

# IoT BASED ENERGY MANAGEMENT SYSTEM

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**Abstract:** Energy is a very important aspect for any household, industries, agriculture and so. Managing the energy efficiently and conserving it intelligently for appliances is very much important. The energy usage is directly affected with Coal, oil and so towards power generation. Towards this, there has been lot of research work carried out in developing some smart lighting system pertaining to classroom for conserving the energy. In one another research, researchers have developed Android based Smart home system for monitoring the usage of power to avoid any kind of anomaly. In none of the research, researchers have worked towards automating the appliance control towards conserving the energy. Most of them concentrate on controlling the appliances using android devices. So with the upcoming of machine to machine communication where devices can be connected wirelessly leading to IoT, we here have developed an IoT based Smart Energy Management system where appliances like Fan and Bulb to start with are controlled wirelessly based on humidity and light intensity information. These inputs are used towards controlling the appliances intelligently rather than just switching on or off. In addition the system also keeps computing throughput the day power consumption of the appliances which gives the user knowledge on power being consumed over a period of time. These details are updated in Cloud server. This prototype system developed have achieved energy conservation at every household

( **Key Words:** IoT, Sensors , Arduino , LCD display )

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## **INTRODUCTION**

Increasing economic growth and consumption patterns are leading to ever growing demand for energy. Since most of the energy supply is from fossil fuels, the resource is depleting thus increasing cost of energy. Burning fossil fuels has also increased concentration of carbon-di-oxide in the environment leading to extreme weather patterns. Research [1][2] has been carried out employing Raspberry Pi3 for monitoring the Temperature and humidity data and controlling the same resulting in an Automated temperature and humidity control using IoT. Research also been carried out in developing smart home monitor and control system using Zigbee, Bluetooth etc.

In none of the research, system been developed towards controlling the electrical appliance usage based on environmental condition which could ultimately reduce the energy consumption of home. So with the upcoming of Machine to Machine communication where all appliances can be wirelessly enabled using Zigbee or Bluetooth, we here have developed a small IoT Prototype system employing Hall and Light intensity sensor to give the Temperature, humidity and light intensity of the environment. The readings are fed to Arduino microcontroller which in turn is communicated to Edge level processors called ESP8266 wirelessly. The proposed system is a smart Energy Management system consisting of a ESP8266 Wifi-Module, Arduino microcontroller, Wi-Fi shield and modules like Hall sensor, light intensity Sensor and ambient temperature sensor. The Arduino microcontroller will vary the appliance usage i.e. fan speed and light intensity based on humidity, temperature and lighting condition of the environment resulting in energy usage reduction.

## **RELATED WORK**

In this section, we would be discussing briefly on various literatures available pertaining to Energy Management and Smart Home System. In one of the research reported, IoT Based Automated Temperature and Humidity Monitoring and Control system developed [1] using raspberry pi. Pi receives the temperature as well as humidity values sensed and the same sent to the internet. This project however has resulted in prototype development of automated temperature and humidity control with good feasibility. Research also been carried out towards Smart Home Control and Monitor System using IoT [2] where an User Friendly GUI been developed which can be accessed globally from any device that has internet connectivity. In addition to the above mentioned research, Smart Home Monitoring prototype developed by employing Android mobile handset and Wireless Sensor systems [3]. This system monitors the usage characteristics of electrical power at the socket outlet in real time. This system measures the Voltage Current and temperature of socket outlet periodically from each room and monitored data sent to the system towards computing the threshold violation for action by the user before circuit breaker gets tripped or fire breakout happens. Also research work carried out in developing an Automatic Lighting and Control System for Classroom [4] for the efficient use of energy. They have also provided mobility and remote command execution to system using Android mobile App via Bluetooth to control lighting based on voice command. Energy Management System for Smart Home [5][6] has been developed to manage energy at the level of appliances. So towards this a Smart Home Energy Management System Architecture been developed. In this system, Sensors control the energy consumption of home appliances. In addition Solar Energy is used as an alternate source where according to change in the weather conditions, resources can be switched. Energy data from numerous home servers are aggregated by the PC server and accordingly compare them for producing statistical analysis information. IoT based Home Energy Management system for Rural Area in Myanmar [7] has also been developed. In this research, demand of electricity been forecasted and accordingly mechanisms been implemented towards meeting the energy demand. Energy demand could be met using non conventional energy sources like solar, thermal etc.

### PROPOSED PLAN

Energy is managed by using the Temperature sensor, Light sensor and Current Sensors. The output values will be displayed on the LCD display.

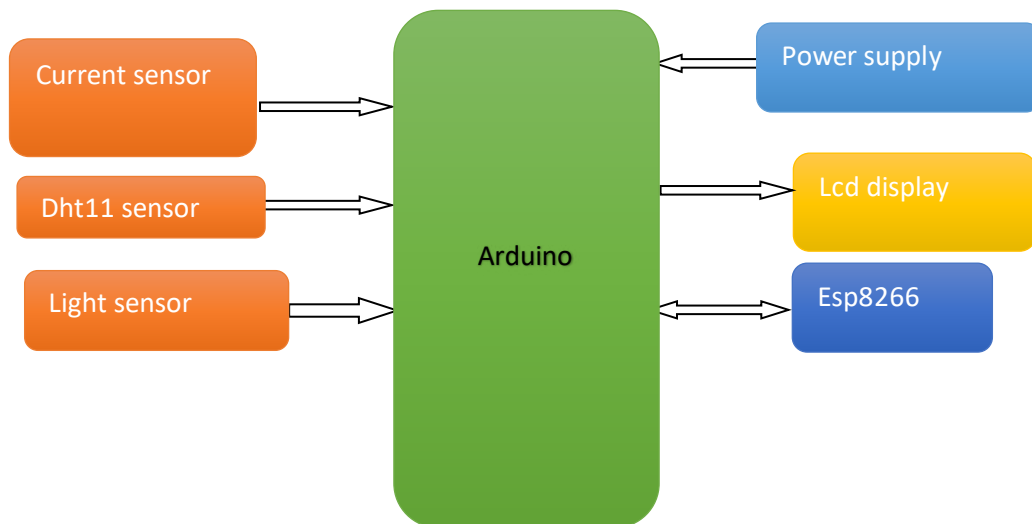


Figure 1: Block diagram of IoT Based Energy Management System

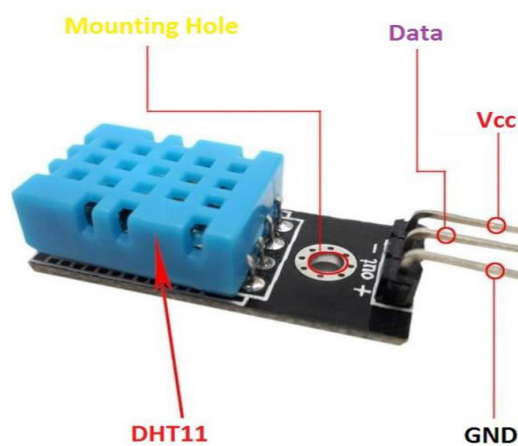


Figure 2 : DHT11 Humidity Sensor

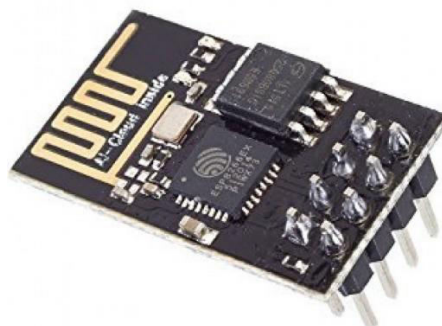


Figure 3: ESP8222 Wi-fi Module

## METHODOLOGY

In this proposed system we use the Natural Parameters such as Temperature, Humidity. By using these Parameters we calculate the current and voltage values present in the Nature.to Interface between the Hardware and Software components the Arduino uno is used. Arduino is a popular programmable board used to create projects. It consists of a simple hardware platform as well as a free source code editor which has a “one click compile or upload” feature. Hence it is designed in way that one can use it without necessarily being an expert programmer (Kushner 1987). Arduino offers an open-source electronic prototyping platform that is easy to use and flexible for both the software and hardware. Arduino is able to sense the environment through receiving input from several sensors. It is also able to control its surrounding through controlling motors, lights and other actuators. The Arduino programming language that is based on the wiring and the Arduino development environment that is based on the processing are used to program the microcontroller found on the board (Banzi, 2005). Due to its open-source environment, one is able to easily write and upload codes to the I/O board. It is also worth to note that Arduino can be run on Linux, Mac OSX and Windows as its environment is written in Java.

The ESP8266 is the wi-fi module which is used to interface between the systems. Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labelled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line.

## RESULT

The final output will be the values of the voltage and current and these values will be displayed in the LCD display. This was done by measuring the values of the temperature ,Humidity ,and Light by sensing these values from the Environment with the help of Sensors respectively.

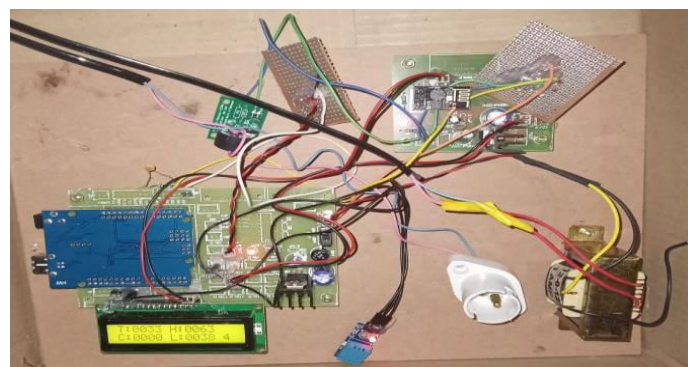


Figure 4:Output of the IoT Based Energy Managment System

These are measured and displayed on the LCD display. By using this IoT based Energy Management system the Energy is conserved. The main purpose is obtained.

## CONCLUSION

Smart Home and Energy Management is current trend with the development of IoT. Lot of work been reported in regards to controlling the appliances of home and also on monitoring the electrical parameters towards hazard. Also work reporting in controlling the appliance for energy consumption. So with all these work reported, we here will be developing an better IoT system for Energy Management which takes the Humidity, Temperature and light intensity into consideration and accordingly interfaced with Arduino Microcontrollers for controlling the usage of appliance like speed of fan, light intensity rather than just switch on or off. Also the prototype system computes the current drawn from each appliance based on appliance usage and send to Raspberry Pi3 where total power consumed of appliances computed against time. This information is computed all through the day and same uploaded in cloud server too. This ultimately achieves in energy consumption of every household resulting in Energy Management using IoT. The system so developed is not fully complete as we have developed a prototype only for controlling two appliances i.e. fan and light. In future, we propose to extend the system for controlling appliances like Refrigerator, Air cooler, Television etc. The presence of human only will switch on the appliances. More amount of power can be saved based on the lesser usage of the appliances. There can be also a manual control over the appliances. We can implement algorithm that learns the change in the weather based on season and detect changes in season based on the temperature, humidity and brightness.

## REFERENCES

- [1] M. Lavanya , P. Muthukannan, Y.S.S. Bhargav, V. Suresh, "IoT Based Automated Temperature and Humidity Monitoring and Control", Journal of Chemical and Pharmaceutical Sciences ISSN: 0974- 2115.
- [2] Abhijeet Rajurkar, Onkar Shinde, Vinayak Shinde, Bhushan Waghmode,"Smart Home Control and Monitor System Using Power of IoT's", International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 5, May 2016.
- [3] Suresh Sankaranarayanan , Au Thien Wanb , Aida Harayani Pusac ,," Smart Home Monitoring using Android and Wireless Sensors", IJ. Engineering and Manufacturing, 2014, 2, 12-30.
- [4] Suresh,S, Anusha, H.N.S, Rajath,T, Soundarya, P and Prathyusha, V (2016), "Automatic Lighting and Control System for Classroom", Proceedings of 2016 IEEE International conference on ICT in Business, Industry and Government, Indore, Madhyapradesh, pp.1-6
- [5] Shamika Kshirsagar, Mr.D.E. Upasani, "Energy Management System for Smart Home", International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 06 | June-2016.
- [6] Vinay sagar K ,Kusuma S, " Home Automation Using Internet of Things", International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 03 | June-2015.
- [7] Ms. Hlaing Thida Oo Dr. Khin Than Mya Ms. Nyain Nyain Lwin," IoT based Home Energy Management system for Rural Area in Myanmar", ICT Virtual Organization of ASEAN Institutes and NICT ASEAN IVO Forum 2016
- [8] H. M. Zahid Iqbal and M. Waseem" Automatic Energy Meter Reading using Smart Energy Meter" Conference Paper · March 2014.
- [9] Ashna.k ,Sudhish N George. "GSM Based Automatic Energy Meter Reading System with Instant Billing" 978-1-4673- 5090-7©2013 IEEE
- [10]Mrs. Mahalakshmi N, Mr.KrishnaiahPararnesh and Ms. ElavarasiE"Design of an Intelligent SMS Based Remote Metering System for ACPower Distribution to HT and EHT Consumers", International Journal Of Computational Engineering Research, Vol. 2, Issue 3, pp. 901-911, May June 2012.
- [11] T. Chandler, "The technology development of automatic metering and monitoring systems," in IEEE International Power Eng. Conf., Dec. 2005.
- [12] G. T. Heydt, "Virtual surrounding face geocasting in wireless ad hoc and sensor networks," Electric Power Quality: A Tutorial Introduction, vol. 11, no. 1, pp. 15–19, Jan. 1998.