Design and Implementation of Intelligent Control System for Domestic Appliance with Enhanced IOT Features Coupled with Energy Efficiency

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ABSTRACT : *This paper deals with the designing and implementing an intelligent home appliance controlling system, low cost and self-controlling arrangement with energy efficiency. One of the best feature of the system is to reduce the effect of phantom loads power or wastage of electric energy. This innovative system can minimize or reduce the consumption of wastage power or phantom loads power by promoting user to switch off the device completely automatically. The system controls other devices according to the user demand which is built in the main controlling section. Atmega328p microcontroller is used as the main controller as they provide open source and low costs solutions. To better lowering the device cost, the IR sensing module is used in the system. No operating switch was required in the system and that is the most special features of the development system. Information sending via server to the user and controlling any device through server are the additional feature of this system. For most user friendly text to speech converter is used in this system.*

KEYWORDS: *Internet of things, Arduino, Wi-Fi, Bluetooth, 1Sheeld module.*

I. INTRODUCTION

In 21st century home will be more and more self-controlled and automated due to comfortable. Especially for a private home with automated will more comfortable than others. Many of home has been designed as wire based that is very complex to plane an automated home. Many researcher has been improved smart home system. One important way to improve the smart automated system to change from wired transmission to wireless communication because the major weakness of wired connection for the difficulty of network arrangement. Hence, development of wireless communication, microelectronic technology, integrated circuit, sensing technology, wireless network has accomplished great progressed.

Wireless communication minimizes the hassle of creating a new connection and will increase the network range. In wireless, the Smart Home network range can be extended with the implementation of wireless sensor network through multi-hopping technique.

Home automation [1] is the control of any or all electrical devices in home, whether owner are there or away. Home automation is one of the most exciting developments in modern technology. There are many of products available today that allow us control over the devices automatically, either by remote control or even by voice command. Home automation [2] is the residential extension of "building automation". It is automation of the home, housework or household activity. Home automation may include centralized control [3] of lighting, heating, ventilation and air conditioning appliances and other systems to provide improved convenience, comfort, energy efficiency and security. The demanding of electricity in Bangladesh is increasing day by day. The production of electricity is not enough to fulfill the demanding factor, so energy wastage will have to less by using home automation [4].
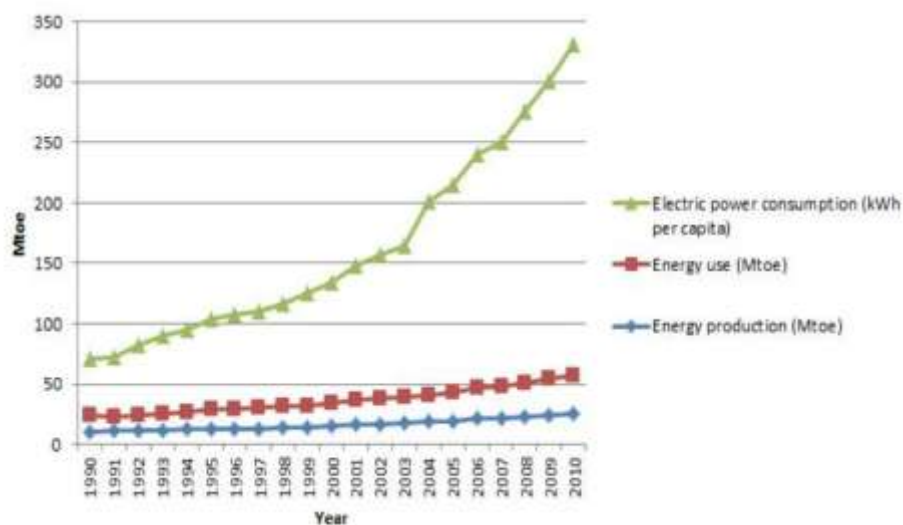
Fig.1. Energy production, energy use and per capita electricity consumption

The energy production, energy use and consumption curve are shown in fig 1. Here the production curve and energy uses curve have more difference, so the demand of energy is large then production. If somehow the energy losses or wastage can be reduced, then it will be economically benefited for a country.

Fig.2. Structure of home automation system

Internet of things(IOT) is a raven technology in modern home automation [4] system. IOT have enabled various things such as light, air condition, TV etc. which are controlled in Home automation system by using internet and make it easier. All the devices which are connected with internet i.e. Called internet of things. This device is controlled whole of the world through internet.

II.   LITERATURE SURVEY

Researcher have designed and implemented my research like automated home appliance controlled. They have proposed new idea and also implemented their proposed system. Fog computing based decision making for low cost smart home automation has proposed by G. P. R. Filho et.all [5]. In [5] they proposed STORM, a decision making solution in residential environment. IoT based system model for end user communication has been implemented by Raj G Anvekar et all [6]. They used raspberry pi to capture image, door locked, unlocked processes and send message to user's smartphone through wireless network. Self-learning and adaptive smart home has been designed in [7]. They follow the machine learning things and use IoT for this smart home. Another IoT based intrusion detector has been implemented in [8]. In this system PIR sensor is used to detect intruder, GSM is used to send text alert, ESP8266 is used to send data to the remote server and ZigBee is used to connect central node. Smart grid system with IoT has proposed in [9]. Here smart grid system is self-optimized. This system can improve the optimization of the smart grid itself. Voice controlled based home automation with natural language has been implemented in [10] with internet of things. They design the system artificial

intelligence and natural language processing. Home automation with surveillance system has implemented by Syed Ali Imran Quadri et all. In [11] Raspberry pi, dc motor, and IP camera for video surveillance. Smart home power and security management system has implemented by Deokar Shital Namde et all. In [12] variety of appliance monitoring system has proposed. variety of appliance have controlled automatically depends on the sensor value. In [13] low cost home appliance system has designed and implemented. Their main goal of this system is to save power.

III. SYSTEM DESIGNING

Automated a home is the demand of modern age for human being. For this purpose, smart, intelligent, self-controlled, low cost IoT based home appliance system has proposed in this paper. In fig 3, a block diagram of this proposed system has showed. This system is designed by using arduino based platform. In the block diagram there is a microcontroller for decision making of the intelligent system. Total 6 IR modules are used for counting the person or people. 3 modules are placed in 3 different space, so that this system can insure that one person has entered into the home and another 3 modules are used also placed in 3 different space to insure that the person get out from home. IR sensor can identify the obstacle present in front of it. A transmitter and receiver device detect the observation in front of it. In this system when people enter the home the main switch of the electric line will be automatically active and still so far as the person present at the home. Another IR module are used to switch the home appliances according to the user demand automatically. Example of this appliance is that, if someone presents in the room then the room light will be automatically ON and if no person presents at the room then the light will be automatically OFF. Another appliance is the automatically controlled/ remoting TV or fan. Another feature of this system is to control light's intensity and fan speed controlling by using a IoT clouds and android mobile through android application & Bluetooth interfacing. In this system a LDR sensor is used to detect the light intensity at day, when the intensity of the light is enough and human present at the room then the room light does not need to ON, at that time PIR sensor detect the human motion at the room.
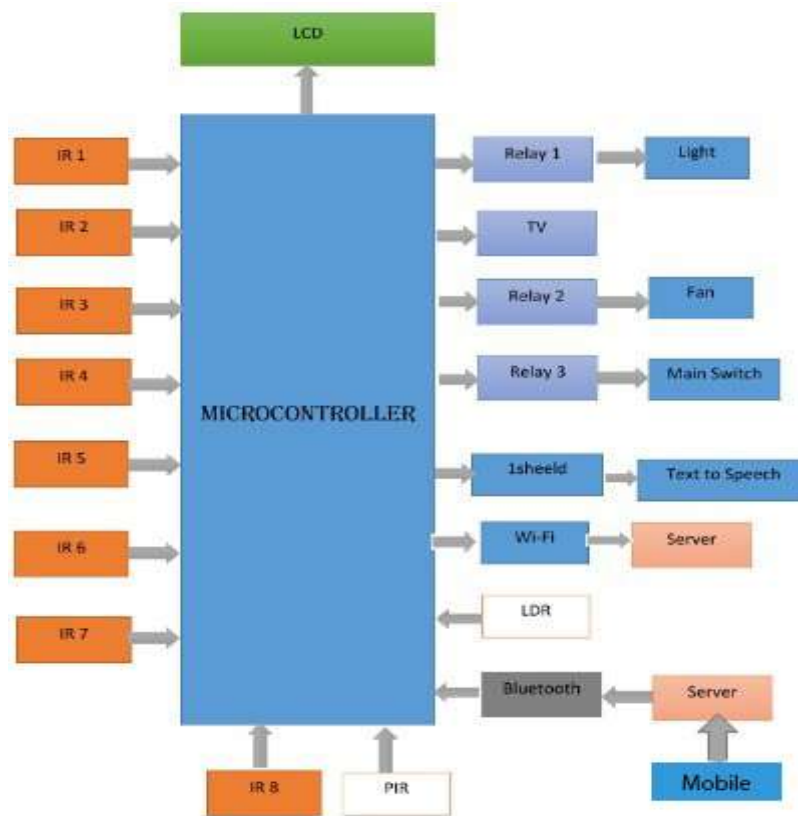

Fig. 3. Block Diagram of this Proposed System

In this system Wi-Fi network is insured to connect the system with server. The present condition of the home can be observed and control anywhere of the world. The sensing result is stored in the server through Wi-Fi. Stored data can be monitored by the owner of the system from anywhere. Here, text to speech converter is used to realize some people that the home appliances are ON or OFF. In this system 1sheeld module is used to

convert the text to speech with the help of android application and phone. This mechanism is held by using google voice to text conversion technique. PIR (Passive infrared) is used to detect the human present in the home. PIR sensor can detect the presence of human being by identifying the temperature of human. PIR sensor can identify the deference between human and others animal. This sensor can observe 120-degree area from its place. From the above description it is said that it is an automated home appliances system.
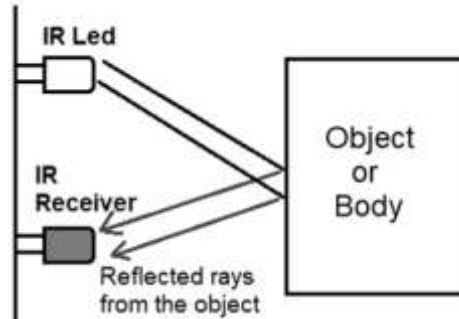
Fig. 4. IR working mechanism

IV. SYSTEM DEVELOPMENT

The proposed system has implemented on the basis of flow chart shown in fig 5. Here three IR sensors are used for person counter who will enter into the home. If the 1st IR sensor response the obstacle in front of it then it sends a signal to microcontroller, at the same time the 2nd IR sensor will wait for a while to detect the obstacle which is first detected by 1st IR. After detecting the object at 2nd IR the 3rd IR sensor will wait to detect that object. If the last sensor detects the object, then the microcontroller counts one person and store on it. This process will be continued if another person enters into the home. Another action will be held when a person gets out from the home. The 4th IR when detects the object then the sensor send the signal to the microcontroller and the microcontroller wait to detect that object in front of the 5th sensor. After detecting this sensor, the 6th sensor wait to detect the object. After completing the detection, the microcontroller decrements the counter value. If one person presents, the home then the main switch of the electric line will on and will off if no one stays in the home. The main target of this project is to save power of reducing the wastage of electric power. Here Wi-Fi is used to control the intensity of light through server and notify by voice when each appliance will active.
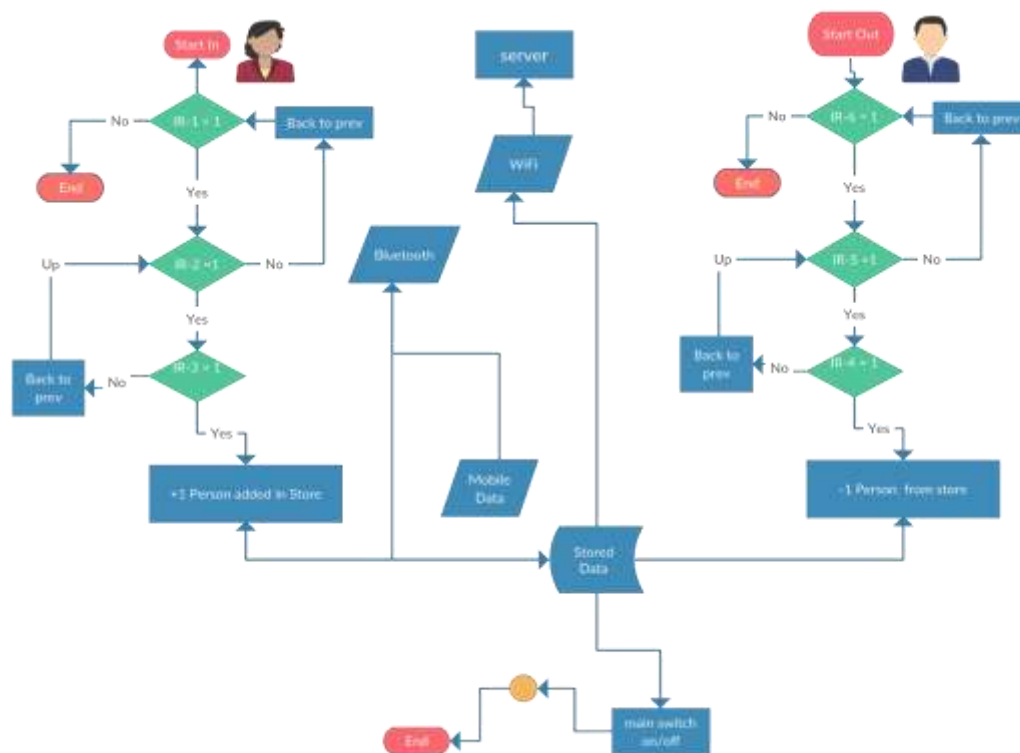

Fig. 5. Flow chart of this proposed system

Fig 6 illustrate the flowchart of appliance such as TV automation controlling. Here an IR sensor has used to switch the TV. When the IR sensor detect the object in front of it then the Television will automatically ON. And when the object gets out from it then the television will automatically OFF. This is automated home appliance system and energy efficiency because of having ON power to TV when someone present in front of TV.
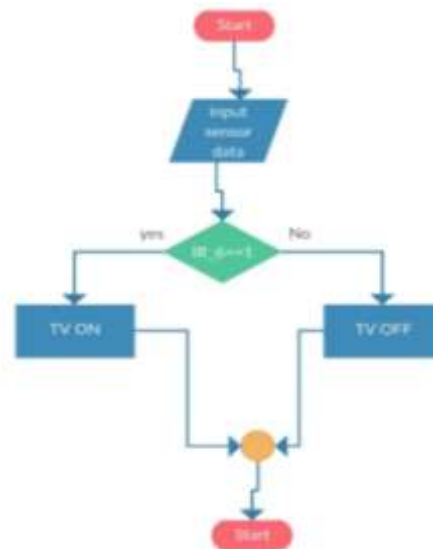

Fig. 6. Flow chart for home appliance(TV) control

Another flow chart is showed in fig 7. Here the light will switch depend on the sensor value. If Sensor detect the high value, then the light will automatically ON and If sensor detect the low value then the light will automatically OFF.
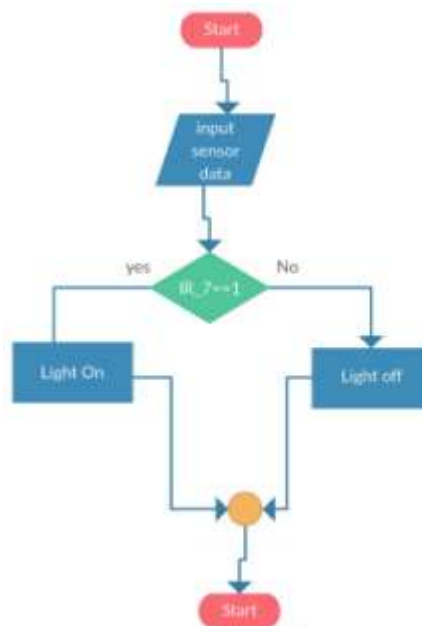

Fig. 7. Flow chart for home appliance(Light) control

Here fig 8 shows the LDR controlled light. When the sunlight energy is sufficient, if the person enters into the room the light doesn't need to turn on. It will off till the sensing value then it will turn on automatically when the condition will fulfill. Table 1 and 2 showed the logical activities and their corresponding proposed output.
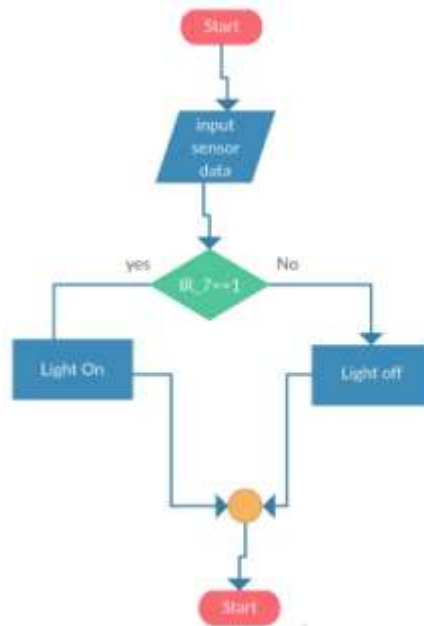
Fig.8. LDR for controlling light

The total simulation circuit of this research have showed in fig 10. This circuit is designed in the Proteus simulation software. This software design circuit is working properly according to the designing algorithm. The implemented circuit of this research is showed in fig 11. Here the LCD display shows the number of counting person and the response of home appliance device. The 1sheeld module is used to convert the text into voice that alarm the user which devices are ON or OFF. The IOT is used for data stored and checking the condition of the home from far distance. In this research the Thing speak server is used. By using the server, the intensity of light is measured by LDR and this data is stored in the server. The PIR motion sensor is used in this research to detect the human motion for continuing power supply in the room when the light intensity is sufficient. Server used in this research is the Blynk server. This server is connected through Bluetooth devices to the controller. This server helps the user to control the intensity of the room light through the apps build in Blynk server and functioning of light to OFF and ON.

Table 1: To Identify person, applied logic.

No	1St IR	2nd IR	3rd IR	Result
1	Active	Active	Active	Person in Room
2	Active	Active	Not active	Person don't enter into room
3	Active	Not Active	Not active	Person don't enter into room
4	Not Active	Active	Active	Person don't leave room
5	Not Active	Not Active	Active	Person don't leave room
6	Active	Active	Active	Person leave room

Table 2: Home appliance activation logic

Name of sensor	Condition	Result
IR 3	Active	TV ON
IR3	Not Active	TV OFF
IR4	Active	Light ON
IR4	Not Active	Light OFF

Fig.9. Android Application for controlling home appliance such as light

This application will be worked through Bluetooth connection with controller. In this application there are 3 function to control the home appliance i.e. light. The light intensity by using the dimmer slider, the push button to OFF and ON the light and the display to monitor the light intensity.
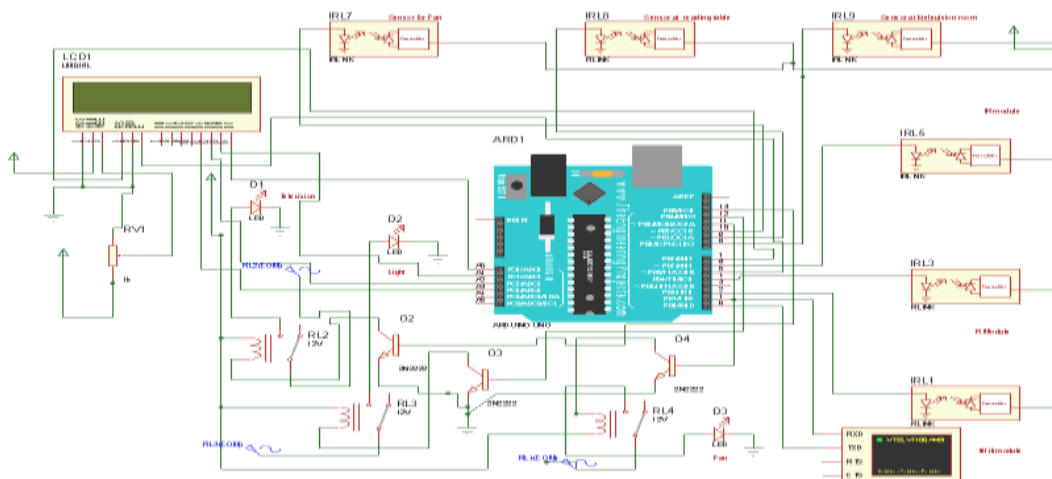

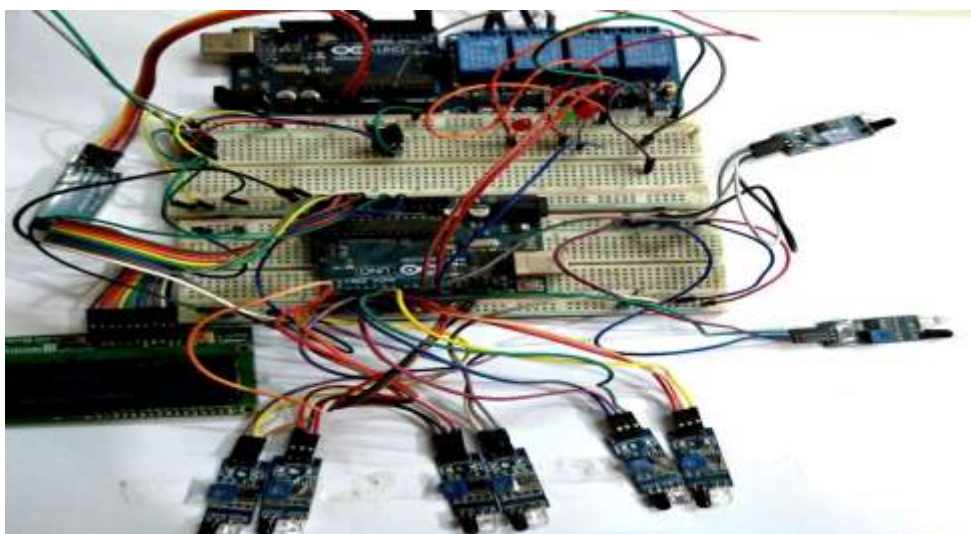**Fig.10. Proteus simulation circuit of this proposed system.**

Fig.11. Final implementation System.

V. RESULT & DISCUSSION

This implemented system's response is nearly same as the proposed idea. Here the person counting and automated home appliance controlling work properly. The response of the data in the server is very fast. The LDR's data response is showed and in fig 12 the PIR motion sensor's data response is showed in fig 13. All controlling device work properly.
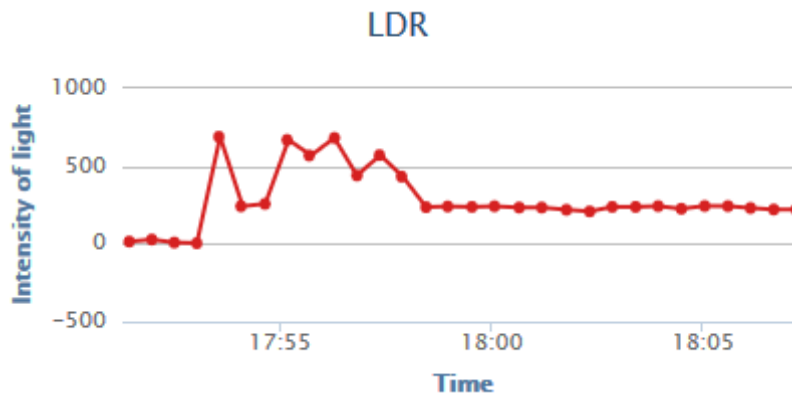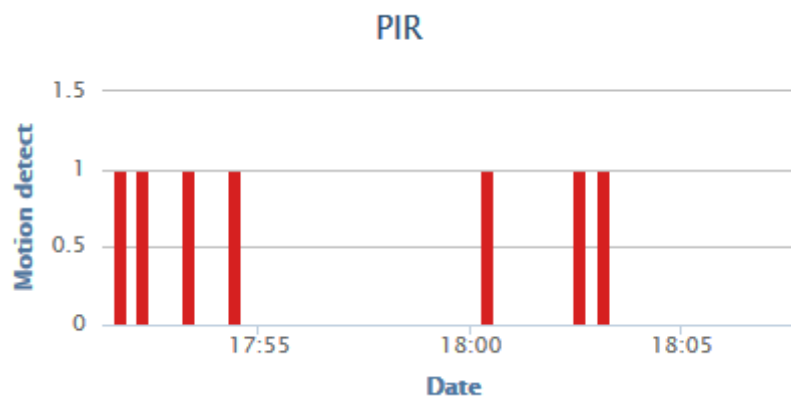

Fig.12. LDR response.

Fig.13. PIR response

VI. CONCLUSION

This research is design and development of a IOT coupling automated home appliance system which consider some factors such as economic, application efficiency and compatible portability [14]. In this implemented system, home automation s presented using automated controlling by using IR sensor module. Our main objective is to save the power and to assist the aged or handicapped people [15]. This paper gives the designing and implementing technique of the user friendly automation system. This research is based on Arduino platform which is FOSS (Free Open Source Software). So the overall implementation cost is very cheap and it is affordable by a common person [16-17]. This research is coupled with IOT, so it is easier to the user to monitor the home outside of it.

REFERENCES

[1]. S.Anusha, M.Madhavi, R.Hemalatha" Home Automation Using Atmega328 Microcontroller And Android Application" International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 06 | Sep-2015
[2]. Pawan Singh, Krupa Chotalia, Sanket Pingale, Sandhya Kadam "A Review Paper on Smart GSM Based Home Automation System" International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 04
[3]. A.V.V.Rama Krishna, Ch.Sukanya Devi, P.RajaSneha "Home Automation using Remote Control System" International Journal of Engineering Research & Science (IJOER) ISSN: [2395-6992] [Vol-2, Issue-9, September- 2016]
[4]. Md. Tasbirul Islam1, A. Z. A. Saifullah " The Importance of Nuclear Energy Utilization for Electricity Generation in Bangladesh" (IJIRSE) International Journal of Innovative Research in Science & Engineering ISSN (Online) 2347-3207
[5]. G. P. R. Filho, L. Y. Mano, A. D. B. Valejo, L. A. Villas and J. Ueyama "A Low-Cost Smart Home Automation to Enhance Decision-Making based on Fog Computing and Computational Intelligence" IEEE Latin America Transactions, Vol. 16, No. 1, Jan. 2018 .
[6]. Raj G Anvekar, Rajat R Bhat Dr. Rajeshwari M Banakar, "Design Alternatives for End User Communication in IoT Based System Model" IEEE International conference on Technological Innovations in ICT for Agriculture and Rural Development.

[7]. Mohamed Sultan, Khaled Nabil Ahmed, "SLASH: Self-Learning and Adaptive Smart Home Framework by Integrating IoT with Big Data Analytic" Computing Conference 2017 18-20 July 2017 | London, UK.

[8]. Khirod Chandra Sahoo, Umesh Chandra Pati, "IoT Based Intrusion Detection System Using PIR Sensor" 2017 2nd IEEE International Conference On Recent Trends in Electronics Information & Communication Technology (RTEICT), May 19-20, 2017, India.

[9]. Adi Candra Swastika, Resa Pramudita, Rifqy Hakimi, "IoT-based Smart Grid System Design for Smart Home" 3rd International Conference on Wireless and Telematics, July 27 - 28, 2017, Palembang, Indonesia.

[10]. Mrs. Paul Jasmin Rani, Jason Bakthakumar, Praveen Kumaar.B, Praveen Kumaar.U and Santhosh Kumar, "Voice Controlled Home Automation System Using Natural Language Processing (Nlp) And Internet of Things (IOT)" Third International Conference on Science Technology Engineering & Management (ICONSTEM) 2017.

[11]. Syed Ali Imran Quadri, P.Sathish " IoT Based Home Automation and Surveillance System" International Conference on Intelligent Computing and Control Systems, ICICCS 2017.

[12]. Deokar Shital Namdeo, Prof. Dr. Pawar V. R "IoT Based Smart Home for Power & Security Management" International Conference on Intelligent Computing and Control Systems, ICICCS 2017

[13]. Md. Khalid Hossain Jewel, Md. Khalid Hossain, Rebeka Sultana, Md. Shahadat Hossain "Design and Development of a Low Cost Intelligent Home Appliances Automation System" Bangladesh electronics society, 2015

[14]. Oke A. O., Emuoyibofarhe, J. O., Adetunji A. B. "Development of a GSM based Control System for Electrical Appliances" International Journal of Engineering and Technology Volume 3 No. 4, April, 2013.

[15]. Mohammad Rabiul Alam, Md. Fazlul Kader, Kazi Tanvir Ahmmed & Nur Akter Jahan "A Computer Control System for Home Appliances" Global Journal of Computer Science and Technology Interdisciplinary Volume 13 Issue 3 Version 1.0 Year 2013

[16]. S. H. Husin, A. A. Ngahdiman, N. M. Z. Hashim, Y. Yusop, A.S Ja'afar, "Home Electrical Appliances Smart System" International Journal of Computer Science and Mobile Computing, IJCSMC, Vol. 2, Issue. 9, September 2013, pg.85 – 91

[17]. Poonam B. Patil, Rupali R. Patil, Swati V.Patil , Avadhoot R.Telepatil, " Home Automation System Using Android and Arduino Board" International Journal of Innovative Research in Science, Engineering and Technology , Vol. 5, Issue 4, April 2016 .