Home Automation Using Internet of Thing

Shopan Dey
Department of Electronics and Communication Engineering
University of Engineering and Management
Jaipur, Rajasthan, India
shopan222@gmail.com

Ayon Roy
Department of Electronics and Communication Engineering
University of Engineering and Management
Jaipur, Rajasthan, India
ayonroy56@gmail.com

Sandip Das
Department of Electronics and Communication Engineering
University of Engineering and Management
Jaipur, Rajasthan, India
info.sandipec@gmail.com

***Abstract*—In this era of digitization and automation, the life of human beings is getting simpler as almost everything is automatic, replacing the old manual systems. Nowadays humans have made internet an integral part of their everyday life without which they are helpless. Internet of things (iot) provides a platform that allows devices to connect, sensed and controlled remotely across a network infrastructure. In this paper we focus on home automation using smart phone and computer. The iot devices controls and monitors the electronic electrical and the mechanical systems used in various types of buildings. The devices connected to the cloud server are controlled by a single admin which facilitate a number of users to which a number of sensor and control nodes are connected. The admin can access and control all the nodes connected to each user but a single user can control only the nodes to which the user itself is connected. This whole system using Internet of Things (iot) will allow mobile devices and computers to remotely control all the functions and features of home appliances from anywhere around the world using the internet connection. The system designed is economical and can be expanded as it allows connection and controlling of a number of different devices.**

***Index Terms*—Internet of thing (IoT), home automation, cloud computing, WiFi Module (ESP8266), Arduino.**

I. INTRODUCTION

The recent scenario shows that in this century of digitization people are fond of automatic devices which are often referred to as smart devices. Since 2013 with the development of new technologies, the Internet of Things (IOT) has also emerged to make smart devices smarter. Earlier in the 1990's almost every home consisted of electrical appliances such as television, heater, air conditioner, washing machine, induction, electronic security systems and other electronic and electrical devices which were manually controlled making a smart home. With the evolution of Internet of Things (IOT) all these manually controlled electrical and electronic devices can be controlled automatically. In 2011 it was predicted that IOT'S application will focus on mainly on the smart city construction and digital agriculture construction. China Communication Standards Association gives three layer structure of IOT: The first layer is the sensing layer mainly used for collecting information; The second layer is the network layer used for information transmission and processing; The third layer is the application layer used for storage and decision making [1]. The main concept of IOT is that it can create a virtual connection between a hub or a network and electronic and electrical objects. This virtual connection helps to control, locate, and track down these connected objects. On the basis of device-to -device connectivity concept the development of smart sensor together with communication technologies such as Wi-Fi, Bluetooth etc. and supported by cloud computing technologies, IOT has become reality and it's goal is to make devices more aware, interactive and efficient for a better and safer world [2]. The IOT technologies although have evolved over

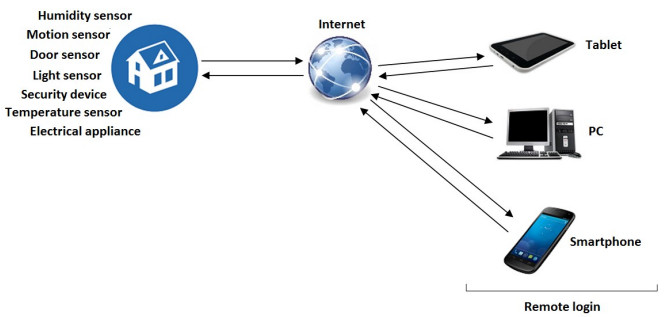

Fig. 1: Proposed home automation system

recent years, most of the earlier work steered towards adopting the IOT technologies for extremely resource contained nodes

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like the sensor network node that simply sends collected data to base station and a little work done on applying IOT technologies into embedded devices around human beings including customer appliances [3].The IOT application have become this popular in this 21st century is due to the dominant use of the internet, evolution of smart phone technology and raised standards of mobile communication [4][26]. In this evolutionary field of IOT, there are a lot of sensors present which the user needs to have control. Now to control these sensors a virtual device must be created which in turn provide portability by abstracting each devices and operating systems [5]. The need for the Internet Of Things (IOT) technologies for home automation system have increased due to the increase in the demand of communication between the home and the outside world [6][18][19][22]. The IOT will infiltrate everyday life in many shapes and forms, and the research community needs to prepare for a security-conscious [7][20]. The Key technologies that will drive the future IOT will be related to Smart sensor technologies including WSN, Nanotechnology and Miniaturization [8]. With the help of IOT, even over great distances the user can monitor and manage their home gate, various appliances and turn on/off the T.V without any human intervention [9]. Recent advancement in cloud computing and data analytics allows intelligent systems to process and analyze the data in a more efficient manner [10]. On the basis of study of the risk associated with home automation system, a step towards a general model of privacy and security for smart homes is taken [11]. Home automation is a forward step is Internet of Things in which everything has configured with an Internet Protocol (IP) addresses, and can be monitor, control and access remotely with the help of web technology [12]. The work attempts to propose a new approach for Home Appliances Controlling Environment, and improve user experience by enhancing two main aspects: Compatibility and Usability [13]. Combining and analyzing data from sensors in wearable electronics, cameras or sound collectors with secure communication is essential to technical solutions where the individual security is in focus [14]. The sensors advanced sensing functionalities and their increasing accuracy enable the development of smart home applications that offer advanced automation [15].The most essential element that is required for making a smart home is an IOT based information centre which will act as a platform for the architectural building block of the whole system. The IOT architecture enables smarter, connected and personalized healthcare and wellness services to the persons in smart homes [16][24]. IOT based home automation is applying new technology to make the housework and household activities more convenient, comfortable, healthy, green, safe and economical [17][25]. A Gesture-based control, using vision or wearable sensors, is another important branch of IOT based remote control [21]. Connectivity is the backbone of IoT that is established by communication standards variety of wireless network protocols are being used in smart home applications [23]. In the IOT networks, some of the devices are embed on quotidian objects and therefore they must have small size, restricted computational resources and energy constraints [24].

II. System Analysis

A. Proposed system feature

In this paper the designed model of home automation fulfills the unique demands of the increasing population of today's world. The peak advantage of our model is that the functionality of an array of electrical and electronic devices can be controlled with ease. Sometimes the busy life and traffic makes it difficult for us to be at work and to be at home at the same time. One of the features of our model makes it possible as it provides home system accessing remotely saving a lot of time. Another feature of our proposed model is that turning of lights and fans and other electronic and electrical devices remotely if they are not in use helping to manage the energy consumption of that home. To control these appliances remotely smart devices needs to be synchronized with the main server. The user may use the login id and password to change the status of any appliances saving time, energy and money. In addition to that our proposed model provides absolute security.

If the user is not sure of weather closing the door or switching on the security alarm, the user may check the data on-line from the database present along with the main server and change the status accordingly. In there is any intruder the system automatically alerts the user with a message helping the user to take action as soon as possible. Altogether our home automation system provides 100% efficiency as it saves time, helps to manage energy consumption which in turn saves money and provide optimum security to the user making the user's home a safer and a smarter place to live in.

B. Network architecture

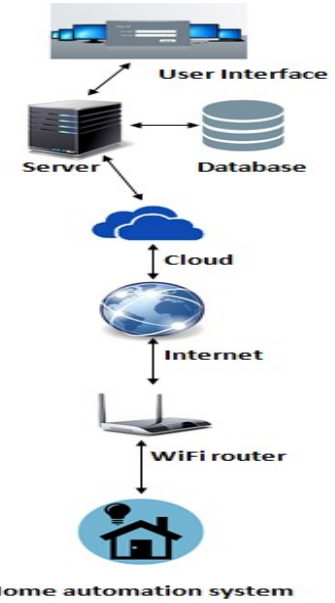


Fig. 2: Network architecture

The main ingredient for any IOT based operation is a server. The centralized sever acts as the heart of all the IOT rooted operation. In this paper the amazons cloud server is used for data storage, sensor feedback and control. A virtual connection between the server and the IOT devices needs to be created. There are several ways to make a internet connection from which we have used point-to-point web socket. A programming language known as the PHP is used to create the point-to-point web socket and a web application for communication with IOT device and taking logical decision. Through this point-to-point web socket a internet connection is made between the home automation system and the server. Due to this connection IOT devices will now be able to send and receive data to the cloud server. All the received data of the server is stored in a database present along with the server. The user may go through all the data stored in the database of the server anytime from anywhere with the help of a web browser or with the assistance of an android application embedded in an android device synchronised with the main server and the IOT devices. To connect the android device with the main server Google Cloud Messaging (GCM) is used. To provide optimum security to this whole system an unique login id and password is provided to each user at the time of installation. Any user can only go through the data of his/her devices connected with the main server with the help of the login id and password and can change the status of his/her any IOT devices connected with the main server but the admin can access the data of all the devices connected and can change the status of any devices connected to the main server. All the above operation will not work and will show an error if the whole system is not online. Here the internet acts as the backbone of the whole system. This proposed model will provide easy control and ensure 100% security if the IOT devices and the user are connected to the internet.

III. System Design and Implementation

A. Software design

The PHP programming language is used to create a pointto-point web socket and a web application. After creation of such a socket, it is connected to the Amazon cloud server with the help of the internet connection. Now as the whole system is now online, it will look for the received messages from the connected IOT devices as shown in fig 4. Ones the data is received, it will show notification and will refresh the data after certain interval. This refreshed data will be send to the control user interface. The control user interface is everything that the user has to act upon. The received data in the control user interface is shown in the monitor or on the control screen. Now to change the status of any devices the user needs to obtain the registered id from the Google Cloud Messaging (GCM). To register the user needs to send a request to the GCM. In response to that the GCM will send the registration id and a unique password shown in fig. 5. The registration id is then send to the subscription API which sends notification and registration id to the GCM. The GCM in turn sends the notification to the client having that registration id. As now the user has the registration id, the user can send command to the connected IOT devices. As the user login, the user can control all the electrical and electronic devices in every section of the house. By entering to each window as shown in fig. the user can change the status of each appliances and can control the security system. This cycle continues until the server or the connected IOT devices is not connected with the internet.

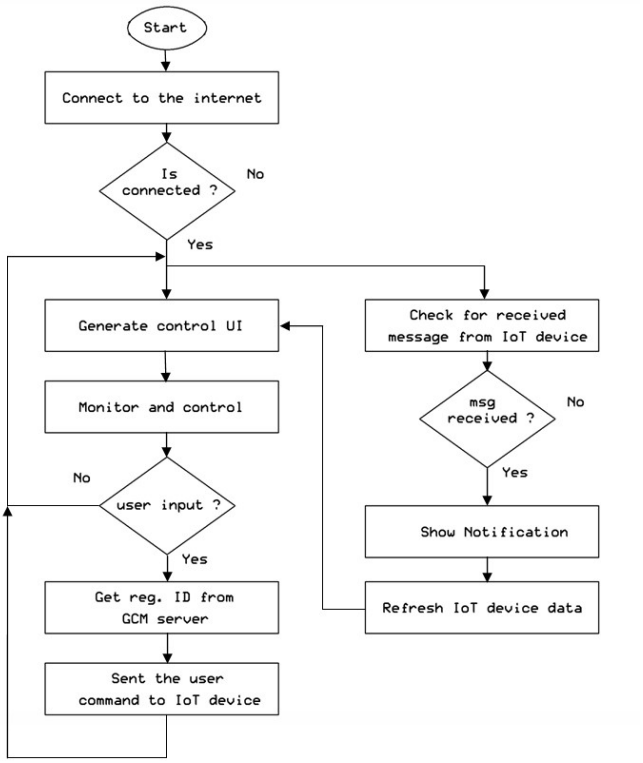


Fig. 3: Flowchart of android application

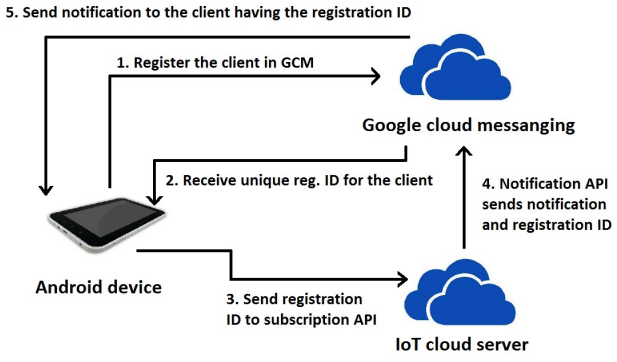


Fig. 4: Functional block diagram of android application

B. Implementation setup

To implements our home automation system we have design a experimental setup as shown in fig. [6]. Where we used raspberry pi as a main controlling unit. And a relay board

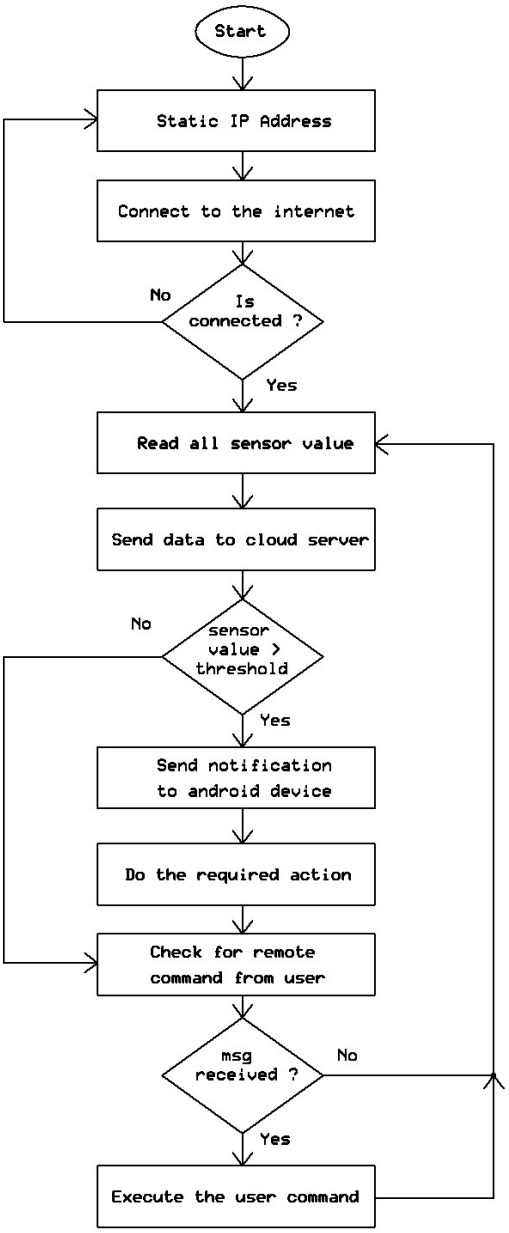


Fig. 5: Flowchart of home automation controller device

to control electrical home appliance. To read environmental temperature and humidity we also used a temperature and humidity sensor module. In our system there also have four mechanical limit switch for door security for four individual door. Which will active when any unauthorized person open the doors. For more security we also used two PIR sensor to detect motion on two different places. In our system there also have a automatic light controller to automatically control the garden light depend on environmental lighting condition. And we have included a blue-tooth module in our system to connect android and other device with our system. We have tested our home automation system on our experimental setup.

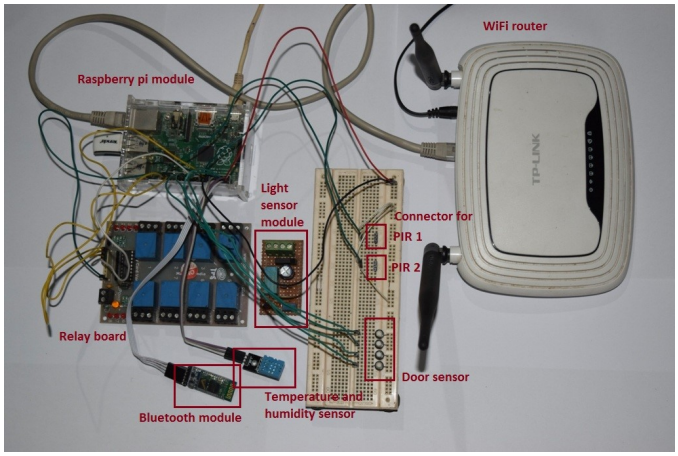
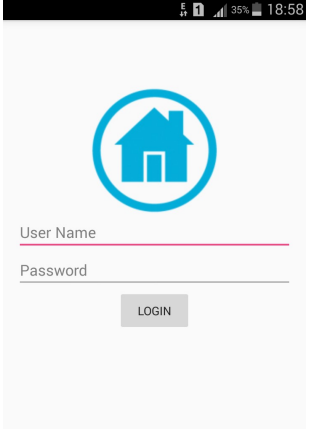


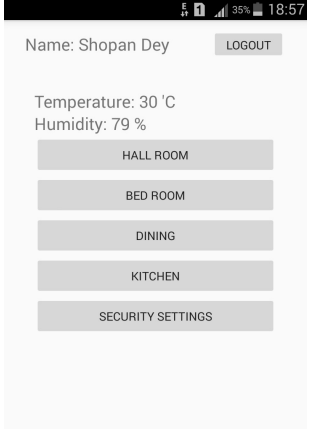
Fig. 6: Experimental setup

Which is successfully worked without any error.

IV. RESULT

The IOT system we have developed is tested by installing smart sensor units and setting up a server for few houses. After installing the smart sensor units, the user needs to install the software to his/her laptop or smart android phone. After proper installation of the provided software the user needs to sign-up on the home automation server. Once the user is registered, a unique user id and a password is provided to the users of each house in which the sensor units are installed. After the user id and the unique password are obtained user can login from our android application. When user start the android application first a login page will appear as shown in fig.[7]. It was observed that the user can successfully login. As soon as the user login, a home page will appear in which the user could keep a track of all the electronic and electrical devices which are connected with the server as shown in fig [8]. Our designed model of home automation can also controlled by using any web browser. To operate home automation system user need to go web-page of home automation system then a login page as shown in fig. [11] will be appeared. By login in this page the main home automation page as shown in fig. [12] will showed. From this page user can control his/her home appliances and change the security settings. This was possible due to the database present with the server which stores all the data received from the server. A threshold value is provided to each sensor connected. If the sensor parameter exceeds the threshold value provided an automatic alarm is triggered. Once the user is notified that the value of a particular sensor has exceeded, the user can immediately change the status of that device from anywhere





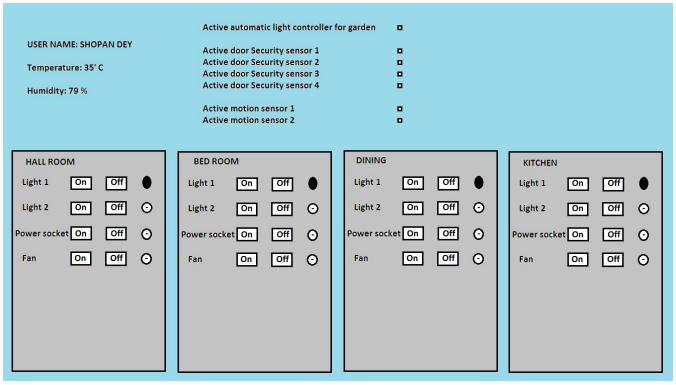


Fig. 12: Home page of home-automation system web-page

around the world with a computer, or with a laptop or with a smart android phone. Our designed model of home automation provides 100% efficiency in terms of communication with the sensor electrical and electronic devices and also provides 100% efficiency in terms of security as it has a single admin who can control all the connected devices.

Fig. 7: Login screen

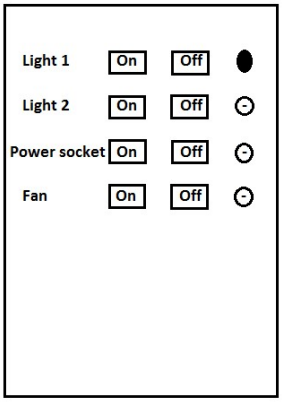


Fig. 8: Main screen

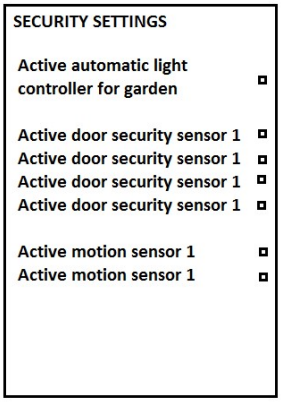


Fig. 9: Control screen of each room

Fig. 10: Security settings screen

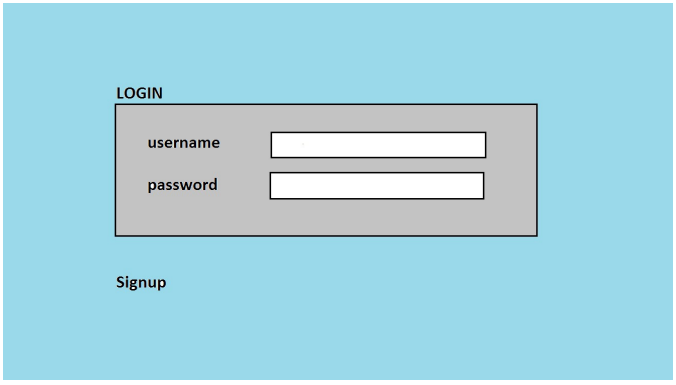


Fig. 11: Login page of home-automation system web-page

V. Conclusion

In this paper we focus on the process of operating or controlling various equipment, machinery, and other electrical and electronic appliances using various control systems remotely. This method of operating or controlling such applications is referred to as automation which has become an integral part of everyday life for human beings. The working model we designed has its focal point on home automation providing 100% efficiency. The model has its roots on an IOT platform that allows devices to synchronize with the IOT platform so that it can be controlled remotely. The platform uses the IOT technology to create a network between the main server and the other electrical and electronic appliances making home a smarter place to live in. The whole network consists of a single admin which makes our model a secure one as the admin only have the authority to access all the nodes present under each user. The model is quite economical as though there is only a single admin but the number of user under the admin may increase making a large complex network but a secure one. For future work we would try to increase the number of networks under a single server making a whole city automation using IOT.

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