IOT BASED ENERGY MANAGEMENT SYSTEM

Prof. Mohan Mendhe[1], Jayesh Thote[2], Chinmay Metangale[3], Piyush Doifode[4]

[1] *Associate Professor, Mechanical Engineering, Yeshwantrao Chavan College of Engineering.*
[2] *Final Year Student, Mechanical Engineering, Yeshwantrao Chavan College of Engineering.*
[3] *Final Year Student, Mechanical Engineering, Yeshwantrao Chavan College of Engineering.*
[4] *Final Year Student, Mechanical Engineering, Yeshwantrao Chavan College of Engineering.*

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Abstract

Energy conservation is gaining popularity day by day because of large usage of electrical appliances and due to not proper use of methodology to conserve it. So, to achieve this home appliances and electrical devices can be connected to internet or cloud storage. This enables automation of devices like fans, lights etc. Which helps in conservation of power. In this project we use IOT based energy conservation system whose goal is to develop a system that can be used to save the extra unused energy and later can be used for other purposes in the future. This system can be controlled from a central host pc, internet and also remotely accessed via a packet pc with a windows mobile based application.

*Key Words***:** Energy conservation, automated system, IOT based.

1.INTRODUCTION

Increasing economic growth and consumption patterns are resulting in 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 with the environment resulting in extreme weather patterns. Hence, it's imperative that Industries and commercial enterprises take steps to scale back energy wastage, become energy efficient and reduce costs. Energy is a precious resource especially when most of our energy sources are being depleted or nature dependent. We often come across situations where excess energy is used up or rather wasted when no one is utilizing it. Sometimes the appliances are left on even when they are not in use. This brings us the need to conserve the energy and make efficient use of it. The project is aimed at monitoring the energy usage and usage patterns to then automate the appliances to function in apt conditions where they are actively being used. The project also aims to control the appliances and their function on the environmental conditions around it. The advantage of using IoT is that the whole system can be brought online and its flexibility can be increased further Not to mention the fact that the system would be able to make switching decisions based on the environmental data gathered by the sensors. The system can also be controlled remotely. The system also aims to learn the usage Pattern and distribute the energy required accordingly.

2. LITRATURE SURVEY

In one of the researches reported, IoT Based Automated Temperature and Humidity Monitoring and system developed using raspberry pi. Pi receives the temperature also as humidity values sensed and therefore the same sent to the web. This project however has resulted in prototype development of automated temperature and humidity control with good feasibility. Research also been administered towards Smart Home Control and Monitor System using IoT where a User-Friendly GUI been developed which may 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. 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 edge 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 the efficient use of energy. They have also provided mobility and remote command execution to system using Android mobile App via Bluetooth to regulate lighting based on voice command. Energy Management System for Smart Home has been developed to manage energy at the extent of appliances. So, towards this Home Energy Management System Architecture been developed. In this system, Sensors control the energy consumption of home appliances. In addition, solar power is employed an alternate source where consent in change within the weather, resources are often switched. Energy data from numerous home servers are aggregated by the PC server and accordingly compare them for producing statistical analysis information.

3. GAP ANALYSIS

● In none of the earlier projects, system been developed towards controlling the electrical appliances usage was based on environmental condition which could ultimately reduce the energy consumption of appliances.
● So we are using hall and light intensities sensor to give temperature, humidity and light intensity of environment

which will help us to control the different appliances according to the required conditions.

4. COMPONENTS

• NODE MCU

Node MCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espresso Systems, and hardware which is based on the ESP-12 module.

• RASPBERRY Pi4

The Raspberry Pi 4 Model B is that the newest version of the low-cost Raspberry Pi computer. The Pi is different from your typical device; in its cheapest form it doesn't have a case, and is simply a credit-card sized electronic board.

• RELAY

Relays are electric switches that use electromagnetism to convert small electrical stimuli into larger currents. These conversions occur when electrical inputs activate electromagnets to either form or break existing circuits.

• PIR SENSOR

A PIR sensor measures infrared that's reflected off moving objects that emit heat. They are commonly won't to detect movement of individual and animals to trigger alarms and security lighting.

• ENERGY SENSOR

Ophir Photonics. Ophir Photonics presents an honest range of energy sensors, or pyroelectric sensors, designed to measure repetitive pulse energies and average powers at pulse rates up to 25000 pulses per second, and pulse widths up to 20ms.

• RESISTOR

A resistor could be a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

• DIODE

A diode could also be a semiconductor device that essentially acts as a one-way switch for current. It allows current to flow easily in one direction, but severely restricts current from flowing within the opposite way.

• CAPACITOR

A capacitor (originally mentioned as a condenser) could also be a passive two-terminal electrical component want to store energy electrostatically in an electrical field. The type of practical capacitors varies widely, but all contain a minimum of two electrical conductors (plates) separated by a dielectric (i.e., insulator).

• CONNECTING WIRE

A wire could also be versatile strand of metal, usually cylindrical. Wires are used for establishing electrical conductivity between two devices of a circuit. They possess negligible resistance to the passage of current.

• LIGHT BULB

A wire could also be versatile strand of metal, usually cylindrical. Wires are used for establishing electrical conductivity between two devices of a circuit. They possess negligible resistance to the passage of current.

• LIGHT SENSOR

The light sensor could also be a passive device that convert this "light energy" whether visible or within the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly referred to as "Photoelectric Devices" or "Photo Sensors" because the convert light energy (photons) into electricity (electrons).

• AC MOTOR

An AC motor is an electrical motor driven by an AC (AC). The AC motor commonly consists of two basic parts, an outside stator having coils provided with AC to provide a rotating magnetic flux , and an inside rotor attached to the output shaft producing a second rotating magnetic flux.

• SD CARD (64GB)

Secure Digital, officially abbreviated as SD, could also be a proprietary non-volatile memory card format developed by the SD Association (SDA) to be utilized in portable devices.

• AC WALL ADAPTER

An AC adapter, AC/DC adapter, or AC/DC converter could also be kind of external power supply, often enclosed during a case almost like an AC plug. ... AC adapters are used with electrical devices that require power but don't contain internal components to derive the required voltage and power from mains power.

5. METHODOLOGY and DESIGN

The system consists of 3 main components: Sensor Node, Hub, Switch Node. The Sensor Node works to gather the data from the environment, in this case the sensed factors being temperature, humidity, light intensity, electrical power, and presence of people. This environmental data is then sent to the hub through the controller connected to the sensors.

The Hub is the brains of the operations; it not only houses the rule engine which dictates the operation rules but also provides an interface for interacting with the system. Many sensor and switch nodes can be connected to the hub.

The switch node is the part which controls the actual switching of appliances. The switching is done when commands are given to this node by the controller. The switch node has a controller for data processing and transfer and relays for opening or closing the actual circuits.

In all the hub provides the instructions to switches based on the environmental data collected by the sensors and the rules set for operations programmed by the users.
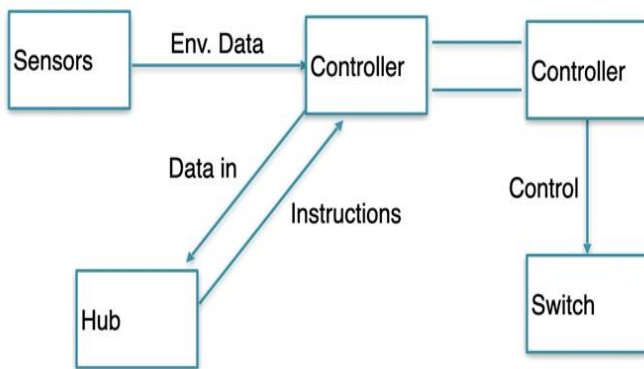
6. CONCLUSION

Smart Home and Energy Management is current trend with of IoT. Lot of labor been reported with 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 works reported, we here have developed a 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, candlepower instead of just turn 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 during the day and same

uploaded in cloud server too. This ultimately achieves in energy consumption of each household leading to Energy Management using IoT.

More amount of power are often saved supported the lesser usage of the appliances. There is also a manual control over the appliances. We have implemented algorithm that learns the change in the weather based on season and detect changes in season based on the temperature, humidity and brightness.

The system so developed is not fully complete. In future, we propose to extend the system for controlling appliances based on the presence of humans.

7. REFERENCES

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