

# Energy Efficient Home Automation System

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**Abstract**— Smart homes have become more popular now-a-days. They can have great benefits for energy, comfort and conveniences and even for helping impoverished people. This paper introduces a home automation system [HAS] based on internet of things. IOT is the emerging technology which uses internet protocols to control and manage the home appliances easily from anywhere around the world. In this paper we make use of Raspberry pi2 that acts as a server to get and post status of our home remotely by the use of android phones and computers that have internet accessibility. This system implements wireless communication, which is easier for the user to control lights, fans and other appliances of our home even when we are far away from home. This system is designed for effective usage of power consumption not only by controlling fans and lights but also other appliances as the hardware module Raspberry pi2 is extended to connect more number of devices to it.

**Key words:** Smart home, Internet of things, Raspberry pi2, Internet accessibility, Wireless communication

## I. INTRODUCTION

In the computer world of 21st century, more and more tasks are becoming automated. Automation can make things easier, safer and often more cost efficient.

Home Automation has been around from many decades in terms of lighting and simple appliance control. It is a term used to describe the working together of all household amenities and appliances. It is essential that the different controllable appliances be interconnected and communicate with each other. The basic aim of home automation is to control or monitor signals from different appliances or basic services. Recently technology has caught up for the idea of the interconnected world (i.e., Internet of Things) allowing full control of our home from anywhere, to become a reality. IOT is evolution of internet technology that allows all of our appliances and devices will be networked together to provide us with a seamless control over all aspects of our home.

With home automation, you dictate how a device should react, when it should react and why it should react. You set the command and the rest is automated and based on our personal preferences thus providing convenience, control, money savings and an overall smarter home. A smart phone or web browser can be used to control or monitor the home automation system.

### A. Convenience:

Control and automate just about every device and appliance within your home whether you are at home or far away.

### B. Security:

Always on guard and at the ready, home automation provides security, safeguarding your home.

### C. Energy Savings:

Home automation works efficiently for you, saving money on your utilities and providing overall convenience.

## II. RELATED WORKS

### A. Central Controller Based Home Security System:

A central controller-based home security system looks to improve the security of the homes in a locality by combining many homes into a security network with a control node dedicated for each locality depending on the number of users. These control nodes are controlled by a few central or chief control nodes with considerably high processing power. The security system described by S. Tsai et al. [1], called Home Security System on Intelligent Network (HSSIN), uses such a central controller-based approach.

### B. Bluetooth Based Home Automation System:

Bluetooth-based Home Automation System The work of N. Sriskanthan et al. [2] shows the implementation of a home automation system using Bluetooth. They use a host controller implemented on a PC, which is connected to a microcontroller-based sensor and device controllers. The device controller is connected to electronic devices through the I 2C Bus.

### C. Mobile-Based Home Automation:

Mobile-based Home Automation System is attractive to researchers because of the popularity of mobile phones and GSM technology. We mainly consider three options for communication in GSM, namely SMS-based home automation, GPRS-based home automation, and Dual Tone Multi Frequency (DTMF)-based home automation

### D. SMS-Based Home Automation System:

The work of A. Alheraish [3] proposes a home automation system using SMS. The proposed system detects illegal intrusions at home and allows legitimate users to change the passkey for the door and control lights in the home. The illegal intrusion into the home is identified by monitoring the state of the home door, which is done using Light Emitting Diode (LED) and infrared sensors. A user can control the lights in their home remotely using SMS from their registered mobile number; by turning the lights on in different rooms at random intervals of time, one can give the impression that the home is occupied, even when it is not.

### E. GPRS-Based Home Automation System:

There are a lot of home security systems implemented using GPRS. Most systems use the word security in the traditional sense, and only address the threat put forth by old fashioned intruders in home. Researchers M. Danaher and D. Nguyen [4] propose a home security system using GPRS. The work uses a webcam to stream video and pictures of the home to its owner's mobile through GPRS. The webcam detects movement by comparing frames for differences, including

light intensity. Video streaming in the proposed work is done using the home Internet connection, not the GSM modem. The work of B. Wu et al. [6] describes video camera surveillance using the GPRS facility in mobile phones

**F. Internet-Based Home Automation System:**

Internet or IP protocol-based communication in home automation systems is always a popular choice among researchers. The Internet is easily scalable, flexible when it comes to access and use, and very popular as a communication method in today’s world, so the hardware and the network required for access is readily available, offers high bandwidth and very low communication cost, and devices can connect to and disconnect from the network easily. These are some of the features that make the Internet such an attractive choice for researchers. Utilizing the Internet as a means to access and control the home seems to be the next logical step forward for home automation systems

**III. SYSTEM DESIGN**

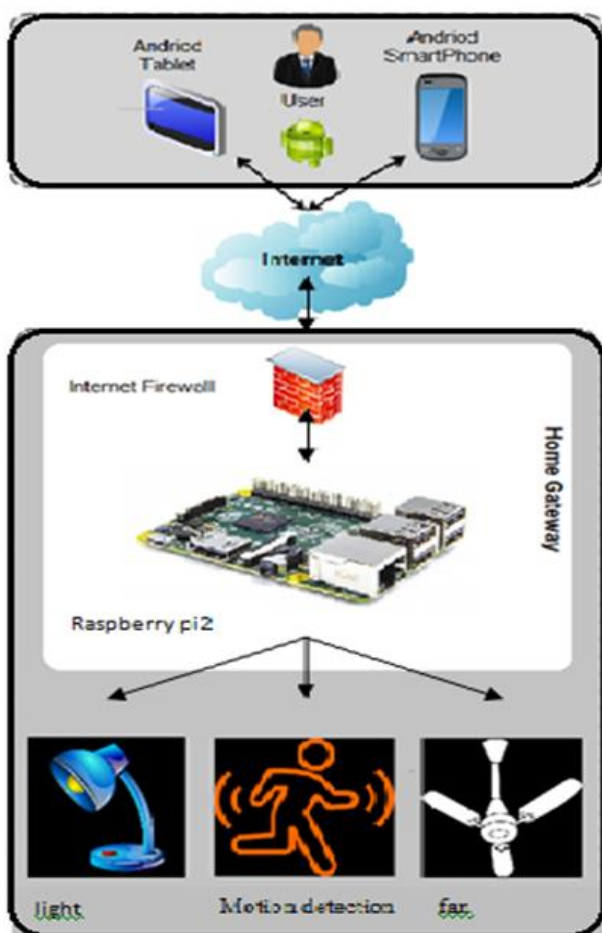


Fig. 1:

**A. Problem Definition:**

Home automation systems are encountered by many problems like installation cost, inflexibility, inconvenience and difficulty to provide security. In contrast to these HAS, this paper proposes home automation system using IoT which helps user to control home appliances with a simple web interface from anywhere around the world. This system is cost-effective and employs effective use of power consumption.

**B. Hardware Design:**

The proposed system is a distributed home automation system, consisting of a server, sensors. The server controls and monitors the various sensors, and can be easily configured to handle more hardware interface modules (sensors). The Raspberry Pi2, which acts as a server, is a small Linux box that features a set of GPIO pins, allowing it to interface with the real world. It has an inbuilt Ethernet socket for connecting LAN directly.

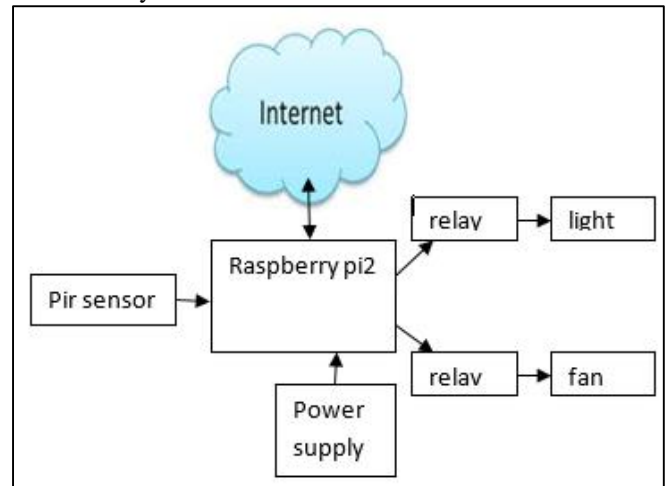


Fig. 2:

When the module is switched on and connected to the internet via LAN or WIFI, the pir sensor starts sensing the intruder (motion detection). If it detects an intruder, the people count is uploaded and updated automatically on the cloud using the thingbox:1880. Where 1880 is the local host port address of the server (Raspberry pi2).

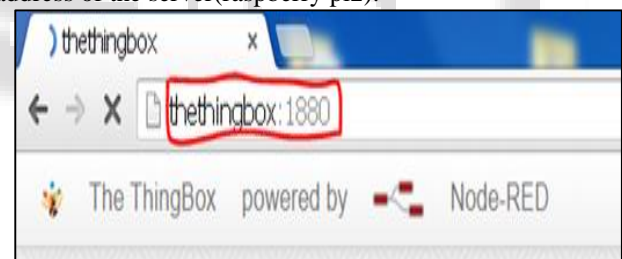


Fig. 3:

It gets connected to the IP address of the server, which enables us to integrate devices on to the cloud (Ubidots). We make use of Ubidots' site as the data gets pinged automatically at regular intervals of time.

**IV. SOFTWARE SIMULATION**

**A. Visual Coding In Node Red:**

Node-Red is a tool designed by IBM that makes it simpler to wire Internet of Things resources, such as hardware devices, APIs and online services. The folks at The Thing Box Project built a nice Raspberry Pi image with Node-Red preinstalled and a set of API functions that make it compatible with services like Ubidots—right out of the box. This website uses the web browser and a graphical drag and drop user interface to produce data flows between the object and the rest of the world.

**B. Thing Box:**

The Thing box is a set of software already installed and configured. The thingbox allows anyone to graphically create

new unlimited applications interacting with connected objects from a simple web browser. It contains the most of the major technologies: a MQTT broker (Mosquitto), a java script HTTP server built on top of Node.js and this tool allows to deal with the connected objects without programming.

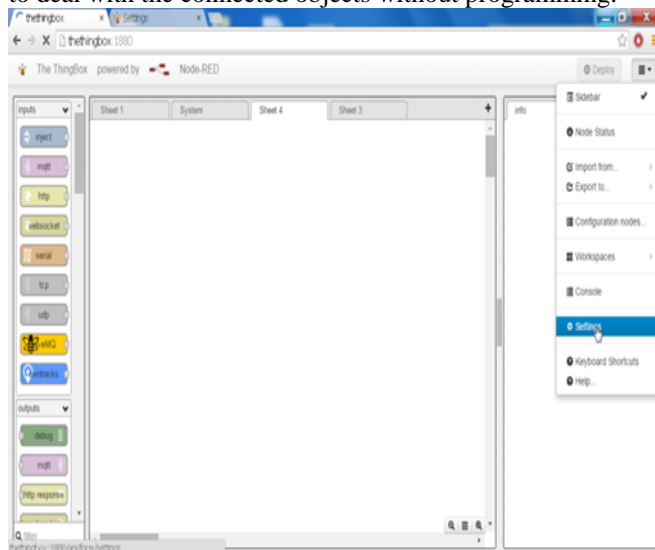


Fig. 4:

### C. Ubidots:

A cloud service to capture and make sense of sensor data. Ubidots offers a platform for developers that enables them to easily capture sensor data and turn it into useful information. Use the Ubidots platform to send data to the cloud from any Internet-enabled device. You can then Configure actions and alerts based on your real-time data and unlock the value of your data through visual tools. Ubidots offers a REST API that allows you to read and write data to the resources available: data sources, variables, values, events and insights. The API supports both HTTP and HTTPS and an API Key is required.

### D. Setup Your Ubidots Account:

- 1) Login to Ubidots and click on "Sources".
- 2) Click on the orange icon to add a new data source.
- 3) Click on the created data source and then on "Add New Variable".
- 4) Copy the ID of the variable.
- 5) Create a token under "My Profile" tab and take note of it, we'll need it later
- 6) Go to the Dashboard and add a new Widget, select "line chart" and then select your data source and variable. Optionally, repeat this process to create a "Statement" widget that sums the total number of "movements" detected by the PIR sensor.

## V. RESULT

When we login to our ubidots account on the dashboard the graphical switches which we created will appear. When you switch ON a device, it will notify that the device respective device is ON by its color. The following page will show the dashboard for controlling devices.

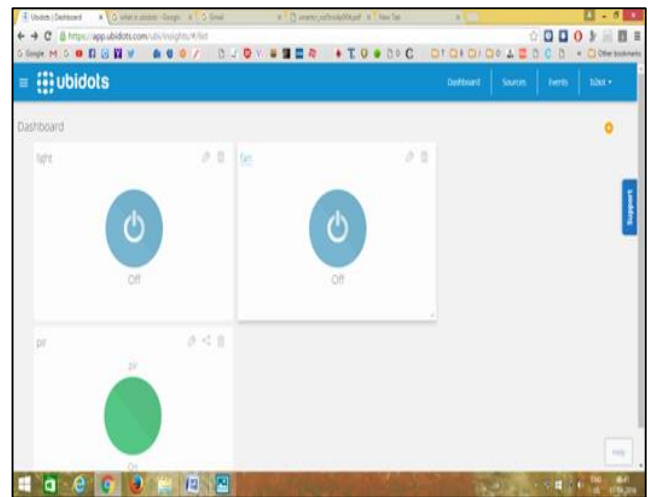


Fig. 5:

## VI. CONCLUSION

The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. It also stores the sensor parameters in the cloud (Ubidots) in a timely manner. This will help the user to analyze the condition of various parameters in the home anytime anywhere.

## VII. FUTURE SCOPE

The system can be expanded to include home security feature like capturing the photo of a person moving around the house and storing it onto the cloud. This will reduce the data storage than using the CCTV camera which will record all the time and stores it.

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