Power Optimisation of the Devices using IOT with Android Application

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***Abstract*—Identifying the power usage and minimising it, is the major concern of today. So here using CPS 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 or with Android application. 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.**

Keywords*— *Energy efficiency; Energy measuring; Energy metering; Energy reporting.

I. INTRODUCTION

Power being the soul of the world, which is related to electricity and the word "electricity" which now rules the world. So, proper utilization of this commodity is of immense important to all of us. Hence, it is necessary to measure power consumption. Normally, large scale industries consist of various departments like production, storage, package, administration, transportation situated away from each other. For such industries, it is necessary to maintain record of daily power consumed by every department to keep check on excess power consumed. To address these shortcomings, and enable energy-saving behaviours in these devices, we are introducing the concept of a communicating power supply (CPS). A CPS adds electricity metering, computation and communication to electronic devices – all embedded in the device's power supply. Our solution adds metering and control capabilities at very low incremental cost. These power supplies allow us to cheaply measure the power being handled by the power supply. Adding the basic measurement capabilities to a power supply costs very less, and adding the microprocessor and communications (if they do not already exist for other applications) adds modestly to the overall device cost. These very low costs place electricity metering and reporting in the reach of very cheap devices like compact fluorescent or light-emitting diode (LED) lamps and battery chargers. Due to the extremely low cost and ease of integration with existing technology, energy awareness is a clear application that can help drive the adoption of IoT concepts across many device types. The CPS concept measures the energy use of the device it is powering, reports the energy use and device's identity over a network to a central entity, and receives control information from users or other devices via the same central entity.

II. RELATED WORKS

The project aims at measuring and controlling the energy use of devices using IOT and with Android application. Several studies [2] [3] [4] had implemented the energy metering and controlling using different techniques. Improving device-level electricity consumption breakdowns in private households using ON/OFF events [2]. A smart meter which is a sensing device that can measure electric power consumption and can report the collected readings at given time intervals, e.g., every second, through a wireless or wired communication interface.

An alternative to plug level energy monitors i.e. a nonintrusive load monitoring (NILM) systems are discussed. NILM systems consist of one energy meter to monitor whole building energy consumption and use signal processing to disaggregate the individual end use loads [3].The smart home application is built on top of Hydra, a middleware framework that facilitates the intelligent communication of heterogeneous embedded devices through an overlay P2P network. They interconnect common devices available in private households and integrate wireless power metering plugs to gain access to energy consumption data. These data are used for monitoring and analyzing consumed energy on device level in near real time [4].

III. ARCHITECTURE OF PROPOSED SYSTEM AND IMPLEMENTATION

The proposed system Architecture and implementation are discussed below. Here this system consists of Transmitter and receiver section, whereas at the transmitter side consists of current sensor which will detect the current and it send to signaling circuit and there the AC signal will be converted to DC signal and then that is fed to the ARM controller to obtain the current measured in Watts. And at the receiver section, Arduino which interacts with the PC and provides the control information to PC and also receives from the PC, Both at the transmitter and receiver side two Bluetooth modules are used like one behaves as master and the other is slave. When the Arduino interacts with the PC, the energy details will be uploaded in the webpage or else even before the receiver side, the power details can be viewed in the android application.

A. *SYSTEM ARCHITECTURE*

The proposed architecture is as shown in the below figure 1. 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.

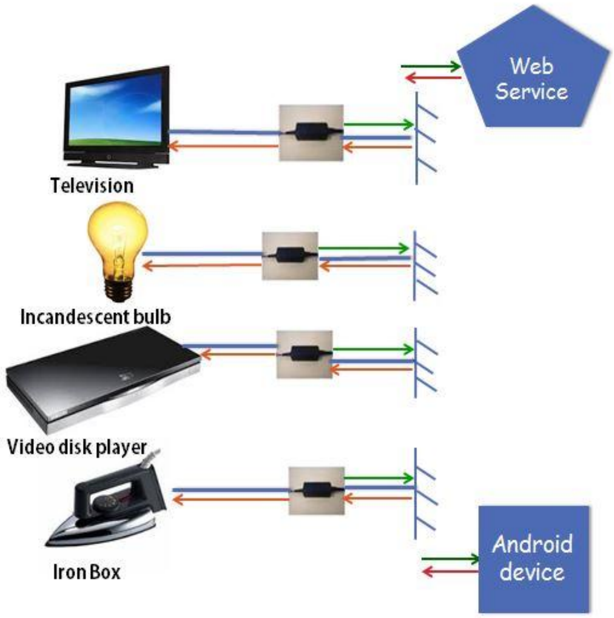

Figure. 1 System concept showing four devices with CPSs that report energy data to a web service or android device and pass control information directly to the device

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 device. Each device also retained the use of its native control interface (e.g., 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.

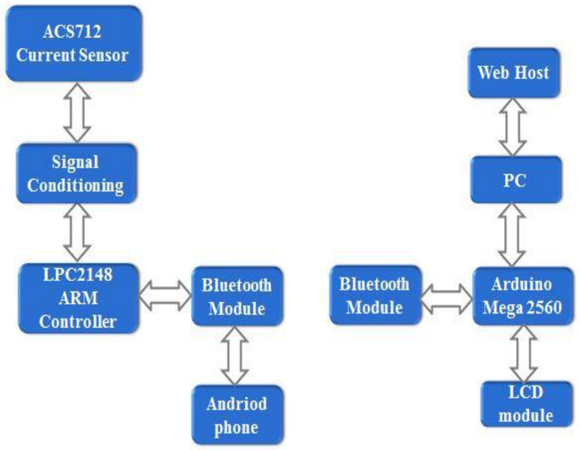

Figure. 2 System block diagram

In addition, these nodes will receive inputs from the control hub and transmit those signals to the devices. All communication between the nodes and the hub will be wireless. The network hub will be an Arduino based device that controls the network traffic. The hub receives energy utilized information from the nodes and sends the control information to the devices integrated with CPSs. A process on both the nodes and then the hub ensures that all CPSs are active and connected to the network. If a network interrupt is detected, the hub will signal all nodes to change the wireless frequencies. The hub transmits the node energy consumption information and web-based controls between the CPS devices and the PC. The PC serves as the Internet gateway for the local network hub device. It is not technically required for the PC to be a part in this configuration. It is possible to connect the Arduino to the Internet and, in turn, make each part in this system based primarily on the embedded platform. A web-based hosting solution [8] was adopted where data were uploaded to the internet. The server will display these data. The same server sends the control signals to the Computer. The server can be configured to send controls intuitively, only send controls based on the direct user inputs, or some combination of the two. Here we used a computer to interact with the web-based server and to allow the user to view energy use information, and also to control the devices via the Internet. This system shows power consumed (real time and cumulative) for each of the device and allows people to control each of the devices with touch buttons and observe the changes in power on the screen.

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.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. The page result will be as shown in the below figures.

App Inventor is open source software, where we can develop Android Applications. Here in this project we use this
App Inventor tool to determine the power measured in Watts and display continuously. The Bluetooth device which receives the data from ARM controller sends the information to Android device. Once the Bluetooth device is paired and connected with the Android application then it will send the data to the android device. In the android application we can control the ON/OFF of the device i.e. T.V, Bulb, Iron box etc. that is connected to the sensor. We here measure the power utilized and control it using the ON/OFF button which will be displaying on the screen as shown in figure 3.

Android Application output

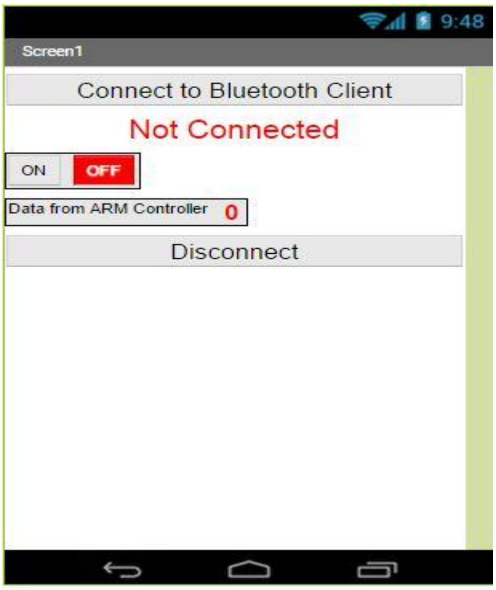

Figure. 3 Android Application

Case 0: When no load

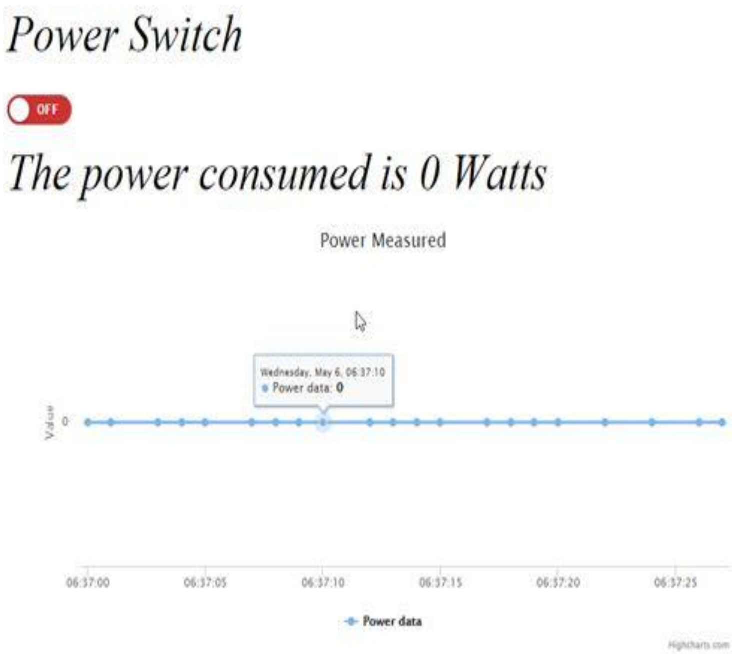

Figure. 4 Web page when Switch is turned OFF.

Case 1: 60W load

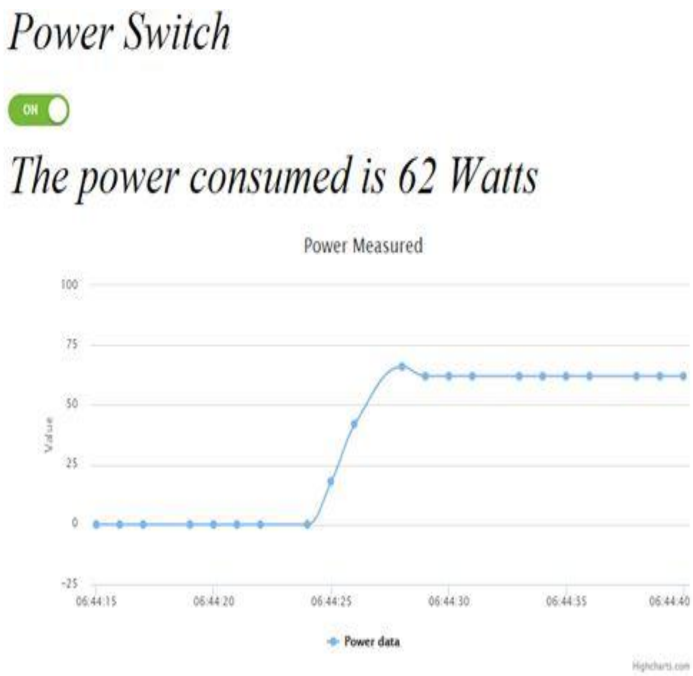

Figure. 5 Web page when Switch is turned ON.

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Case 2: 100W load

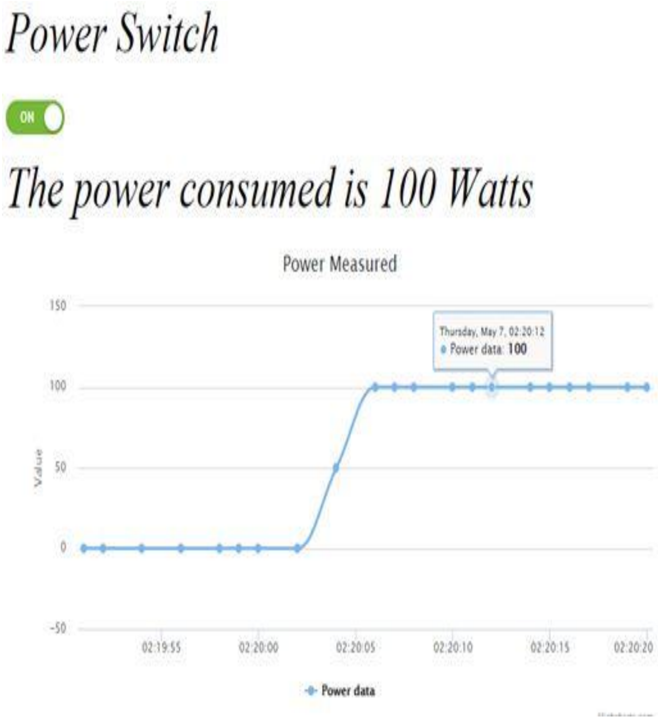

Figure. 6 Web page when Switch is turned ON.

Case 3: 164 W

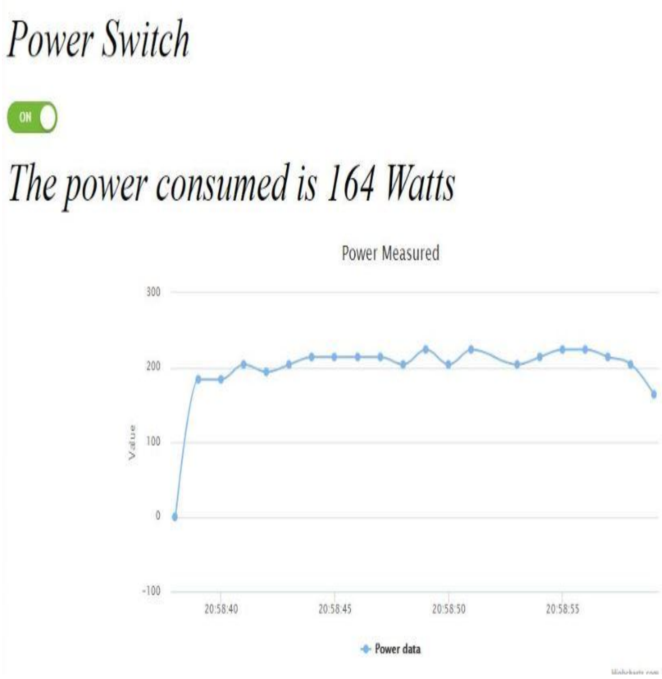

Figure. 7 Web page when Switch is turned ON.

CONCLUSION

The Internet-connected system of CPSs enables improved energy awareness of devices and users. Communicating power devices using IoT device technology is the future of energy monitoring for plug loads, and all energy-using devices will one day be aware of their identity and share energy information over IP networks. The Communicating IoT device concept shown here demonstrates that this concept is valid at reasonable price points even for quite low-cost devices. Energy awareness enables new sets of interactive energy-saving behaviors where devices control their power state to meet user requirements while reducing energy usage. Unlike existing technologies, Communicating Power devices with IoT are integrated into the product to provide native controls and automatically include product unique and identity information. The less cost, reduced configuration burden and tight coupling with the powered product make IOTs an excellent application.

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