

# ENERGY CONSUMPTION AND MONITORING SYSTEM USING IoT

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**Abstract** - Energy monitoring and conservation holds prime importance in today's world because of the imbalance between power generation and demand. IoT based energy management system can contribute a lot into conservation of energy. The current scenario says that the power generated, which is primarily contributed by fossil fuels may get exhausted within the next few years. Also consumers are dissatisfied with the power bill as it does not show the power consumed at the device level. This is because the domestic electricity bill shows excess amount which causes consumer dissatisfaction and complaints. This paper implements an energy monitoring system which displays the power consumed by individual or multiple devices. This can help a user to detect any errors in the electricity bill. A smart energy monitoring system can help a user to analyze the energy consumption data at device level and manage it rather than assuming it to be a fixed monthly expenditure. The goal is to visualize and monitor the power consumption online on a smart phone using mobile application by integrating smart plugs, sensors, Internet of Things (IoT) devices, microcontroller, WiFi and arduino which enables the connection between the various smart plugs and the web server hosting the monitoring system application.

**KEY WORDS:** Internet of Things (IoT), energy monitoring system, Microcontroller, Atmega 328 Arduino, Sensors.

## 1. INTRODUCTION

The future is moving towards the smart energy management which require changes from energy usage and energy supply. Reducing the amount of energy required to deliver various goods or services has become essential. For the energy management of domestic consumers the smart meter is need for the hour. The smart meter are an embedded system which incorporates microcontroller in their implementation. The main purpose of the microcontroller is to simplify the system design and provide flexibility. IOT is defined as a kind of network which not only can connect the objects, can be fully automatic, can collect, transmit and process information intelligently but also can realize the scientific management and any time anywhere through variety of sensing devices and the internet. The basic characteristics of IOT are: Network, Instrumented, Automated. Energy management system based on Internet of Things(IOT) is designed in order to improve the energy management labels and to do the better jobs in saving energy. The energy management system based on IOT can solve the problems of collecting, transmitting, saving and controlling of massive data in energy running process by

using variety of techniques such as smart meters, communicating networks, database and so on..

## 1.1 CONCEPT

Internet of Things (IoT) advances when regular ordinary objects have inter-connected microchips inside them. These microchips help stay informed concerning other objects, as well as a significant number of these devices sense their surroundings and report it to different machines and also to the people, so is the application of home environment. There is a principle prerequisite that makes a wireless sensing perfect for use in the IoT, which is the energy efficiency. The system aims to achieve a cost effective energy management system by Real-time monitoring of the loads and achieve demand forecasting based on acquired data for a certain period. Once a certain limit is reached, that specific device gets tripped and hence over usage of power is avoided.

## 1.2 LITERATURE SURVEY

We have put up few points based on the research on this paper. It covers pertinent established concept and techniques related to multi objective Power Management System. Simulation and real time implementation result of energy consumption using IOT technology employed in various literatures are analyzed and discussed. Literature survey was conducted on various optimization techniques involved in optimizing the use of Internet of Things with single and multiple conflicting objectives. Within the IoT, devices across a variety of industries will be interconnected through the Internet and peer-to-peer connections as well as close networks like those used in the smart grid infrastructure. With the global focus on energy and water management and conservation, the IoT will extend the connected benefit of the smart grid beyond the distribution, automation and monitoring being done by utility providers. Management systems for in home and in- building use will help consumers monitor their own usage and adjust behaviors.

## 2. PROPOSED SYSTEM

The system we are developing consist of Atmega 328 Arduino micro processor, wifi module, current sensor, LCD display. The current sensor measures how much current device is using and then send this data to wi-Fi module. The principle of the monitoring system are wireless communication between user and devices. We aim to provide real time current analysis of each device. This

system is easy to use as it provides wireless communication between devices. The knowledge of hourly energy use and electricity cost provides vital information that motivates changes to consumers behaviour. Basically our system provides daily analysis of energy and make user aware of the energy consumed and also helps user to manage the devices.

**2.1 SYSTEM REQUIREMENTS**

**A) HARDWARE REQUIREMENT:-**

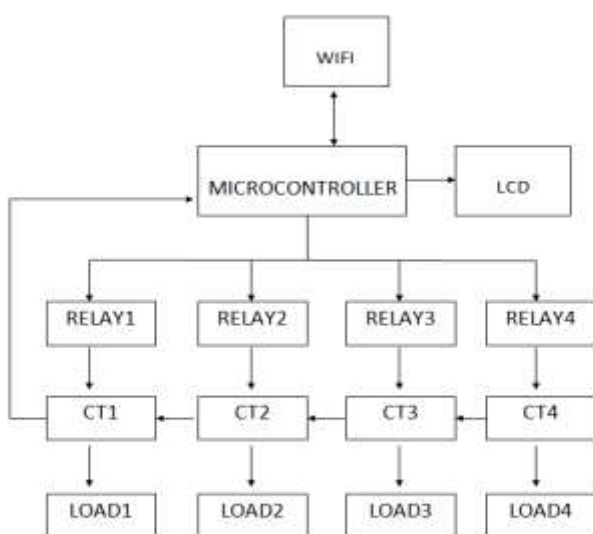
- Microcontroller used is AtMega328.
- 16x2 LCD used for displaying the units of all loads.
- A 12 volt, single pole double throw, SugarCube relay is used for ON-OFF control of Loads.
- Current transformer is used to measure the current of the loads.
- WiFi module ESP 8266 01 is used for data transmission and to access the devices remotely.

**B) SOFTWARE REQUIREMENT:-**

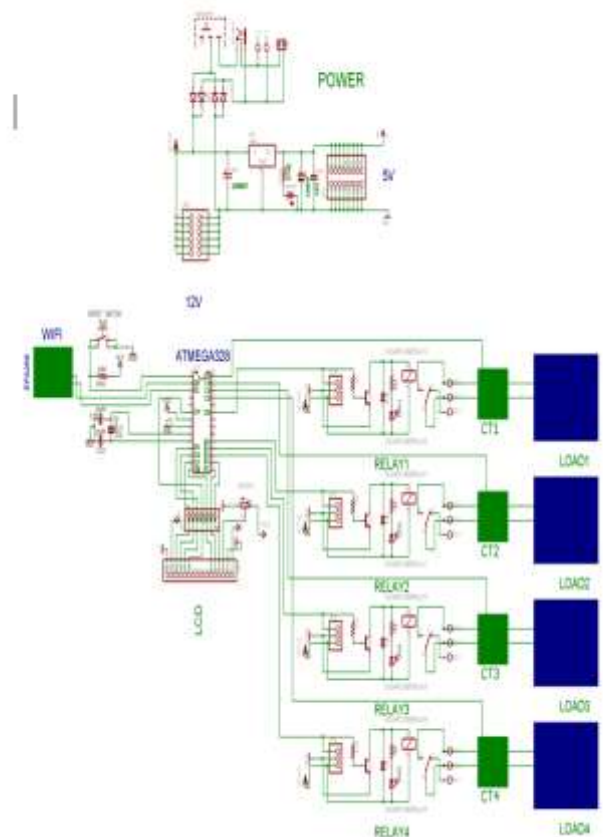
- Arduino IDE is used for writing the C code.
- Cadsoft Eagle software is used for designing hardware.
- Docklight is a terminal software used for getting data (values ) from WiFi.
- TCP/UDP Terminal is the software used for developing the mobile application.

**3. Design of System**

**BLOCK DIAGRAM:**



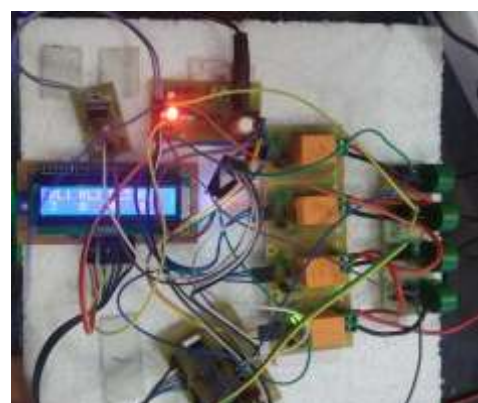
**CIRCUIT DIAGRAM:**



**4. EXPERIMENTAL RESULT**

By monitoring consumption of power of the appliances, data is collected by a system, which saves all data in the system for processing as well as future use in software. The parameters which will be entered in the data coordinator in software from appliances include voltage, current and power. These parameters will be stored in a database and analyzed. These parameters data will be displayed on graphic user interfaced (GUI) window so that appropriate action can be taken from the GUI.

Following are the results.





## 5. CONCLUSION

This project implements an IOT based energy consumption and monitoring system to display on web page and control the device via mobile application using WiFi. Power management is accomplished as we control the devices when not in use and also automatically Switch OFF the respective device when it reaches a critical defined limit.

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