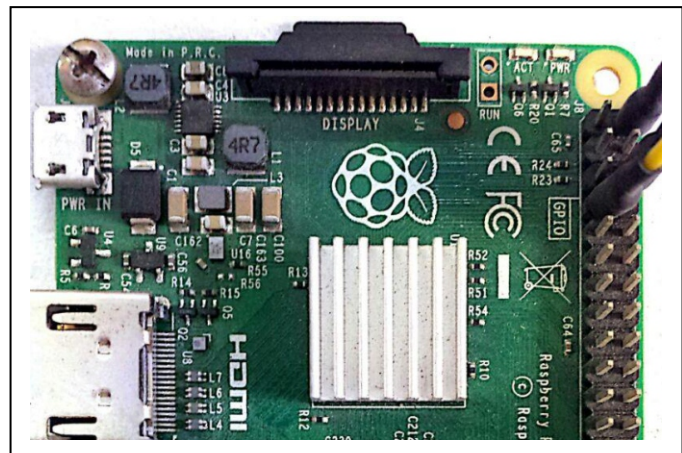


Fig. 5. Raspberry Pi

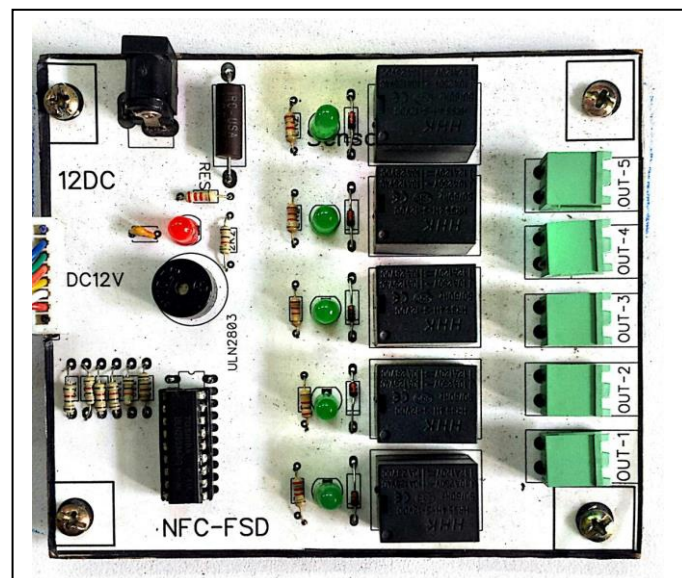


Fig. 6. Relay Kit

There is another kit, which is used to control the load according to our given command, known as relay kit as shown in Figure 6. It consists of number of relays depend upon the

number of loads to be controlled. These relays get the command signal from our microcontroller and switch the load according to our command. The load is connected with our relays. As the “ON” command signal is received by the relay, its contact are set to the state where its contacts closed and load is supplied by the power and when “OFF” command is given to relay kit then that specific relay’s contacts open and disconnect the power to the load.

The other kit is the sensor kit as shown in Figure 7. This kit consists of connection of sensors and that kit is indirectly connected with microcontroller. These sensors sense the climatic condition and send to the microcontroller which is displayed on our website. The kit consists of light emitting diodes (LED) and the short circuit protection to control the kit from being damaged.

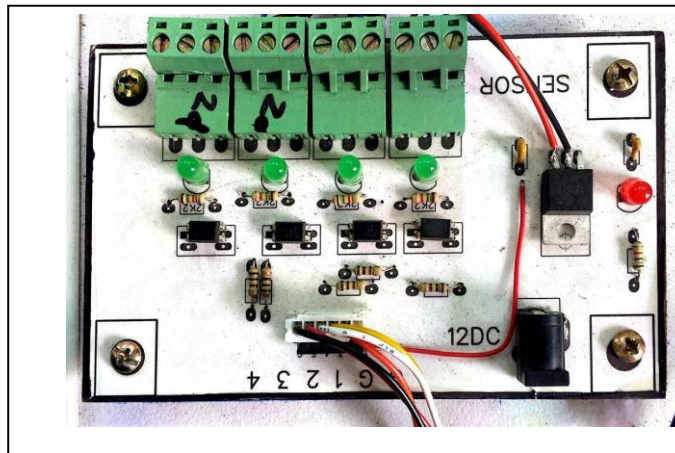


Fig. 7. Sensors Kit

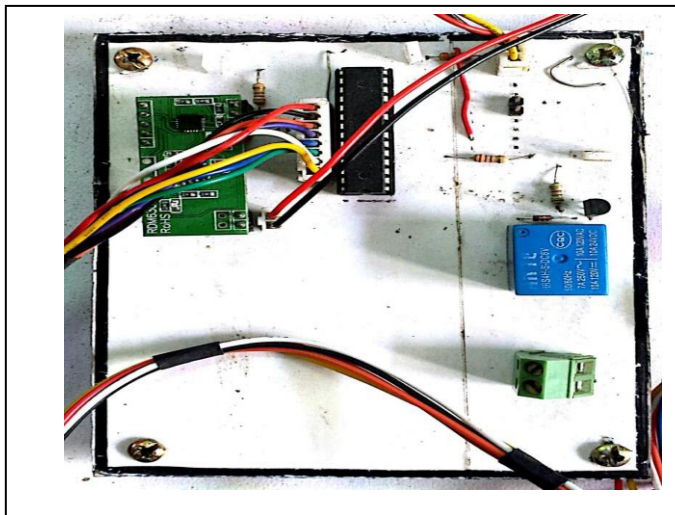


Fig. 8. RFID Kit

The other kit is radio frequency identification (RFID) kit as shown in Figure 8 which has an ability to control the RFID coil to open the door lock when you are outside the home. It just need to scan you RFID card with your RFID sensor coil and the door lock will open. This kit has its own

microcontroller named as PIC microcontroller. It is basically an integrated circuit (IC), which is programmed accordingly to perform our specified function as in our case to control RFID circuit.

There is a liquid crystal display (LCD) as shown in Figure 9, which is used to display the status of the door of our house. It will show status of “OPEN” when our door is unlocked by using RFID kit and will show “CLOSE” when there is no such command through RFID kit.

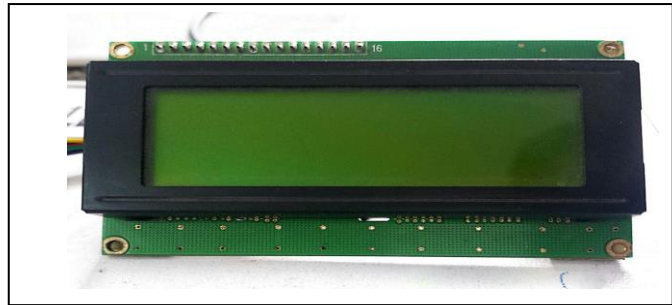


Fig. 9. LCD

There are some sensors, which are used to ensure the home security. It consists of a motion sensor, which is used to detect the motion of any person in the home when you are out of home. A heat sensor, which is used to sense the fire through its heat and to create, and alarming situation to know about the condition. A light sensor to know about the atmospheric condition. A temperature sensor, which is used to inform you about the climate temperature. A humidity sensor, which is used to know the percentage of humidity in atmosphere. All these sensors send their information to the microcontroller which is further sent it to the website through interment.

The power to our control system is direct current (DC) power source. There are two power sources in our control system. One is 5V DC, which used to give power to our raspberry pi microcontroller. Its required power is 5V DC. And another power source is 12V DC, which is used to power up the remaining kits of our circuit.



Fig. 10. House Load Model

The load in real life is consist of 220V system but in our project we have created a small house model as shown in

Figure 10 which consist of 2 rooms and 1 hall, and the total appliances in our model are three 12V DC bulbs, one 12V DC fan and one 12V DC water pump which is used in comparison to our motor in real life. This all equipment's are powered by a power supply of 12V DC.

The other main part of our project is the website through which we control our different loads or appliances. The website consists of different switches and the sensors inputs as shown in Figure 11 and Figure 12.

IV. SYSTEM EVALUATION

The main part about system evaluation is basically the response of internet. Response is basically defined as the time elapsed between the initiation of the command and command completion.

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Description	On	Off
Switch 1	<input type="checkbox"/>	<input type="checkbox"/>
Switch 2	<input type="checkbox"/>	<input type="checkbox"/>
Switch 3	<input type="checkbox"/>	<input type="checkbox"/>
Switch 4	<input type="checkbox"/>	<input type="checkbox"/>
Switch 5	<input type="checkbox"/>	<input type="checkbox"/>

Fig. 11. Switch's Section

Sensor Name	Status
Light Sensor	Dark
Humidity Sensor	98
Temperature	98 Celcius
Fire Sensor	2134
Motion Sensor	2134

Fig. 12. Sensors Section

That response time most of the time depends upon the speed of internet. The more better the speed of internet, the more will be the quick response of our relays to enable or disable the load. It does not depend upon the distance upon which the response time depends upon. The other factor upon which is

the amount of traffic on the website. The more the traffic, less will be the response time of our device and vice versa.

V. CONCLUSION & FUTURE WORK

The IOTs based home security and automation is very useful for remote users. Any home can be monitored and controlled by using the prototype implemented in this paper. This IOTs based system is the building block of all internet based diverse applications. The system developed in this paper is cost effective solution of IOT applications. The modules used in its formation are light, easy to use and cost effective. It also enables easy operation and quick access of information. It enables user to access file by computer anywhere in the world. It extends internet productivity gain to things not just to people as more data is generated by things than just by people. It is a prototype which provides reliable, cost effective and efficient IOT applications solution to the whole world i.e.; our system is applicable on other many things, some of them are mentioned below:

Healthcare system to monitor the health of the patient.

Crowd monitoring

Traffic management in terms of intelligent transportation system and to optimize the path.

Infrastructure monitoring to monitor the building infrastructure to avoid any hazard and to maintain the building.

Water management system to check the quality of water and its leakage and other such terms.

SCADA system to monitor the grid station.

Surveillance system.

Environment monitoring system to monitor the noise pollution or air pollution etc.

Smart Greenhouse system to control its parameters through web.

There are many other fields in which we can use IOTs to modify that field and make it a field called smart field.

VI. ACKNOWLEDGMENT

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