Advances in Computational Sciences and Technology
ISSN 0973-6107 Volume 11, Number 12 (2018) pp. 1059-1063

http://www.ripublication.com

Internet of Things Based Smart Home Control

Amita Yadav

Maharaja Surajmal Institute of Technology, New Delhi, India

Abstract

Internet of things (IOT) is the technology which allows things or objects to communicate each other through the internet technologies by physically or virtually. Things can be sensed and hence be controlled remotely using the existing network infrastructure, generating opportunities for direct integration between the real world & computer-based systems, and resulting in accuracy, improved efficiency, and economic benefit. This paper proposes architecture, which is based on the principles of IOT to control the home devices sitting online and also check the electricity consumed and the cost against its consumption. Architecture creates an interface between users and the smart home devices and electricity meter with the help of Arduino uno microcontroller and internet technologies. Detecting meter reading with the help of LDR sensor, uploading usage and consumption to the cloud, estimating bill and controlling connected devices by sending commands through ESP wifi chip and switching using relays are the modules to be designed. An interface on the web will provide remote access to fulfill requests. In this way user will be able to control the devices sitting online.

Keywords: Smart Home Control (SHC), IOT, Arduino, LDR.

I. INTRODUCTION

Internet of Things is also called Internet of Everything, is the network of "things" or physical objects which are embedded with sensors, electronic components, software and connectivity to make things to exchange data with the other devices based on the underlying infrastructure of International Telecommunication Union's Global Standards Initiative. Simply Internet of Things can connect living & non living things through internet. Internet of Things allows things to be sensed and controlled via internet remotely using existing network infrastructure, hence generating opportunities for direct integration between the real world & computer based systems, and hence resulting in accuracy, improved efficiency and economic benefit. Each and

every thing is uniquely distinguishable or identifiable using its embedded system but is capable to inter-operate inside the existing Internet infrastructure. One research reveals, the Internet of Things, which excludes tablets , smart phones and PCs, will rise to 26 billion units installed in 2020 representing an almost 30-fold increase from 0.9 billion in 2009[1]. The aim of Internet of Things is Anything, Anyone, Anytime, Anyplace, Any service and Any network [2].

Today the energy meters which are placed in our homes or offices collect the data of the energy consumed and displays it on a digital display or by a number dial. At the end of every billing cycle, one person from service provider used to visit the site where the meter is installed to collect the reading and either note it down or takes an image of electricity meter for further data processing (i.e. for generating the bill). Ashna, K[3] presents the design of a simple low cost wireless GSM energy meter and its associated web interface, for automating billing and managing the collect data globally. Yin Jie proposed a novel idea of applying IoT technologies to smart home [4].Alberto M.C et al. proposed an architecture for accessing smart home devices through web clients.

The proposed system automatically reads the energy meter data by sensing the blinking of LED of the meter with the help of LDR sensor and uploads it on the cloud through wifi chip. The system can also provide the facility to the user to check the status of devices at his home and to turn ON/OFF the same as per his requirement.

To implement this system, an Arduino uno , LDR sensor, an ESP 8266 wifi chip and relay is used. The program can be developed on Arduino IDE and can be burnt to ESP 8266 using Arduino UNO or FTDI cable.

II. PROPOSED WORK

A. Meter Reading detection

Meter reading is detected by the LDR sensor by sensing the blinking of LED in the meter. By counting the number of blinks we can check the energy units consumed. This value is sent to the cloud through esp-wifi chip. This value is displayed on a responsive website (compatible for any screen size) so that users so that they can check the reading on web using their laptops , mobile or any other smart device.

B. Device Control

For the users, this system provides a facility to check the status of the devices at his home and control the same. User can do the online with a single click. The esp-wifi chip reads the value from web and decides whether to switch it ON/OFF. It can do this by making its GPIO pin high or low which is connected to the devices to control. Relays can be used to control large appliances which works on 220 volts. Number of relays required is equal to the number of devices to control.

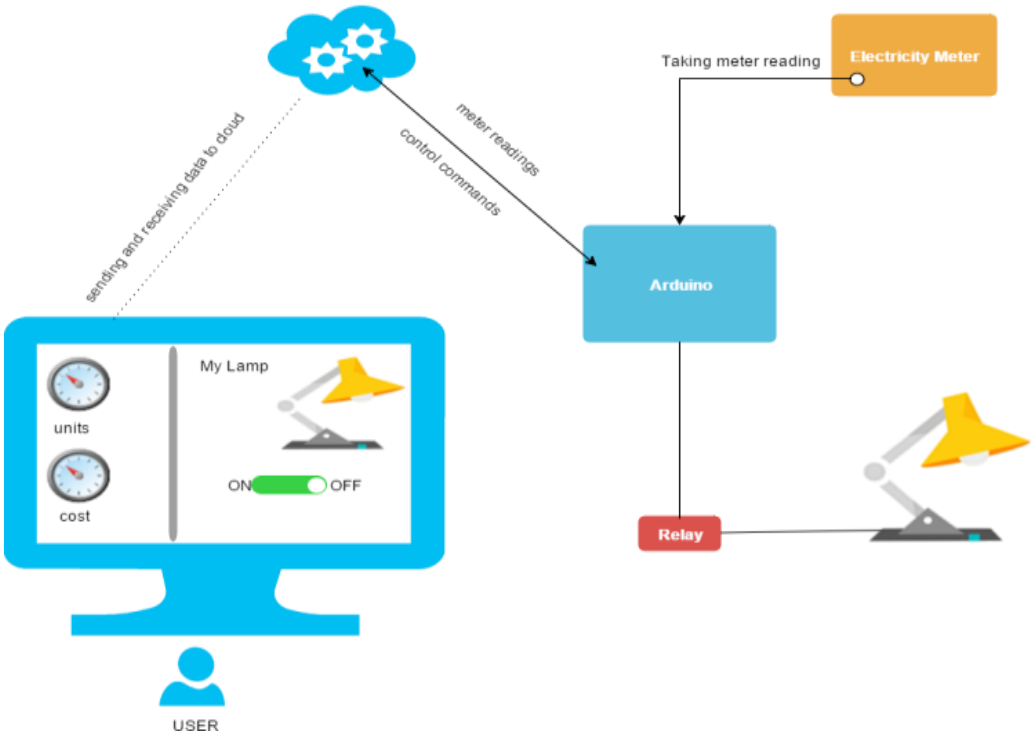

Fig. 1 Conceptual representation of the proposed system

III. IMPLEMENTATION DETAILS

The system is designed around an Arduino UNO microcontroller (ATmega 328P) and ESP wifi chip. Arduino Uno has 14 digital pins for input and output (six of which can be used as PWM outputs), 6 analog inputs, a power jack, a USB connection, reset button and an ICSP header. It has everything which is required to support the microcontroller. The code is written using Arduino IDE for programming both the Arduino microcontroller and ESP wifi chip. ESP8266 has 8 pins, 4 pins in two rows. The first pin on the top left corner is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right corner is the RX pin and the pin on the lower left corner is TX. These are the pins for communication. The central pins on the bottom are RST(reset) and CH_PD(chip power-down).

The ESP wifi chip is programmed using arduino IDE and arduino UNO. The arduino here acts a a serial to ttl converter. FTDI cable can also be used to do the same. After when the ESP is programmed , the program inside it runs in a continuous loop. The program makes the ESP to connect to a wifi network (SSID and password provided) .Then LDR senses the blinking of the led and counts how many units are consumed and then send the readings to cloud. It also keep listening for the user action to switch device ON/OFF. As soon as user makes a click to switch the device on/off , the ESP reads the user action and decides what to do . It can switch the device on/off by setting its GPIO pin high/low accordingly. This whole process runs in a continuous loop as long as ESP is supplied 3.3 volts. The web application displays the readings

sent by the ESP to the appropriate user and also let him know the status of various appliances at his home. The web application is deployed to Google app engine, hence it can easily scale up or down according to the changing traffic needs (pay-as-you-go model).The website is made on bootstrap framework so that it is compatible on any device of any screen size (laptop, desktop, smart phones, tablets, etc).

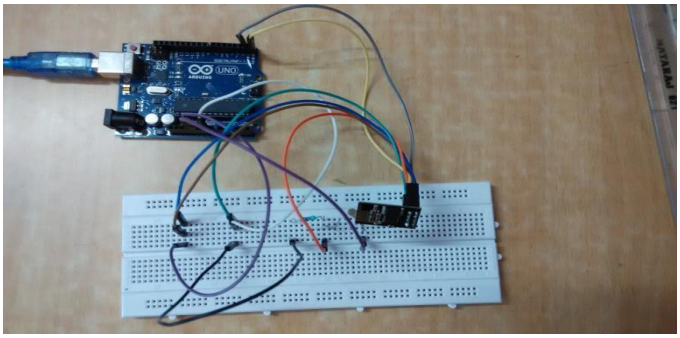

Fig 2 Connection between Arduino IDE and ESP wifi chip

The LDR senor senses the number of times the LED of electricity meter blinks. If the intensity of the light is more than a threshold value (depends on intensity of led) then LDR consider it as a blink. When number of blinks reaches 3200 (vary from meter to meter) then it is considered that one unit is consumed. Then the reading is uploaded to cloud from where it can be accessed anytime, from anywhere, on demand.

By using a cloud based web application the customer will be able to check the meter reading anytime. With every unit of energy consumed it will be keep updating the site and cost against the consumption will be calculated.

For the device control, a relay would be used to control the device. A relay is an electrically operated switch. Many relays use an electromagnet to operate a switch mechanically, but some other operating principles are also used, such as solid- state relays. Relays are used when it is necessary to control real world devices such as table lamps, electric kettles, etc by a low-power, or where many circuits must be controlled by one signal. The current status of the device would be read from the database on cloud. If the user wishes to toggle the status of device, he would click on the button and the status would be updated. This new value would be read by the ESP-wifi chip which will in turn make its GPIO pin high or low which is connected to relay. The relay is connected to the device which is to be controlled.

IV. ADVANTAGES AND FUTURE SCOPE

The system designed here, minimizes the efforts for manual reading collection of energy meter by electricity department.With the help of this the electricity department can keep a watch on the readings of every meter. Also the user can check the electricity being consumed and also the cost against its consumption. Also, with

the help of device controlling ability, the user need not worry about the risk of forgetting to turn off a device. He can just log into the account and switch on/off the devices as per his wish.

In future, the system can be extended to detect electricity theft. The system can analyze the unit consumption pattern of a particular meter and then check if other pattern is detected. Also it can detect the same if the meter is not sending the readings for a long time.

V. CONCLUSION

With the help of above system, the electricity meter reading collection and bill generation task becomes fast and easier. It is beneficial for both electricity department and the users. User can keep a check on the electricity being consumed and also the cost against its consumption. Also the devices can be controlled from anywhere, anytime, anyplace.

REFERENCES

[1] P. Magrassi, T. Berg, "A World of Smart Objects", Gartner research report R-17-2243, 12 August 2002.

[2] White Paper: "Internet of Things Strategic Research Roadmap",

[3] Ashna, K, George, S.N. "GSM based automatic energy meter reading *system with instant billing*", International Multi-Conference on Automation, Computing, Communication, Control and Compressed.

[4] Yin Jie, Ji Yong Pei ; Li Jun, Guo Yun, Xu Wei. "*Smart Home System Based on IOT Technologies*", International Conference on Computational and Information Sciences (ICCIS), pp. 1789 – 1791,June 2013.