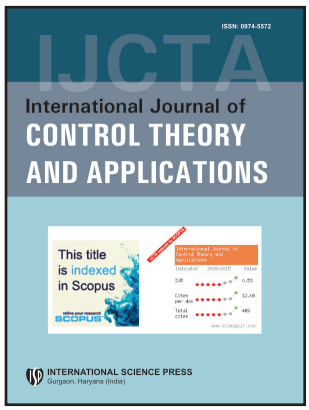

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Towards the Implementation of IoT for Environmental Condition Monitoring in Homes

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Abstract: This work presents the design and model implementation of an Internet of Things used for monitoring regular domestic conditions by means of low cost ubiquitous sensing systems. The integration of smart sensor response is helping us to manage the energy consumption. The prototype was tested. Intelligent smart home system virtually interconnected through Internet by the way of machine to machine communications. These systems offer the features of comfort, centralized control low power consumption, and economic.

Index Terms: Internet of things (IoT), wireless sensor network, home automation, Wi-Fi module, energy management.

1. INTRODUCTION

Now a days, there is a higher demand for automation and intelligent system, so for people are showing more interest on smart devices. Example with a tap of your finger you can control home appliances via smart phone or tablet, with a single clicks you can book your movie ticket, flight tickets, to know the traffic status and weather status etc. [1] [2] [4] The Internet of Things is the network of things, it make virtual network path in order to communicate, exchange data or control each other. The problem of the regular monitoring system is implementing the data analysis. Internet of Things can be collecting the data from various devices responses and storing large set data in cloud servers. Using data mining techniques, converting raw data into useful data, predicting how a particular device would behave in the future adds to the value of IoT.

2. EVOLUTION OF INTERNET OF THINGS

The advancing Internet technologies are expanding the boundaries of the Internet connectivity is becoming cheap and ubiquitous, even in developing countries or rural areas. [3] Device processing power and storage capabilities are significantly increasing while their sizes are becoming smaller which extremely appropriated for equipped with different type of sensors and actuators; the combination between small devices and multi-function sensors producing an extensively across communities where devices are able to connected and communicate over the Internet, has the ability to sense, compute, act and effectively become part of the Internet.[2] Furthermore, physical

objects are increasingly equipped with RFID tags (Radio-Frequency Identification (RFID)), NFC tags (Near Field Communications (NFC)) or other electronic bar code that can be scanned by smart devices such as tablet, smart phone and other small device embedded with RFID/NFC readers. This combination connects between the physical worlds and cyberspace via the smart device, thus enhancing the Internet capabilities toward the next generation of Internet can be called the "Internet of Things". [6] The terminology of "things" in the IoT aspect is extremely extensive and includes an array of physical stuffs . For instance, personal objects (i.e. smart phones, tablets, digital cameras, smart watch, game consoles, etc.), environmental elements and other electronic equipments embed with either RFID or NFC tags which able to connect the Internet via gateway device. According to the word "Things" that mentioned above, the numerous devices and things will be connected to the Internet almost, simultaneously and each elements providing gathered data and information, even services.

The Internet of Things (IoT) completely transforms connectivity from "any-time, any-where" for "any-one" into "any-time, any-where" for "any-thing" . The IoT is able to connect real world elements and embeds the intelligent in communication system for smartly process its specific information and autonomous decision. [9] Hence, IoT is a key enabling the different types of beneficial applications and services which can sustain our economies, transportation, environment and health that we never expected before. The generic scenario of IoT for home automation is shown in Figure 1.

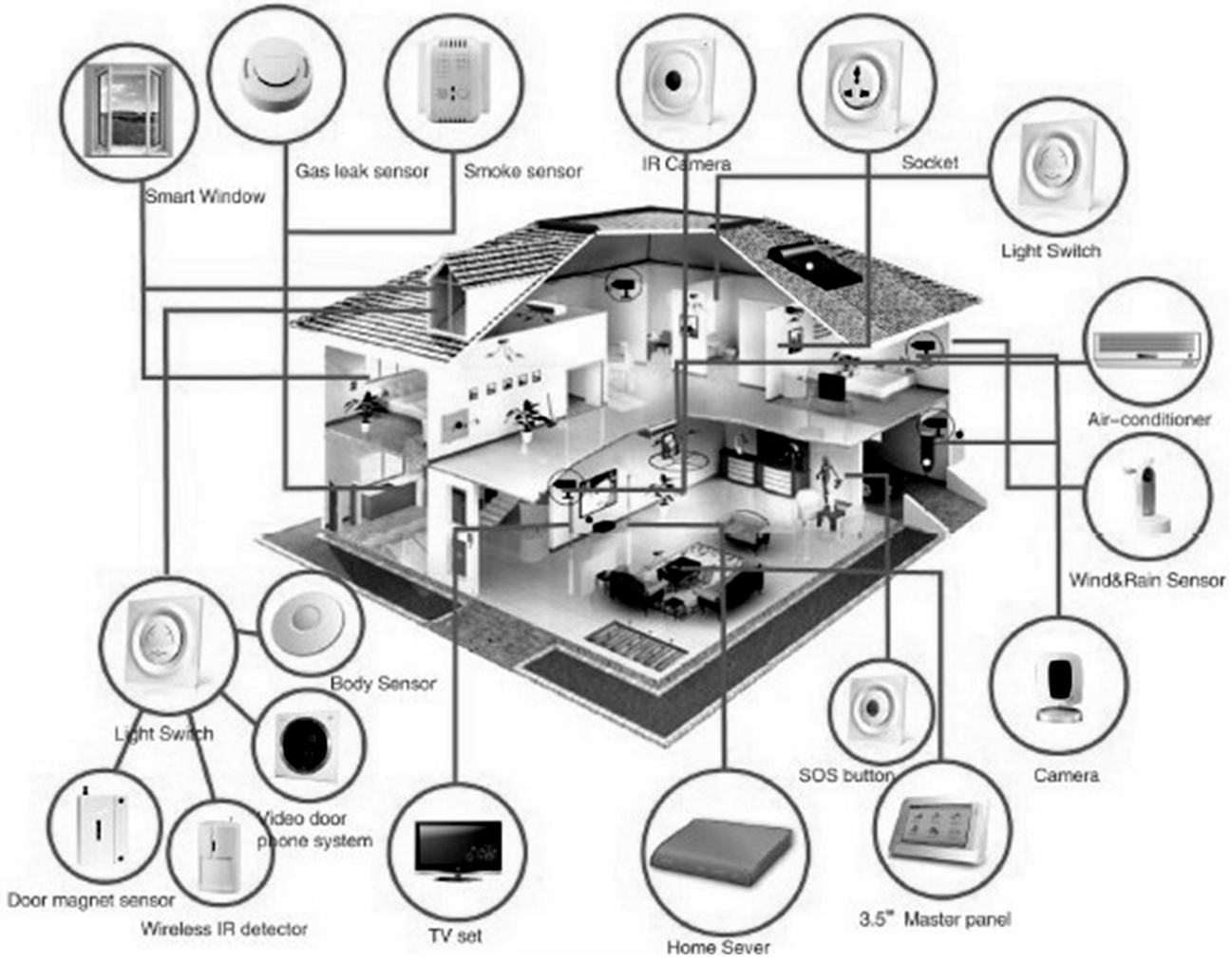

Figure 1: The smart home

2.1. The Feature of the IoT

- Advanced sensing and measurement technologies
- Information and communication technology (ICT)
- Analytical and decision making technologies
- Automatic control
- Energy saving

2.2. Power Demand

The Energy Statistics 2013 of India's National Statistical Organisation (NSO) shows electricity accounted for more than 57 per cent of the total energy consumption during 2011-12 in India, and building sector is already consuming close to 40 per cent of the electricity. This is expected to increase to 76 per cent by 2040. A large quantity of incremental electricity demand will come from the residential sector in India. Residential electricity consumption1 (REC) is the total electricity used by households to run appliances like ceiling fans, televisions, and refrigerators. It has increased about 50 times since 1971 and now constitutes about a quarter of India's total electricity consumption. It may continue to increase in the future due to three main reasons. India is aiming to provide uninterrupted (24 × 7) electricity to all households by 2019, quarter of which currently do not have an electricity connection and the rest of which face frequent power cuts. Household incomes are increasing, which combined with reliable electricity supply, will mean that more households will buy high electricity consuming appliances like refrigerators (currently only 23% of households own refrigerator in India). Finally, technology is rapidly developing. New technology can be energy efficient but also makes usage of more appliances affordable resulting in higher ownership.

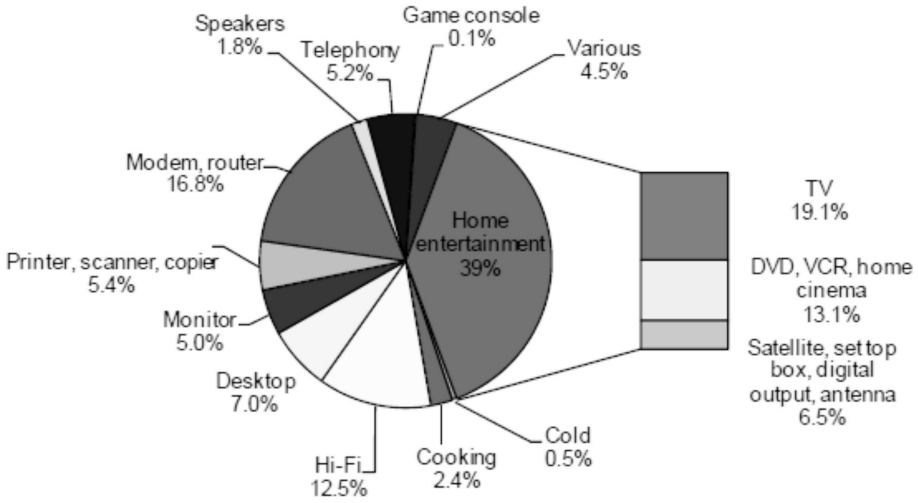

Figure 2: Home appliance power consumption

Trend in India's residential electricity consumption (1971-2014)

3. PROPOSED SYSTEM

The different electrical home appliance are virtually connected through a home area network such as wifi. The system regulate AC machine, lights, LED TV, turning them on and off as we enter or exit from the home and as they learn our schedules according to the programme. The proposed model is shown Figure 6.

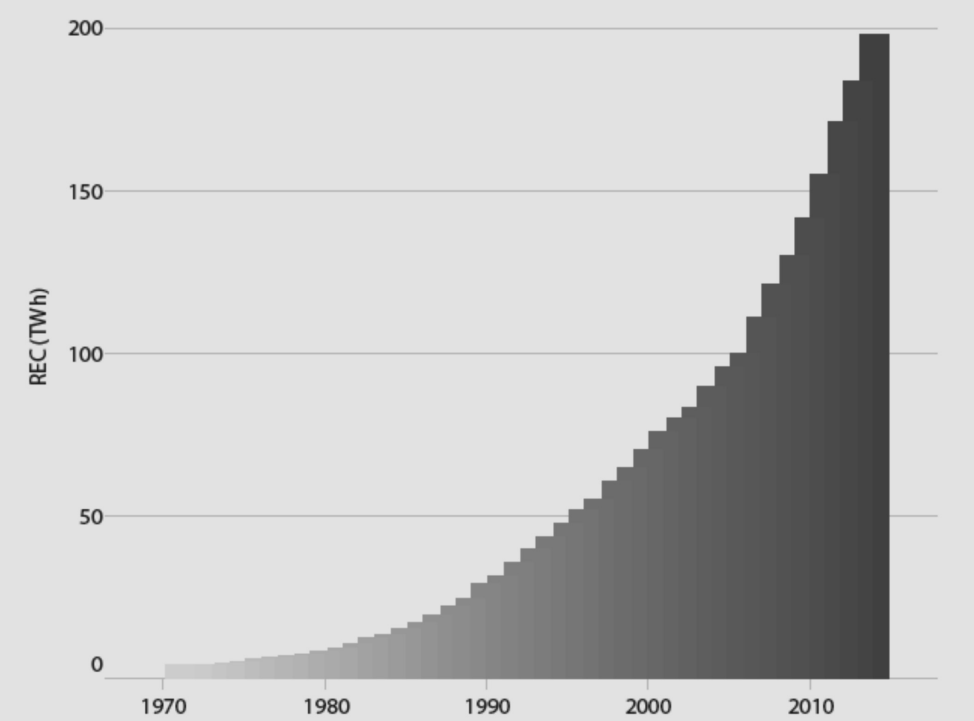

Figure 3: (MOSPI, 2015), (CEA, 2011), (CEA, 2014) and older Annual General Reviews by CEA

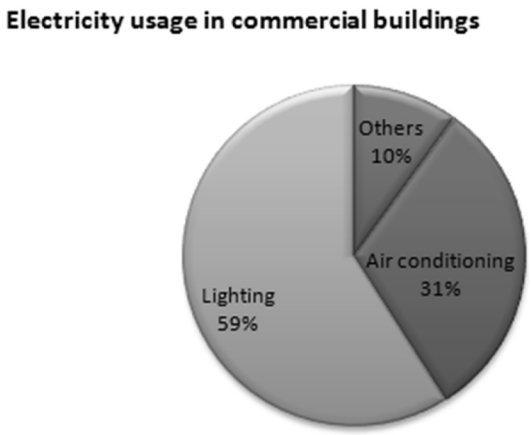

Figure 4: Commercial building Consumption of Electricity in India

1. Main power supply board
2. Dc supply for embedded controller
3. Embedded controller
4. Wifi unit
5. Realy control
6. Remote control unit
7. Home appliance

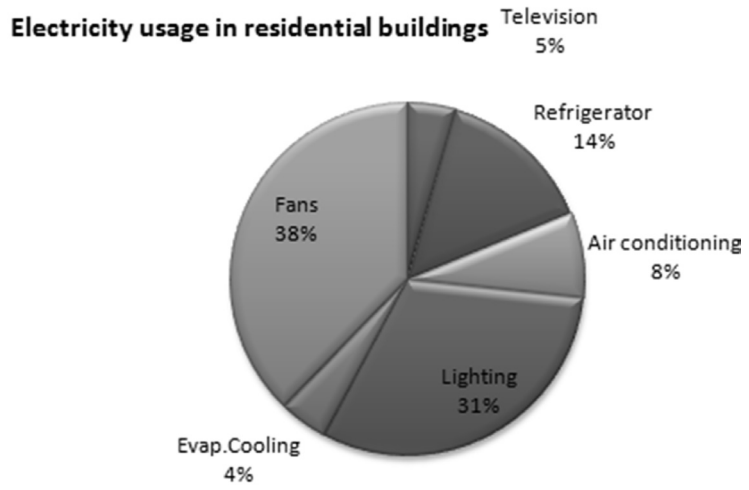

Figure 5: Residential Consumption of Electricity in India

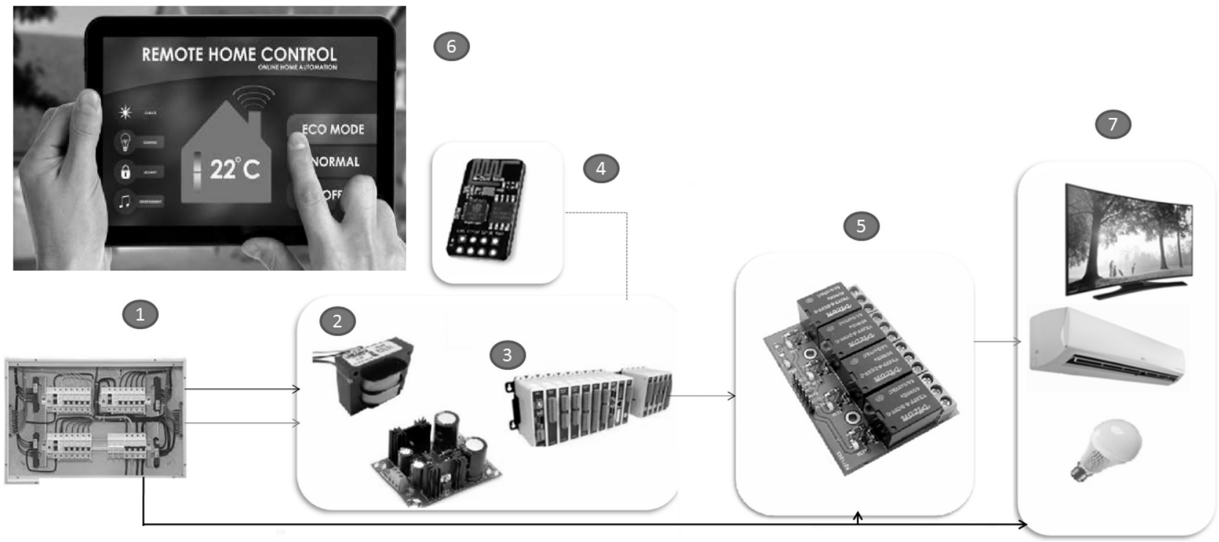

Figure 6: System Architecture

This paper illustrates an effective low-cost and flexible solution for condition monitoring and energy management in home. The innovation of IoT will drive the future of technology; various innovative and creative products will design. However, some challenge problems need to address, to reduce the standby power losses, secure protocol control, manage the power efficiently. Low-power Sensing unit: The low-power consumption is one of the most interesting issues in IoTs which focused on energy-efficient designs. The low-power sensing unit can operate over the lifetime without the need for battery replacement. However, high performance processing units or intelligent sensor modules may consume a huge amount of power and become a major design problem that needs to address. There are two common alternatives that widely used to design low-power sensors viz; Firstly, create a group of low-accuracy modules to reduce sensor power consumption then apply the fusion technique to recover high-accuracy information. Secondly, based on circuit researchers found that digital circuits consume the power less than analog circuits in wireless communication aspect. Hence, the types of transmitters are one of concerning factors that should examine for designing an energy efficient sensor. One of the common and appropriate techniques is replacing the analog transmitters with digital transmitters in wireless communication. High efficiency in connectivity: Through rapid growth and popularity in Internet technologies. Many wired/ wireless standards and protocols are defined. For estimate the demand, its need to understand, the households

appliance power consumption. A realistic future demand, which accounts for potential savings from energy efficiency and conservation measures, can help in optimizing the addition and management of the electricity generation sources.

The IoT is making simple method of analysis home environmental status by using the different sensor and monitoring system. From this database it actuates or enables the home appliance function at various mode of operation in efficient manner. The main controller will analysis the utility of the devices based on various aspects like peak hour, non peak hours power consumption and intimate to the user. So the people can easily schedule the appliance usage. Which is also known as smart home scheduling so automatically it reduces the electricity bill by the way of significantly reducing the peak energy usage

4. STANDBY POWER CONSUMPTION

In day by day standby power consumption is an increasing due to fast penetration of digital technology. Because the digital device having features of standby function, that features always enable the clock circuit, memory unit,

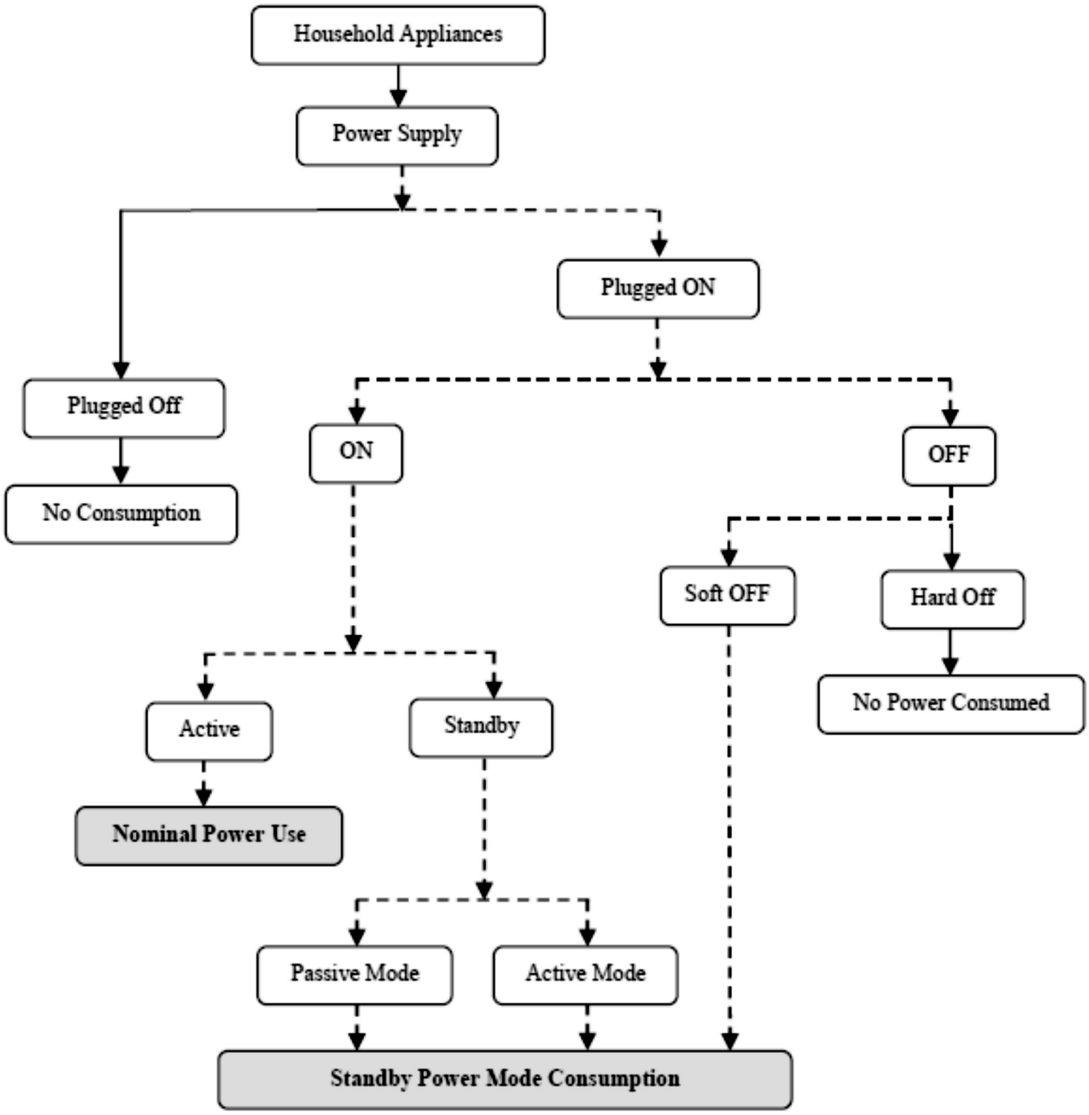

Figure 7: Flow chart for power mode analysis

display unit for identifying the status of equipment. The typical losses range varies from 1 W to maximum of 30 W. In this case nearly 10% of electricity loss occurring. So for that International Energy Agency (IEA) made some initiative for reduction of the standby power consumption. This agency identified the total standby power demand of the residential sector in industries countries amount to 15 GW. As per the estimated value from varies data analysis, that reduction of standby power could result in 1% of CO_2 emission reduction.

Table 1
Stand by mode power loss

Appliance	*Number of Appliances Metered*	*Average of Power - Off (W)*	*Average of Power - Passive (W)*	*Average of Power - Active (W)*
Computers – Laptop	15	27.3[1]		
Computers – Monitor	14	0.6	0.7	
Computers – Speakers	26	1.5		2.4
Stereo – Integrated	30		2.8	11.1
Stereo – Portable	30	1.3	2.0	4.0
DVD Player	30	0.3	1.2	5.7
DVD Recorder	25		4.2	16.0
Espresso Machine	19	1.8		
Hard Disk Recorder	30		5.2	23.2
Microwave	26	0.2	1.9	
Multi Function Device	30	2.0		8.5
Printer – Inkjet	25	1.4		3.4
Printer – Laser	22	0.1		5.4
TV – CRT	30	0.0	4.5	
TV – LCD	20	0.2	3.3	
TV – Plasma	31	0.6	2.0	
Washing Machine Front Loader	2	0.9		2.5
Cordless Phone Base Station	18		1.4	2.6
Washing Machine Top Loader	27	0.4		3.1
External Power Supplies	30		0.3	
Mobile Phone	20			3.3

5. SYSTEM DECRYPTION

The various technologies is introduce for smart home controlling device developed with Bluetooth, Internet, android app. Even though the Bluetooth control device is having good competence, the range of communication environment is limited. The selection of wifi controlling is the best option for this case. In proposed model have an Ethernet based system. The user can monitor the real time switching information of the home appliance and can control by using mobile. The model have temperature sensor, smoke sensor, PIR motion sensors.

5.1. Network System

Generic Architecture and Protocols of IoT The TCP/IP protocol stack plays a key role in digital communication which was defined long time ago. Nevertheless, the IoT may connect enormous number of objects which will

create a massive traffic and tremendous amount of data capacity is needed. Moreover, IoT will face numerous challenges especially privacy and security issues . Therefore, the new standard architecture and protocols for IoT needs to address many essential factors (i.e. sustainability, reliability, Quality of Service, confidentiality, integrity, etc.). Due to the IoT procedures are mainly to connect between everything and everyone to exchange information with each other that not only exponentially increasing the network traffic but also storage capacity as well. Thus, IoT improvement relies on the advances in technology and applies to different types of useful applications and business models. The basic architecture and protocols of IoT proposed in and respectively. With P2P discovery procedures, passive or active scanning once in the host command start, it will be done automatically. Perform power management, interaction with the host at least, this way, the task of effectively minimized.

The ESP 8266 is used in the proposed system. It built-in TCP/IP protocol stack, PLL, voltage regulator and power management components, Support antenna diversity, power amplifier and matching network. The data packet transfer rate is 2 ms and standby power consumption of less than 1.0 mW

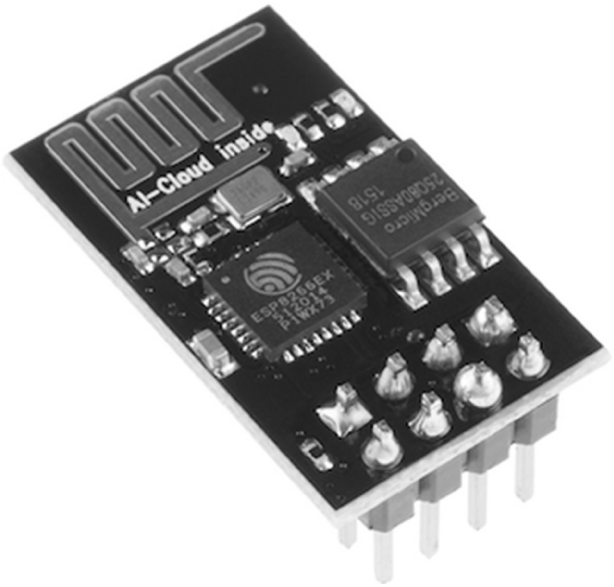

Figure 8: Wifi module

5.2. Sensors

We have used three different types of sensing units for supporting the effective data management in this system. PIR Sensor, Temperature sensor, Gas sensor are introduced in the prototype. The PIR detect the person movement, whether has presents in living room or out of the home. Through this information the system can guide the lighting system to turn on and off. Based on the PIR response the system will identify the needs and activate the home appliance. It have features of Low power CMOS technology, high input impedance operational amplifiers, Bi-directional level detector/Excellent noise immunity, Built-in Power up disable & output pulse control logic, Dual mode: retrigger able & non-retrigger able operating condition. The temperature sensor will support the system in way giving data about the room temperature variation and user requirements. According to the user schedule the controller will control the air-conditioner or fan. For the safety measure the gas sensor is enabled. The smoke sensors to check for fire at the user home. Now this typical home automation system enables with three types of sensor for centralized control.

Figure 9: Sensing unit type

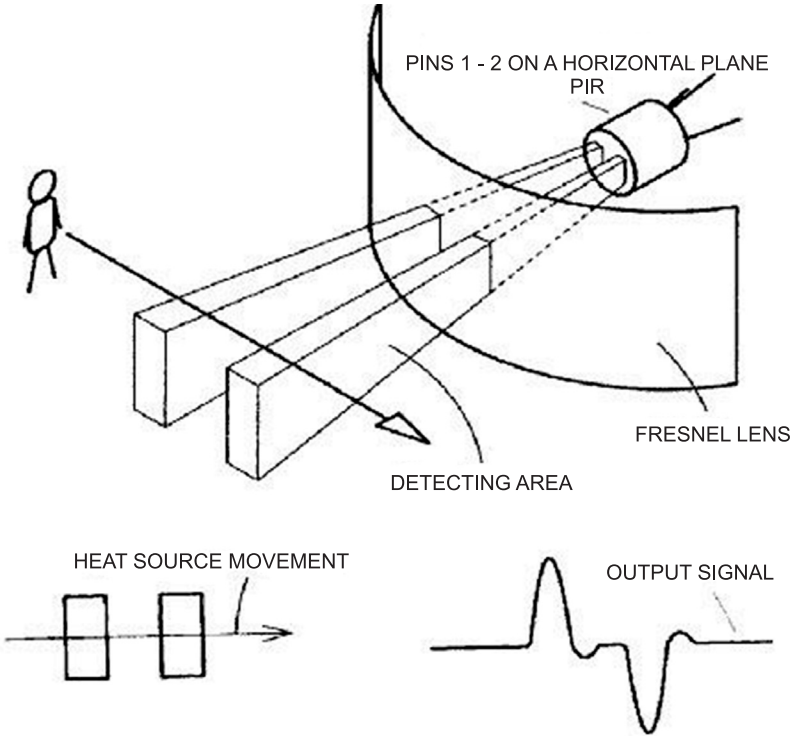

Figure 10: PIR control method

6. RESULT

The prototype was developed for intelligent smart home in the rating of 220V. An android mobile is made for control and monitoring the home appliance were connected through the Wi-Fi network. In the welcome screen is showing the status of the device whether the device in on or off condition. The status of the three different load of fan, two lighting system was tested under turn on condition as shown in Figure 11. Through accessing the manual control mode, the particular components can operate. The setup has secure method of access the components by using the techniques of P2P. If the device is in auto mode control, the various sensor based the intelligent controller will operate the device. The user can track the status of the device by using the mobile. An auto connect feature offer the user to connect with the controller for fresh tracking and monitoring the system.

7. CONCLUSION

To add intelligence to existing infrastructure, by using IoT technology integrating inter connectivity in to all kinds of home appliance like TV, air conditioner, music system etc. this means distributing computing intelligence throughout all equipment. Various embedded sensors are gathering data about home environmental condition at every aspect of electricity supply chain. From this data base main processor will make power analytics and define the function of home appliance. It make real value of IoT.

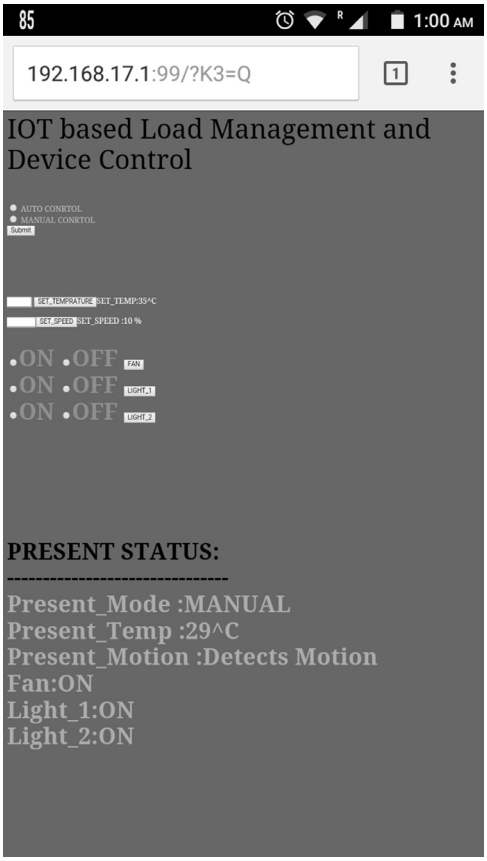

Figure 11: Android Mobile App Welcome Screen

Figure 12: Load status in mobile control

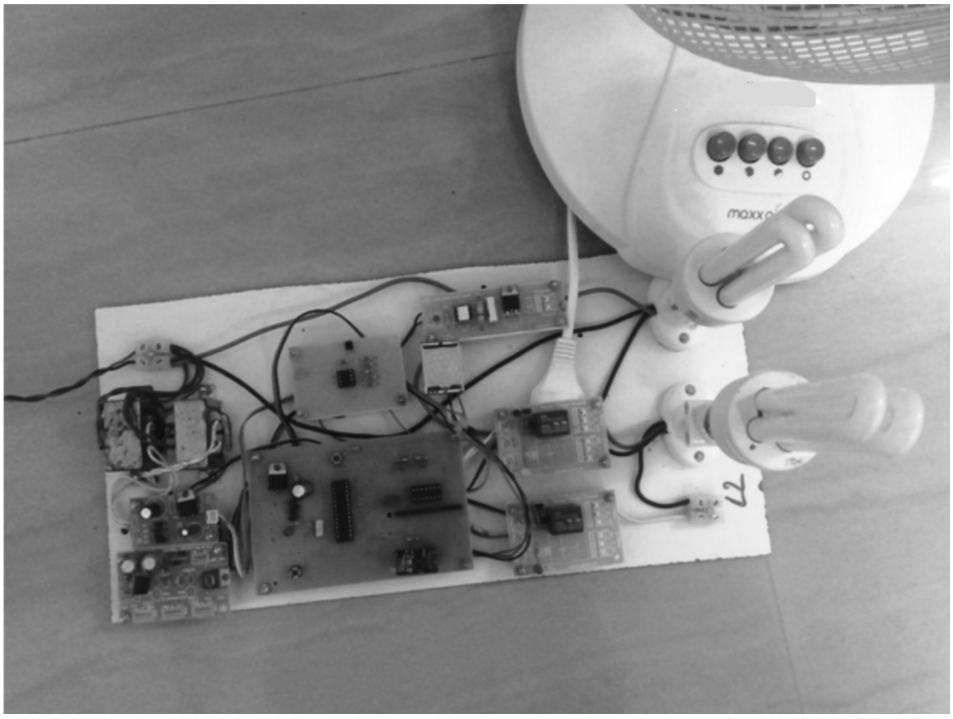

Figure 13: Prototype for home automation

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