Smart Home Utility System Using Internet-of-Things

Mrs. Veena Potdar[1], Prof. Prabha R[2]

[1]*Associate Professor, Department of CSE, Dr.AIT, Bengaluru.*
[2]*Professor, Department of CSE, Dr.AIT, Bengaluru.*

Abstract - *Smart home has evolved from exclusively referring to the centralized and semi-automated control of environmental systems whereas Internet-of-Things (IoT) is the expansion of internet services. Applications of IoT are increasing. Uses of new technologies in IoT environment are increasing rapidly. It has been already developed in Industrial Wireless Sensor Network (WSN). A smart home is also one of the applications of IoT. Rapid growth in technologies and improvements in architecture comes out many problems that how to manage and control the whole system, Security at the server, security in smart homes, etc. This paper presents the architecture of IoT. Smart homes are those where household devices/home appliances could monitor and control remotely. When these household devices in smart homes connect with the internet using proper network architecture and standard protocols, the whole system can be called as Smart Home in IoT environment or IoT based Smart Homes. Smart Homes ease out the home automation task. This paper presents not only the problems and challenges come in IoT and Smart homes system using IoT but also some solutions that would help to overcome on some problems and challenges.*
Key Words: *Internet of Things (IoT), Smart Home, Load cells*

I. INTRODUCTION

Internet has changed human's life by providing anytime, anywhere connectivity with anyone. As there is much advancement in technology, the sensors, processors, transmitters, receivers, etc. have now become inexpensive. Hence these all things can be used in our day to day life [4]. If anyone wants to expand the services of internet then Internet of Things can be said to be the extension of internet services [1]. Today's internet is now expanding towards Internet of Things (IoT).

1.1 **Internet-of-Things**: The internet where the existing network of internet to the computer systems will connect to the real world objects or things. Things may include any objects, home appliances, devices, vehicles, etc. And when these things connect to the internet in specific infrastructure via standard protocols then the whole system is said to be Internet of Things (IoT) [1-4].

1.2 **Things**: Things may be real or virtual, moving or steady but things will be active participants in the whole system. Things will communicate with each other, called as things-to-things communication. Things will also able to communicate or interact with human then it is called as things-to-human communication [4]. However the internet of things is not just deep vision for future. It is already here and is having an impact on more than just technological development. These things and communicating objects which used to communicate with the internet can configure themselves independently and can operate without human intervention [3].

1.3 **Smart Home**: A smart home is the home or that living environment having technology to allow all the household devices/home appliances to be controlled automatically and can be controlled remotely [8]. In Smart homes user can easily monitor and control all home devices/home appliances through internet. Home appliances connect in predefined proper network architecture and using standard protocols. Basic idea for Smart Homes using IoT is shown in figure 1 [2].
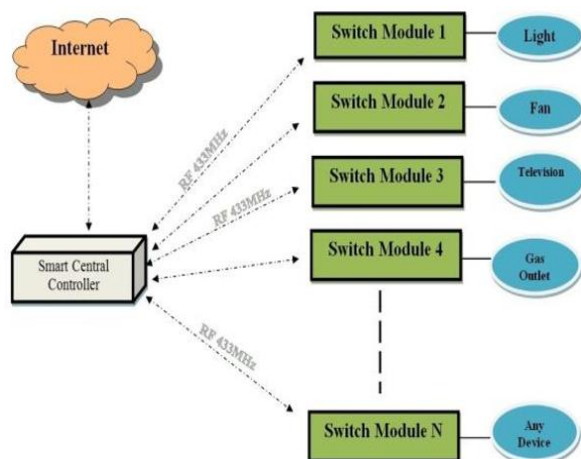
Fig. 1. Basic idea for Smart Home System using IoT [2]

In this paper only three household devices are considered: Light, Fan & Digital weighing scale. But in reality, a user can connect number of devices. All these household devices will connect to the switch modules. Switch module may contain any type of module which changes its state as it received signal. Switch module connects to the device in such a way that when it changes the state, the state of household device connected to it will also change. Relays can be used as a switch module. It is an electromagnetic device or normally called as relay switch. It isolates two circuits electrically and connects them magnetically.

II. RELATED WORK AND METHODOLOGIES USED

Figure 2 shows the layered architecture of the IoT-based Smart Home System and is described by Kang Bing et al., in [8]. The smart home system is divided into three layers: application layer, network layer, and sensing layer. Starting from the bottom, sensing layer is responsible for data collection from all the home appliances and it sends data to the middle layer that is network layer. Network layer uses internet for sending data to the upper most application layer which has different applications on different level for different purposes. For data collection and data processing at the sensing layer it uses microprocessor SAMSUNG S3C2440A which is a type of ARM microcontroller [8]. To transfer the collected data to the network layer it uses Zigbee module which is based on IEEE 802.15.4 wireless standard [7-8].
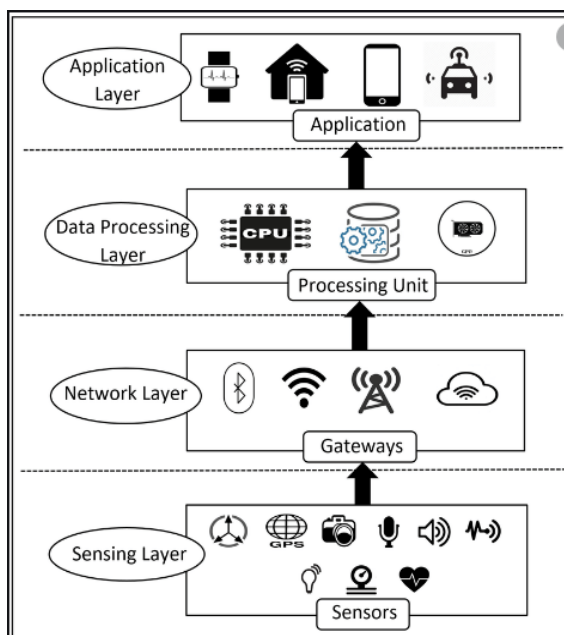

Fig. 2: Layered architecture of the IoT-based Smart Home System [8]

III. PROBLEMS AND CHALLENGES

There are many problems, issues and key challenges which the Smart Home system has to face. As the applications of IoT are increasing rapidly it is difficult to handle all the applications in IoT environment. Problems such as how to manage and control these various increasing applications emerge. The whole system could not be more comfortable, secure if these increasing applications are not controlled efficiently and conveniently [2]. Security is less on the server side as no special method for authentication is used. This could lead to an insecure system. An attacker can get access to victims home and he could break the whole Smart home system. Connectivity is also one of the major challenges [4]. For communication towards internet 3G services are used [8]. But it could have signal problem & hence it will not have continuous internet connection. The functioning of the smart home system in IoT environment should be done in real time. RF identification is used at 433MHz [1] [2] [4]. It may cause the problem of interference.

3.1 Standards: Standardization is very essential for IoT environment as it is expanding globally. Challenges are regarding which standard should be used, which will provide secure medium, how it will make system more reliable.

3.2 Identification: Identification is essential for each device so that every device can identified uniquely.

3.3 Privacy: The user's data should be confidential. Connection should be done with preference given to privacy.

3.4 Data Storage: As applications of IoT are increasing, the amount of data getting collected is huge. The challenge is where to storage the huge data. Huge databases can solve this problem. Artificial intelligence algorithms must be applied to extract meaningful data from redundant data.

3.5 Network Self-Organization: Network structure should be created in such a way that every device connected to it could self-organize them. Actually it is network which should be able to self-organize.

IV. PROPOSED SOLUTION

The recommended framework may be suggesting greater efficiency & higher expenses. Arduino is utilized, likewise a web server and associations. The user may be prompted to join the intended Arduino. Then the user controls it utilizing a standout amongst Arduino yield. That Arduino user in the app sends an http appeal on Arduino that runs the web server. The deliberation will be that the smartphone sends an http of the Arduino. A little furthermore straight forward web server runs the Arduino tolerating the http appeal.
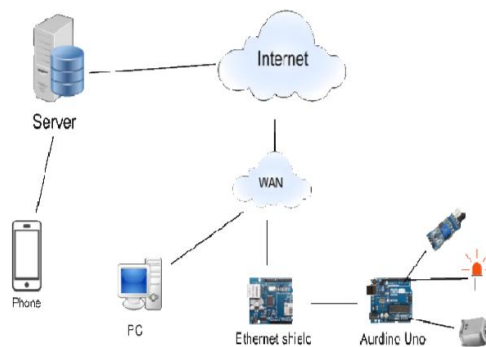

Figure 3: Framework of the proposed system

The physical layer comprises of the gadgets which incorporate lights, fans that would with make regulated as shown in Fig 3. The information join layer comprises of the claiming gadget manager, and different correspondence conventions. The gadget supervisor will connect to only those Arduino. Arduino used to impart will individually check or advanced mobile telephone toward utilizing web in the transport layer. Also presentation layer comprises the claiming web server which will be utilized for outlining a web page to control our home appliances. In the following image connections, can be observed; an bulb is connected to the 13 pin in the Arduino which is a digital pin. A fan motor is connected to the analog pin A1.

Measuring the weight is achieved by interfacing Load Cell and HX711 Weight Sensor with Arduinos as shown in Fig 4. We have seen weighing machines at many shops, where machine displays the weight just by placing any item on the weighing platform. So here we are building the same Weighing machine by using Arduino and Load cells, having capacity of measuring upto 40kg. This limit can be further increased by using the Load cell of higher capacity.
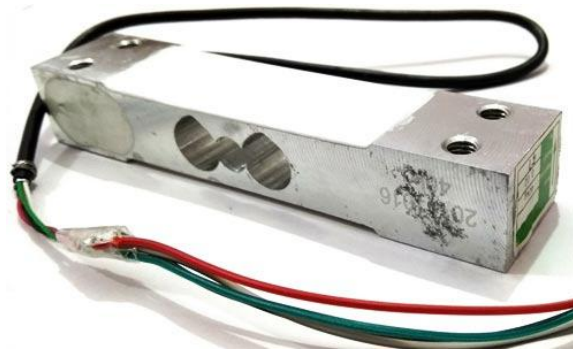
Figure 4: HX711 Weighing Sensor

Now the electrical signals generated by Load cell is in few millivolts, so they need to be further amplified by an amplifier and hence HX711 Weighing Sensor comes into picture. HX711 Weighing Sensor Module has HX711 chip, which is a 24 high precision A/D converter. HX711 has two analog input channels and we can get gain up to128 by programming these channels. So HX711 module amplifies the low electric output of Load cells and then this amplified & digitally converted signal is fed into the Arduino to derive the weight.

In this project, **Arduino** has been used to control whole the process. **Load cell** senses the weight and supplies an electrical analog voltage to HX711 Load Amplifier Module. HX711 is a 24bit ADC, which amplifies and digitally converts the Load cell output. Then this amplified value is fed to the Arduino. Now Arduino calculate the output of HX711 and converts that into the weight values in grams and show it on LCD shown in Fig 5.
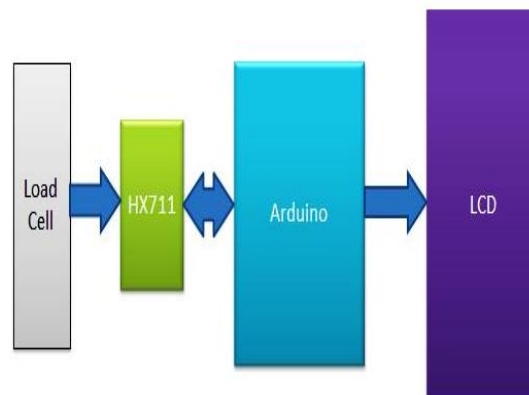

Fig 5 : Basic Architecture

V. CONCLUSION

This paper about Arduino based project will provide a competent method for lighting systems and make the whole process of energy saving easier and efficient. With a capability to change the amount of light emitted depending upon the outside condition is no doubt an innovation with many potential applications apart from the fact that it can also be used in many present day technologies such as head lights, street light, park lights, industrial lights and many more. The usage of the smart lighting system will undoubtedly change the world that is seen today.

REFERENCES

[1]. Gaurav Tripathi, Dhananjay Singh, and Antonio J. Jara, "A survey of Internet-of-Things: Future Vision, Architecture, Challenges and Service", IEEE World Forum on Internet of Things (WF-IoT), 2014, pp. 287292

[2]. Ming Wang, Guiqing Zhang, Chenghui Zhang, Jianbin Zhang, and Chengdong Li, "An IoT-based Appliance Control System for Smart Homes", Fourth International Conference on Intelligent Control and Information Processing (ICICIP) June 9 – 11, 2013, pp. 744-747

[3]. Vittorio Miori, and Dario Russo, "Domotic evolution towards the IoT", 28th International Conference on Advanced Information Networking and Applications Workshops, 2014, pp. 809-814

[4]. Sarita Agrawal, and Manik Lal Das, "Internet of Things – A Paradigm Shift of Future Internet Applications", International Conference on Current Trends in Technology, December, 2011

[5]. Qingping Chi, Hairong Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu, "A Reconfigurable Smart Sensor Interface for Industrial WSN in IoT Environment", IEEE Transactions on Industrial Informatics, vol. 10, no. 2, May 2014

[6]. http://www.engpaper.com/home-automation2015.html

[7]. https://arxiv.org/ftp/arxiv/papers/1504/1504.03564.pdf