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SMART POWER OPTIMIZATION WITH IOT

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ABSTRACT - Applications based on IOT are becoming popular now a days and are providing effective solutions for real time problems. In this research one of the problem on daily basis that we are facing is discussed. One of the solution for monitoring and controlling power consumption is proposed here

In our daily life we normally forget or don't care to switch off the electrical devices used at our homes i.e. fans, tubes, bulbs etc. Every device has a particular power ratings according to which it consumes electricity now the working of these devices without any use will lead to wastage of power and ultimately to the electricity bills.

This project can be used to avoid this problem. In this project every room will be monitored by a single microcontroller and the microcontroller will keep the record. By the usage of wifi module the controlling part of proposed system will be done.

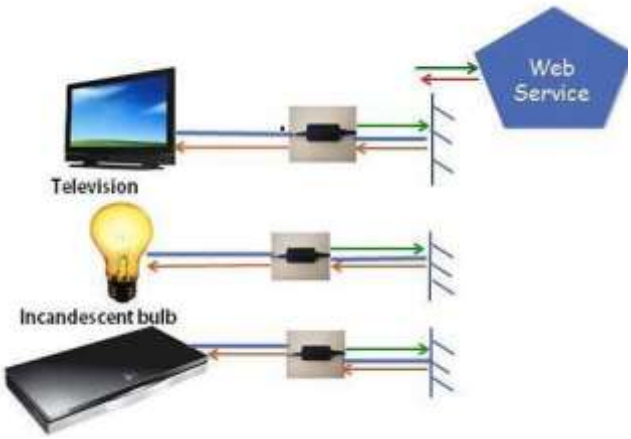
Keyword: IOT, CPS Technology, Home Automation .

I. INTRODUCTION

Identifying the power usage and minimising it, is the major concern of today .So the system that has been designed will help us in reducing the wastage of power consumption by continuously monitoring and controlling the devices that have been monitored.Atmega8A microcontroller is used because of his high performance and advanced risc architecture. The current sensor used will send input to the microcontroller and which further helps in monitoring the data continuously. The primary task of the designed system begins with the monitoring of the devices. The monitored values from the sensors can be continuously stored and updated in a cloud platforms such as xiveley, thingspeak, html, etc. Controlling of the devices is the secondary task that can be used to conserve energy .Relays can be used as a switch to turn on and off the devices as per the needs.So here using CPS(communicating power supply)[1] technology. We measure the power usage of the devices and once the data is measured it will be uploaded on webpage and we will control it using IOT. Here we have demonstrated a proof of measuring and controlling of different power supply devices. In homes, Building, Industries we will process this aggregated data and an estimation of the individual appliances consumption can be retrieved and can be used to provide novel services, such as, personalized recommendations on how do we reduce the overall energy consumption of the household or Industry. In particular, we can investigate the use of ON/OFF events, which will signal when the appliances have been turned on or off, to improve the accuracy of the system, state-of-the art disaggregation which uses such events along with smart meter data to estimate the single appliances consumption.

II. PROPOSED ARCHITECTURE

The proposed architecture is as shown in the below figure 1[2]. It is connected along with the power supply devices then the power data will be uploaded in the webpage or can be even viewed through an android application. The power consumed will be displayed on the Android phone or on the webpage, there the ON/OFF of the device power supply can be controlled.



III. B.IMPLEMENTATION

This hardware demonstration utilized commonly available prototype hardware with open-source software libraries for nearly all components. The only system components that were custom made for this demonstration were the signal conditioning circuit board that contained various interface components. The Wires will run from the CPS to the device under control, so that the device will natively carry out the power commands which are issued by the CPS. Providing control to the products connected requires basic understanding of the product's existing user interface. Device ON–OFF control operation will be often controlled through a button press

(such as a TV power button). The CPS emulated button presses using a relay module will be in parallel with the user controlled switch. When it is fully integrated into the product, integrating with the existing interface is easily completed as the part of design process. We implemented our CPS technology in an Incandescent bulb and an Iron box. The bulb in real time was power monitored, and the resulting data will be uploaded to the Internet immediately after measurement of power. The energy utilized information will be displayed on a web-based dashboard, which also allows a user to control each device. The user dashboard will provide automatic energy-use information and control each of the connected devices. Each device also retained the use of its native control interface, switch of bulb), allowing the user to seamless switch between direct-device controls and web-based. The embedded devices with radios will serve as the CPS brains and as the network hub. The hub will be connected to a PC and also handles the interactions with our web service running in the web host. This section details the interactions and functions of each of these system components. The ARM based nodes are integrated with the bulb's power supplies. Each node will measure the device's power consumption and sends that information to the control entity. This information will also allow the device's power state to be inferred by the server.

IV. METHODOLOGY

i. Keil µVision IDE

During the implementation of our project we have utilized certain software. The source code for the ARM microcontroller was written in programming language C. The IDE used was KeilµVision. The µVision IDE from Keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The µVision development platform is easy-to-use and helps you quickly create embedded programs that work. The µVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment.

ii. Arduino IDE

The Arduino Software (IDE) is an open source software and it makes easy to the code and upload it to the board. It runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software to be installed on the machine this software can be used with any Arduino board.

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. An Arduino contains a microchip, which is a very small computer that you can program. You can attach sensors to it so that it can measure conditions (like how much light there is in the room). It can control how other objects react to those conditions (room gets dark. LED turns on).

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. Microcontrollers use inputs and outputs like any computer. A switch and a sensor could be a digital and an analog input respectively into the Arduino. Any object we want to turn on and off and control could be an output. It could be a motor or even a computer.

An Arduino board consists of an Atmel 8-, 16- or 32-bit AVR microcontroller (although since 2015 other makers' microcontrollers have been used) with complementary components that facilitate programming and incorporation into other circuits.

ATMEGA8A-

ATMEGA8A-PU - ATMega8is a 28-Pin, 16MHz, 8kb 8-bit Microcontroller.

This is used because of its high-performance, Low-power and AVR 8-bit Microcontroller.

It has Advanced RISC Architecture.

Current Sensor (ACS 712)

This is the transducer used for sensing and monitoring of current flow. In essence, Allegro ACS712 current sensor was used owing to its high accuracy. It senses AC and DC currents based on Hall-effect principle illustrated in Fig. 3. The ACS712 Current Sensor is a Hall Effect current sensor that accurately measure current when induced. The magnetic field around the AC wire is detected which gives the equivalent analog output voltage. Since, the actual current reading is needed, the analog voltage is sent to the Arduino for processing.

ESP 8266 Wi-Fi module

(Node MCU) The ESP 8266 Wi-Fi module is a low cost component with which manufacturers are making wirelessly networkable microcontroller module. ESP 8266 WiFi module is a system-on-a-chip with capabilities for 2.4GHz range. It employs a 32 bit RISC CPU running at 80 MHz. It is based on the TCP/IP (Transfer control protocol) [3]. It is the most important component in the system as it performs the IOT operation. It has 64 kb boot ROM, 64 kb instruction RAM, 96 kb data RAM. Wi-Fi unit performs IOT operation by sending energy meter data to webpage which can be accessed through IP address. The TX, RX pins are

connected to the 7 and 8 pins of the Arduino microcontroller.

V. WORKING

A functional description of the IOT based energy meter as well as the cloud integration was achieved through a high level integration. Since the proposed system is to be used in the consumer power system end, the following were put into consideration in realizing the system, viz: cost, method of sensing and signal conditioning, reliability and performance efficiency of components. Also, the selection of system sensors were based on factors viz: sensitivity, accuracy, precision and accuracy. Table 1 show the specification used in this paper. The choice of the design module was informed by the availability of materials at the time of design.

- Step 1: In order to establish connection between the client and the server, the Wifi option in is enabled
- Step 2: It is connected to the Wifi module of the system
- Step 3: Each electronic/electrical appliance in the system is connected to the digital pins on the Arduino Uno Board
- Step 4: A Relay is used for connecting each device to the Arduino, which helps in converting high Voltage supply to low voltage
- Step 5: A C-program is loaded on to the microprocessor chip on the Arduino Uno Board which specifies what action is to be performed on receiving particular inputs
- Step 6: An web page has been developed which enables the end user to monitor and control the appliances from any remote location
- Step 7: Socket Programming has been used to achieve client-server communication
- Step 8: Successful controlling and monitoring of appliances

Firstly we have to switch on the mains. Current sensor senses the power utilized by the load. Which gives output in analog form. The output of the sensor is supplied as input to the analog input part in the Arduino Nano Board. Arduino board has inbuilt analog to digital convertor which converts analog input of power to digital output. This digital output is displayed on LCD display. There is a set point value; when the power utilized by the load exceeds the set point value LCD displays "The Node MCU is used to connect internet with the monitoring hardware system. The power utilized by the load is displayed in the cloud viz, ThingSpeak cloud in graphical format. It shows time to time power utilization of the load/loads connected to the system.

Energy Monitoring using IOT is an innovative application of internet of things developed to control home appliances remotely over the cloud from anywhere in the world. In the proposed project current sensor is used to sense the current and display it on internet using IoT. The system updates the information in every 1 to 2 seconds on the internet. In the present system, energy load consumption is accessed using Wi-Fi and it will help consumers to avoid unwanted use of electricity. IOT system where a user can monitor energy consumption and pay the bill Online can be made. Also, a system where a user can receive SMS, when he/she crosses threshold of electricity usage slab can be equipped. We can make a system which can send SMS to the concerned meter reading man of that area when theft is detected at consumer end. Also using cloud analytics we can predict future energy consumptions.

VI. PROGRAMMING TECHNIQUE

To achieve the IOT metering depicted in Fig.5, C++ was used as the programming language. This was used to realize the communication between the Arduino Uno, GSM Module and the Cloud server. For communication between the Arduino and GSM module, the Arduino accesses the preinstalled GSM library using the 'AT commands' so as to effectively communicate with the GSM module. The microcontroller was programmed using Arduino C++. Essentially, the Arduino software consists mainly of two parts: the Integrated Development Environment and a core library. The development environment is a complete source code editor, serving as a cross platform application. Code management, editing, compilation as well as code script uploading is carried out via the IDE which has a serial monitor. This enables a user to send and also receive data from the board. Programs are written in the development environment of the Arduino and then loaded to the Arduino board via a USB in circuit reprogrammer. Also, the AT commands were used to control the interface modem.

RESULT AND DISCUSSION

This proposed system was evaluated as a standalone energy conserving method. The power measured is continuously monitored in real time and displayed in the web based user interface (UI). The graph is plotted in real time and dynamically updated. The device can also be controlled using the UI by clicking the switch in the web page and it can also be displayed in an Android phone, the power consumed details and the ON/OFF control. The web page provides the interface for the user to control the load and also view the power consumed by

the load in real time. The power measured by the current sensor is displayed on LCD module at Arduino hub to monitor the power values without internet connection.

BIOGRAPHY

Gurpreet Kour is currently pursuing M.E from National Institute of Technical Teachers Training and Reasearch, Chandigarh India. She has completed her B.Tech in 2005 from Jammu University, Jammu, India. She has 8 years industrial academic experience, presently she is working Assistant Professor in Model Institute of Engineering and Technology, Jammu, J&K. Her areas of interest include Advanced digital Communication, Advanced Digital Signal Processing, Wireless Communications Networks and IOT

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