

# Acute Electricity Management

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**Abstract**—Automation plays an important role in today's human life and people's life is gradually changing with smart living due to modern technology development and daily deployment. It allow us to control electrical appliances like light, fan, refrigerator etc. It plays a vital role in modern era because of its flexibility in using at different places with high quality which will save money and time by decreasing human efforts and also electricity management can be done. In today's world, everywhere and everyone prefers Automatic systems over manual system. Automated System is always attractive as it reduce human efforts as well as time errors due to human negligence. It is meant to save the electricity and human efforts or energy. This paper put forward the design of electricity management using Electronics controller board. Communication is established between controller board and PIR sensors. But in such kind of modules we need to change the existing wiring of the house and wires of sensor not looks good, module with mobile application uses RF Transmitter and Receiver module to establish a communication between a sensor and switching module of a system. It depicts the design and implementation of this system that can control and also monitor home appliances via controller board and it has low cost and power saving. This gives a huge advantage on smart system of electricity management.

**Keywords:** - *RF Transmitter and Receiver module, Controller/Launcher Board, PIR sensor, Electricity Management*

## I. INTRODUCTION

Automation is a system of controlling a process by electronic devices which reduces the human involvement to a minimum. The automation at any place (e.g Home, Office, Industry, Organization etc.) increases the quality of the control of the electrical equipment. Main purpose of automation is to **save electricity**. As we all know 21<sup>st</sup> century is becoming automated day-by-day due to the comfort that automation provides. Automation plays a vital role for an efficient and economical use of the electricity and reduces the wastage to a great extent.

Automation is one of the most important aspect of the technologies like AI and IoT. It is the monitoring of the energy consumption and controlling the environment in buildings, schools, offices and public places by using different types of sensors and actuators that control electrical or electronic appliances. There is an integration of information technologies with the environment, system and appliances which are able to perform in an integrated manner which indirectly comes up with convenience to human efforts, result in energy efficiency and also some benefits related to safety. We are using Arduino mini micro-controller which is an open source single board micro-controller. Arduino is programmed using wiring based language, similar to embedded C with some slight simplification and modification, with a development environment.

## Literature Survey:

For smart living concept, RF technology has been one of the major technology it is a wireless technology developed to replace cables on device like mobile phones and PCs. By using RF devices are able to communicate with each other wirelessly within a particular range. Nowadays lot and lots of smart living applications have been developed which are based on wireless technologies. PIR motion sensor act as user interface through which user can control device. Bluetooth module, SMS facility and GSM module are generally used for automation of Home Appliances.

This paper includes Building Automation as well as control domestic activities such as Fans, electric tube lights, and other loads which are only needed when humans are present. It not only monitors environment but acts according to inhabitant requirement. It eliminates human interaction which will eventually manage low cost, flexible smart homes to adjust its environmental conditions and resolve its errors with energy saving. [2]

It proposed the design and architecture of smart home system which enhances comfortable living assistance. Solar energy is tremendously available in nature, so there is enough production of power supply to the home appliances. The cost of

implementation is low and also the system reduces the cost of power. With the help of this user can control various home appliances and save total power consumption in an efficient way.[3]

### ➤ Evolution of System

#### Comparison

Sr No.	System	Communication Interface	Controller	User Interface	Applications	Benefits
1.	Arduino Micro-controller	Wireless LAN	Hardware interface module	web based Application	Temperature and humidity, Motion, Monitoring detection, Video monitoring, Controlling appliances	Cost Reduction, Security, Easily configurable, Controlled by mobile application
2.	Web platform and mobile app based using micro-controller	Web server and interface card	Raspberry pi	Mobile application	Smart washing machines	Home automation, scalable and energy saving
3.	Cloud Based using hadoop	Cloud based data server uses Hadoop Technology	gateway and Router	Compatible and intelligent device	Control and monitor loads and appliances	Reduce computational burden of devices
4.	Cloud Based Using Zig Bee Microcontroller	Zig bee wireless Network	Smart Socket	PC or smart Phone	power usage, temperature and humidity analysis	convenientt, safety, and Power saving
5.	Task Scheduling Based using Arduino and smart devices	Wired X10 and Wireless	Arduino	smart Application	power usage, temperature and humidity analysis	convenientt, safety, and Power saving

### Proposed System

The systems available today in game have their own limitations like can't be used efficiently on personal offices or cabins which are covered up to some extends by advancing its code, hardware and design implementation. Hence the proposed system is designed such which will turn on and off the appliances with the help of data generated by PIR sensor at remote location and the data is sent to switching module using RF technology which result in power saving or electricity management.

#### • Software :

The software system consist of Arduino language which is used to configure the Arduino mini board and the sensors. Arduino mini board will help to develop an interface between the hardware and software application.

Using the official software of Arduino itself with manipulations in code like to turn on the appliance it takes a fraction of second and it checks for 10,000 times before turning the it off. Additionally within 50 to 100 seconds of inactivity the appliances turns off.

#### • Hardware :

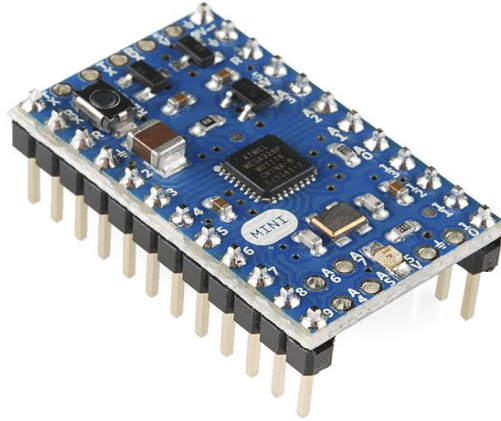
The hardware system consist of Arduino mini board, PIR sensors, RF TX and RX module and load. It is not just designed to work efficiently but to also look glossy and attractive for innovators, industrialists and consumers of interest. RF module help in transmitting and receiving the output given by the PIR sensor.

Also it is easily portable with size even less than a credit card including a passive infrared sensor with wireless technology to place it in such a way that it can cover most of the area of interest into its range.

The Components used in this system are described as follows:

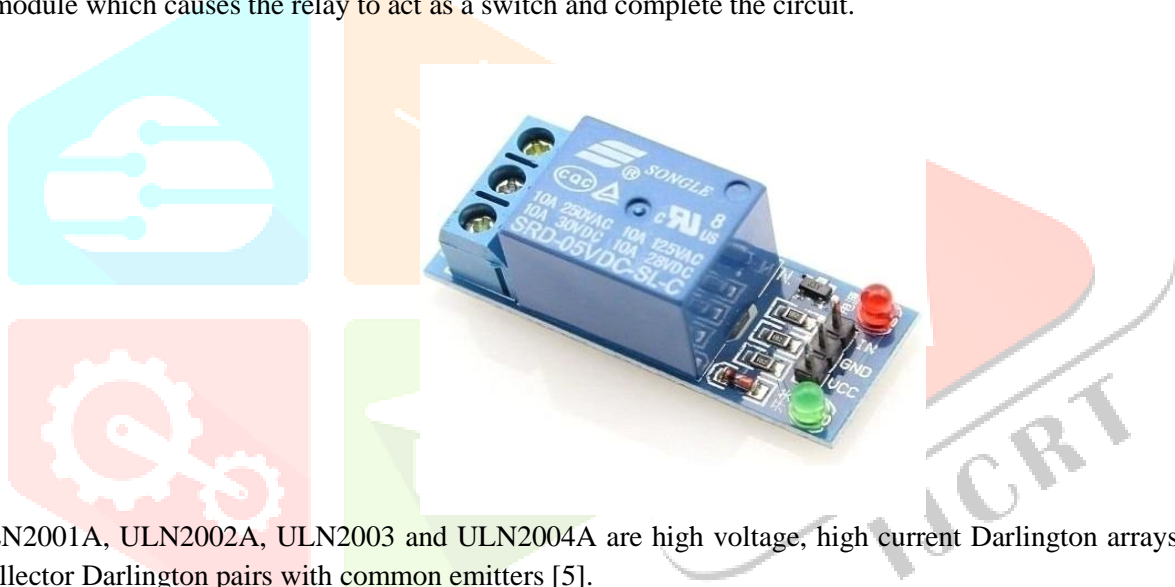
#### 1. Micro-controller:

Arduino mini is a micro-controller module to which we can directly interface our modules through its GPIO pins and we found it as one of the most efficient and cost effective micro controller we found in our survey of processing analog and digital signals, inputs and outputs.



## 2. Relay module:

A relay coil mounted inside a Electromagnet relay module plays a master role in switching relay and completing or breaking the circuit as the coil gets charged i.e. as the coil gets both VCC and GND the coil gets charged and produces electromagnetic field inside the module which causes the relay to act as a switch and complete the circuit.



- The ULN2001A, ULN2002A, ULN2003 and ULN2004A are high voltage, high current Darlington arrays each with seven open collector Darlington pairs with common emitters [5].
- The two LED's shown in the image indicates whether the relay module is switched or not, red LED is always turned ON whenever there is a active power supply and when the relay switches i.e. the situation of close circuit, the green LED also turns ON i.e. both the LED's remain ON.
- The three GPIO(general purpose input output) pins are of VCC, GND and I/P where if the input pin gets ground from the controller the coil gets charged and relay switches.

## 3. PIR Sensor:

PIR sensors are used to sense the motion. It is generally used in home automation applications to detect the human motions within the sensor's range. PIR sensors are used to detect the IR wavelength when a human being is in its range. Sensitivity vicinity: 20 feet i.e. nearly 6 meters [6]. Power Supply: 3.3 V to 5 V [6].



Working:-

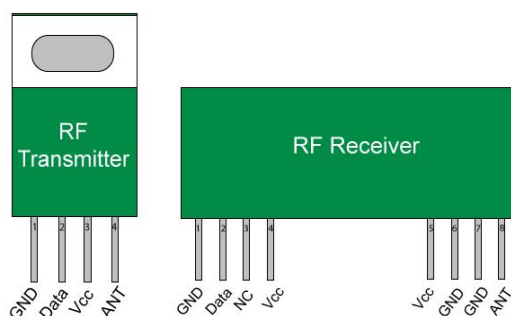
Every object above the temperature absolute zero emit the heat energy in the form of infrared radiations the pir sensor is designed for the exact purpose of detecting these infrared waves/Radiations.

The PIR sensor detects the motion or movements of a human, animal or any alive moving object. The range in which the sensor senses the human motion is about 6 meters and about 180 degree.

The commonly used versatile PIR motion detection sensor used in the market generally has two rotating switches to adjust its sensitivity by adjusting time delay between two consecutive senses and sensitivity adjust switch

#### 4. RF Module

It is a serial port wireless communication device which transmits and/or receives the radio waves. It simply established a connection between two devices it has a frequency of 30 kHz to 300 GHZ.



Working:

This module is get used when we use the mobile application to turn on and off the appliances. The RF Transmitter will be the master device and RF receiver will be the signal receiving device. The controller will be on the both sides of a device where one (i.e. Transmitting part) will take the data generated by PIR sensor and the wireless radio communication will begin between RF Transmitter and receiver.

The TX and RX pair operates at the frequency of 434 MHz and data transmits at the rate of 1Kbps to 10Kbps

➤ **Block Diagram with Working:** - Following Fig. shows the block diagram of the system.

1. 230V 50Hz Ac Supply is given to the adapter to convert it into 5V DC.
2. Here we used RF TX and RX pair to communicate wirelessly between two of the controllers at transmitting and receiving edge. Whenever the PIR motion detector sensor detects the movement of a human being or any alive moving object then the signal is sent to the controller which further transmits the signal to another controller situated at receiver's edge via TX antenna module.
3. The RX module communicates with the TX module continuously and updates the controller at receiving end as the RX controller receives the high signal it switches the relay module which turns ON the load.

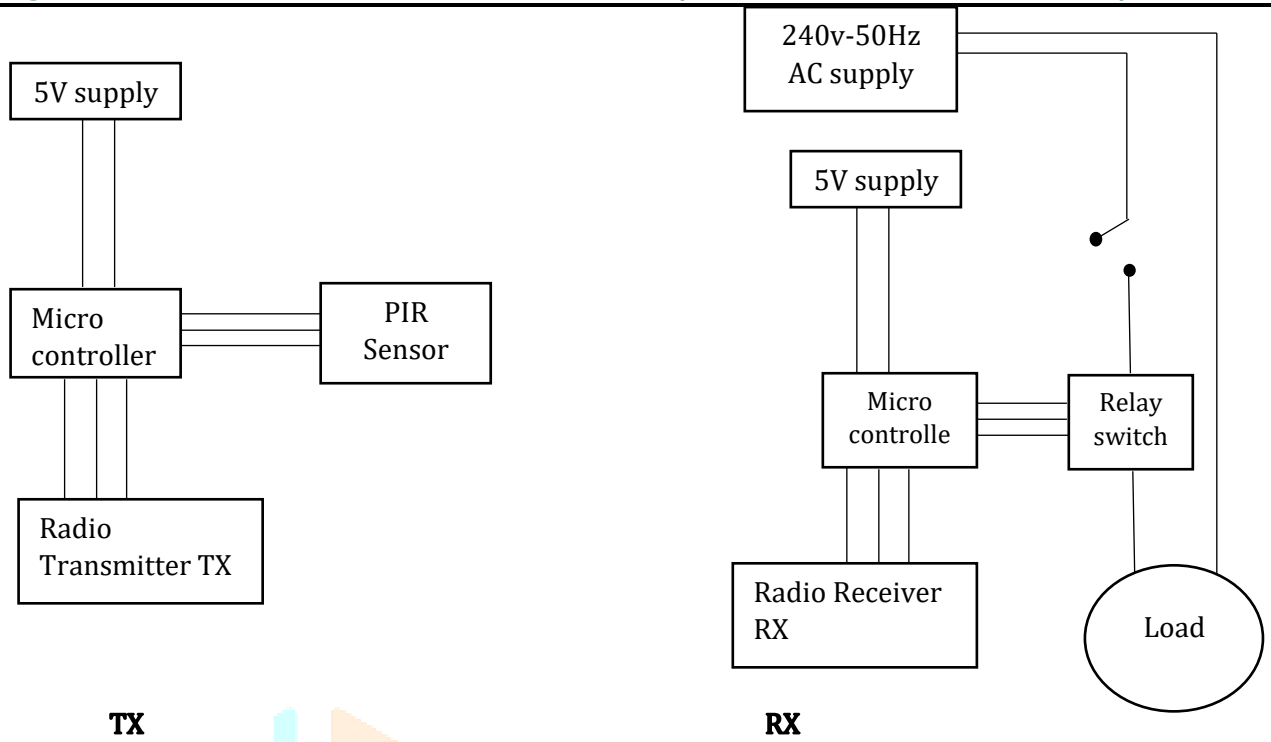
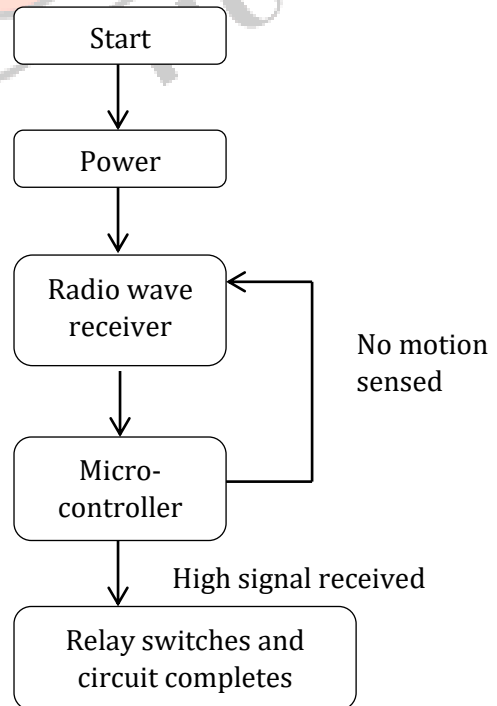
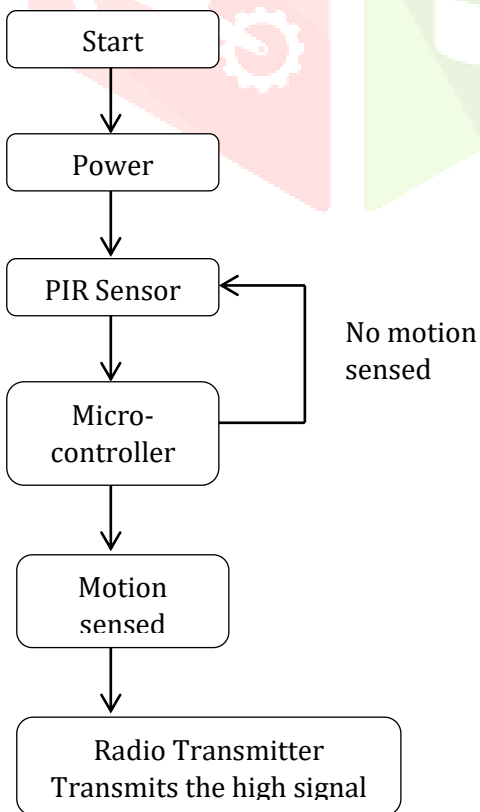


Fig: Block Diagram of the system

**Flow chart: -**

Fig describes the system using PIR Sensors where photovoltaic as a supply given to the PIR sensor. PIR sensor will sense the presence of human being and results the output. If it sense any motion then lamp will get on. Otherwise it will continue till it sense any motion.

Fig (a) shows TX part. Fig (b) shows RX flowchart.



Fig(a):Flowchart of system using PIR sensor and TX module Fig(b):Flowchart of system using RX module



### ➤ Technology specification

The entire system is based on the concept of IoT where micro controller is the brain of a system and PIR motion detector sensor is a sense organ which senses the motion of a alive body and sends digital signal to micro-controller on which the RF Transmitter is connected to transfer the signal to switch load connected with relay module, RF Receiver module and microcontroller. This is how the system is smart and intelligent enough to detect motions and inactivity into its specified range.

### Technical usage

#### ➤ *Replacing human efforts with automated algorithms*

Sophisticated analysis can reduce human efforts that would otherwise remain hidden. With automated algorithms there is possibility to reduce human efforts providing automation in any field. Regarding home automation, automation in electrical appliances can be consider.

#### ➤ *Reducing loss of energy with automation*

Analysis proves that there is a lot of wastage of energy due to non-automated system that is presently existing in today's world. So, by providing automation there will be reduction in loss of energy and hence, increase in efficiency.

### ➤ Types of Automation System

Common types of automation used in the homes. There was a wide range of techniques, from scheduling and specifying events at specified times to using environmental sensors such as a rain sensor to trigger the closing of a skylight [4]. commonly there are three ways of automating Timers, X10, and Right Schedule [4].

1. Timers: Here generally the timings of schedules are monitored and fixed timed schedules are scripted for example ringing daily alarm, playing morning music, throwing garbage out of dustbin, etc.
2. X10: Here schedules are set into the computer system and digital data is sent and received to and from controllers these are somehow more advance and intelligent then timers but come under low-tech solution.
3. Right scheduled: Here the system is targeted at controlling multiple devices

### ➤ Impact on Environment

To create a innovative and skill worth eco-system, such type of gadgets are needed are needed to be installed. After all this, it will increase the eagerness and curiosity among employees and authorities as well.

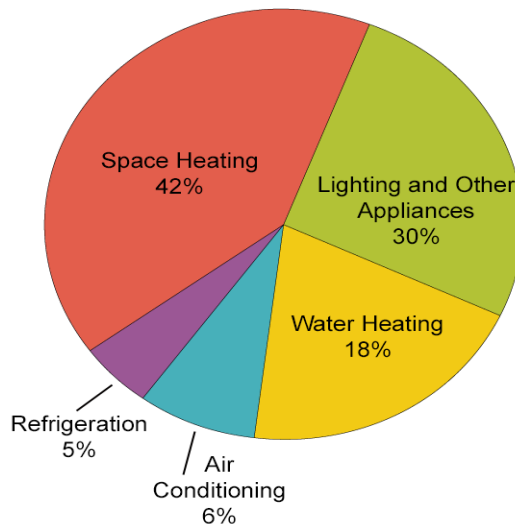
- Social Impact Perhaps the engagement of worldwide population towards electrical appliances is at immense, and huge amount of electricity is just wasted so if we automate our gadgets then this amount can be proposed and dedicated for actual needy.
- Economical Impact As electricity is used it is charged, perhaps this small footsteps can count huge cost which will be transparently visible after certain period of time.

### ➤ Quality of Management

- i) Development of Digital Structure
- ii) Transparency
- iii) Interaction between the buyers and developers
- iv) Quality of product

## ➤ Statistical Analysis

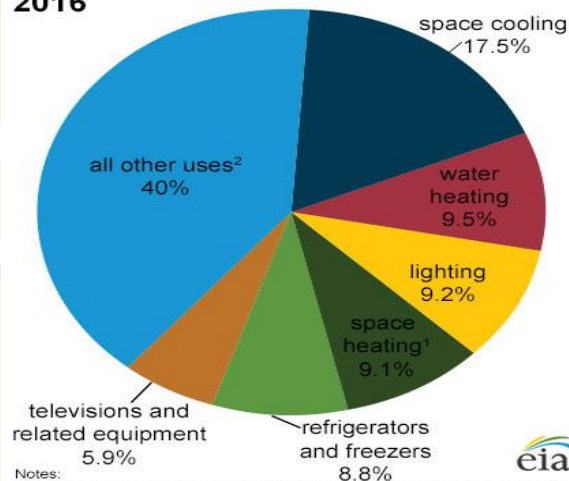
### How Energy Is Used in Homes (2009)\*



\* 2009 is the most recent year for which data are available.

Source: U.S. Energy Information Administration, *Residential Energy Consumption Survey (RECS) 2009*.

### U.S. residential sector electricity consumption by major end uses, 2016



Notes:

<sup>1</sup>Includes consumption for heat and operating furnace fans and boiler pumps.

<sup>2</sup>Includes miscellaneous appliances, clothes washers and dryers, computers and related equipment, stoves, dishwashers, heating elements, and motors not included in the uses listed above.

Source: U.S. Energy Information Administration, *Annual Energy Outlook 2017*, Table 4, January 2017

## ➤ Improvement in Customer Service

Design and develop healthy ecosystem with digital infrastructure for organization or institutional collaboration. Service Oriented: Services all about the value that customer gets which in turn depends upon its own perception about what constitutes value. System Oriented: System Orientation at the existing system is less optimal but the automation are digitized which will increase in optimization. This automated system involves the design of a model that improves the efficiency of relevant processes. Installation as per demands.

## ➤ Return on Investment

In India, the use and importance of technologies is not as that much of extent compared to developed countries. The three main categories that comprises any system which we conclude at the time of investment are:

- People
  - i) Engagement with employee and suppliers
  - ii) Infrastructure Development

- Planet
  - i) Saves energy
  - ii) Healthy ecosystem
- Profit
  - Cost reduction
  - Asset utilization
  - Resource utilization
  - Brand image and positioning

## ➤ Benefits

There are many benefits regarding automation in electrical appliances and especially useful in large-scale commercial locations where power efficiency can otherwise be a daunting task. Here are some of the benefits and advantages of automation:

### • Energy Efficiency:

It can be useful to increase our home energy efficiency by powering off appliances when they aren't in use. Some of the automation products give us active control, some of them monitor systems which enables users to gain knowledge and apply it to achieve greater control and energy efficiency.

### • Savings:

Home automation actually pays off. It firstly and mainly plays the vital role in utility bills. No more worry to be taken about what was or wasn't turned off. And, no more wasting money on lights left on when you aren't at home.

### • Laborsaving:

Use of automation provides to replace manual intensive tasks that are done by machine can be a big time saver. It will not eliminate employees from their current position rather it gives higher-functioning roles that make use of the expertise they will be trained for.

### • Improved Quality and Consistency

Automation does not provide any human error or fatigue, so they can help which provide a consistent basis of care activities. Automation provides greater quality when it comes to electrical systems.

## II. CONCLUSION

Automation system is useful at every place and this system will be used wherever the appliances are to be used. If we build more smart and intelligent devices out of the human inventions then we might be able to conclude most of the human efforts, minor and major problems including social and economic crises.

## III. FUTURE ASPECTS

Using this system as a framework, the system can be further extended to include various other applications which could include security features like capturing the photo and store it to the cloud. The system can also be used in the future for energy monitoring. Further, fire and smoke detection can be added in functionality to reduce the risk of life whenever any misfortune occurs.

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## REFERENCES

- [1] Anandhavalli D, Noorul S. Mubina and Bharathi P, "Smart Home Automation Control using Bluetooth and GSM", International Journal of Informative and Futuristic Research, Vol.2, Issue 8, April 2015.
- [2] Harsh Mehta, Kunal Jadhav, Avinash Mishra, Prof. Anushree Deshmukh, "IOT Based Home Automation System Using Arduino Board", International Research Journal of Engineering and Technology, Vol.4, Issue 01, January 2017.
- [3] Mr. G. Parameswaran, Ms. S. Kamatchi, Ms. S. Keerthana, Ms. S. Kiruthika, Ms. M. S. Lavanya, "Smart Home Energy Management System using GSM", Journal of Electronics and Communication Engineering, e-ISSN: 2278-2834, p-ISSN: 2278-8735, Pg. 33-37



- [4] Allison Woodruff, Cornell university Library, Sabbath Day Home Automation: "It's Like Mixing Technology and Religion" Article id: 0704.3643
- [5] Prashant R. Chandre , Aarti R. Salunke "Home Automation using Android Application & Bluetooth Home Automation System (HAS)", Article id: 1426056544, International Journal on Recent and Innovation Trends in Computing and Communication, ISSN:2321-8169, Volume:3, Issue:2, 815-819.
- [6] Krishna Sarath Chandra Kotcherlakota, Vamsi Bharadwaj Reddy Chinta, "Smart Home Automation Based On 555 Timer", Krishna Sarath Chandra Kotcherlakota et al. Int. Journal of Engineering Research and Application, ISSN : 2248-9622, Vol. 6, Issue 5, ( Part -7) may2016, pp.77-80.
- [7] Vaishnavi S. Gunge, Pratibha S. Yalagi, "Smart Home Automation: A Literature Review", International Journal of Computer Applications (0975 – 8887) National Seminar on Recent Trends in Data Mining (RTDM 2016)
- [8] R.Piyare, M.Tazi, "Bluetooth Based Home Automation System Using Cell Phone", 2011 IEEE 15<sup>th</sup> International Symposium on Consumer Electronics .
- [9] D.Naresh, B.Chakradhar, S.Krishnaveni, "Bluetooth Based Home Automation and Security System using ARM9", International Journal of Engineering Trends and Techology, Vol.4, Issue 9, September 2013.
- [10] Zaid Abdulzahra Jabbar, R.S.Kawitkar, "Implementation of Smart Home Control by using Low cost Arduino and Android Design", International Journal of Advanced Research in Computer and CAommunication Engineering, Vol.5, Issue 2, February 2016.
- [11] Somnath Singh, Debjyoti Saha, Pragya Khaware, Suman Das, Dayanidhi Raj, Subhabrata Das, Chandra Sekhar Nandi, "Home Automation and Internet of Things", International Advanced Research Journal in Science Engineering and Technology, Vol.3, Issue 6, June 2016.
- [12] Dhiren Tejani, Ali Mohammed, A.H.Al-Kuwari, Vidyasagar Potdar, "Energy Conservation in a Smart Home", September 2016.

