Iot Based Industrial Protection System with Energy Management

[1]Revathi R, [2]Aravind B, [3]Deepak B, [4]Kathiresan C

[1]Assistant Professor, Department of Electrical and Electronics Engineering, KPR Institute of
Engineering and Technology, Coimbatore, Tamilnadu
[2]UG Scholar, Department of Electrical and Electronics Engineering, KPR Institute of
Engineering and Technology, Coimbatore, Tamilnadu
[3]UG Scholar, Department of Electrical and Electronics Engineering, KPR Institute of
Engineering and Technology, Coimbatore, Tamilnadu
[4]UG Scholar, Department of Electrical and Electronics Engineering, KPR Institute of
Engineering and Technology, Coimbatore, Tamilnadu
Corresponding author Mail: [1]*revthir@gmail.com*

Abstract
Energy conservation can be done by energy auditing to reduce the consumption of energy in industries, etc. In industries, energy consumption and protection have been increased gradually. The evolution of the internet has become a major part of the advancement of technology with the help of sensors. Energy Management Systems are used to achieve high energy efficiency and give the consumer knowledge about the power consumption which is consumed over a period. The main functions of the management systems are in the generation, distribution, and transmission of power. Energy Management System is a platform that comprises both software and hardware that allows the consumer to monitor energy usage and control power consumption by increasing energy conservation. Monitoring and controlling of power can help the consumers to get the values of specific devices from the system.

Nowadays, industries are using machine-to-machine communications which are developed by IoT device wireless and can be controlled by Android devices. This system is used for energy conservation in the industry which helps the user to reduce energy wastage and costs. By using an energy management system, the fans and lights can be controlled automatically and the values are noted as feedback to conserve energy. This system is used to manage the global energy demand and to maintain energy efficiency. In the urban areas, the energy demands are insufficient which causes distribution and transmission losses. Thus, the energy demand protection systems are used to maintain the energy in a sufficient way. In energy management, IoT is a promising platform with energy use cases and reliability for accurate data, proper calculation of energy consumption, and easy fault detection.
Key words: Energy management system, Energy efficiency, IoT.

1. Introduction

Smart Energy Management systems have the ability to store the data that comprises operation time and energy consumption. The interface provides the consumers to monitor and control consumption to optimize energy efficiency, energy usage. With the help of the Android interface,

the consumer gets all the information details about the consumption of all devices instantly. This system helps to make the energy conservation in an efficient manner by improving power utilization, predicting system function, and reducing energy consumption. Depending upon the environmental condition the system controls the electrical device using IoT, which improves the energy management levels and better energy savings. This system can solve the problems of distributing; transmitting and controlling energy data are stored in the cloud by a Wi-Fi module. In a house energy management system, it is used to define communication with the user by monitoring lighting, air conditioner, and heating. This can be operated from remote places by controlling the power consumption for home appliances.

In today's world, there is advancement in technology which makes the easier way of energy conservation and managing electrical devices by giving them an alternate solution. This android interface provides an automatic fault detection occurring in any specific electrical device using IoT and thus enhancing the energy-saving time. The data are stored in the cloud which ensures that various technologies were integrated for retrieving at any time. It is impossible to maintain power in a critical situation. It is a smart intelligent system that is used for industrial security as an advanced security system for industries to monitor all the devices with the help of a sensor. The alarm indicates the fault in the system which can be monitored automatically and can control the system operation to improve energy efficiency.

The stored data can be retrieved from the cloud which helps the industry person to monitor the parameters which can be accessed automatically. The parameters include the light intensity, humidity, and temperature of the industry. Thus, the system provides the conservation of energy wastage in the industry which is not needed. The sensors are used for monitoring the light intensity, humidity, and temperature which can be seen by the user, and the values from the Arduino are stored in the Blynk server, which can be retrieved later. This smart system can be achieved by the network-based embedded systems to identify the specific fault, which helps the industry person to monitor and control the devices. The house management system provides monitoring and controlling of household loads like light, fan, and air conditioner using IoT for conservation.

This process can be affected by the bad weather in which the energy utilization gets interrupted. At peak hours, there is a power quality issue for the process of monitoring, controlling, conserving, and utilization of energy. The system is responsible for the input and output ports in the industries which provides advanced communication automatically with the industry person for energy conservation. Depending upon the feedbacks from the interface the devices can be switched ON and OFF and controlled automatically by the user. The industry checks for the data collection periodically with the help of values stored in the cloud. This can be done by the energy auditing process to identify energy efficiency and economic stability. Energy auditing is the process of monitoring the power consumption and finding the areas for conservation to alter the financial demand and needs.

The main objectives of the energy management systems are:

- To reduce energy consumption and energy costs.

- To increase the energy efficiency with reduction of global demand.

- To reduce the misuse of energy and use for proper utilization.

The system drawbacks are the energy management data collections require more time for analysis and more human resources. This concept can be measured from the values of already existing devices, creating the communication path between the user and the system to get an accurate result and financial benefit. It shows the data of the temperature, light intensity, and gas leakages in the system and compares it with the system data that is stored in the cloud server. The measured values are stored on the server which helps the industry for monitoring and controlling of energy consumption. The industry protection system is used to prevent losses and to find the low lighting level, temperature.

2. PROBLEM STATEMENT

The energy management system has a wide area of benefits. The existing problems in the industry protection systems are:

1. **Low energy efficiency** – Energy wastage during distribution and in case of faults.

2. **No consumption pattern** – The operational inefficiencies are obtained and cannot be managed for later use.

3. **No insightful reports** – The data of the system is not monitored and stored to develop efficient operations.

4. **Less accessibility** – The system usability and management control are not used to assert failure conditions.
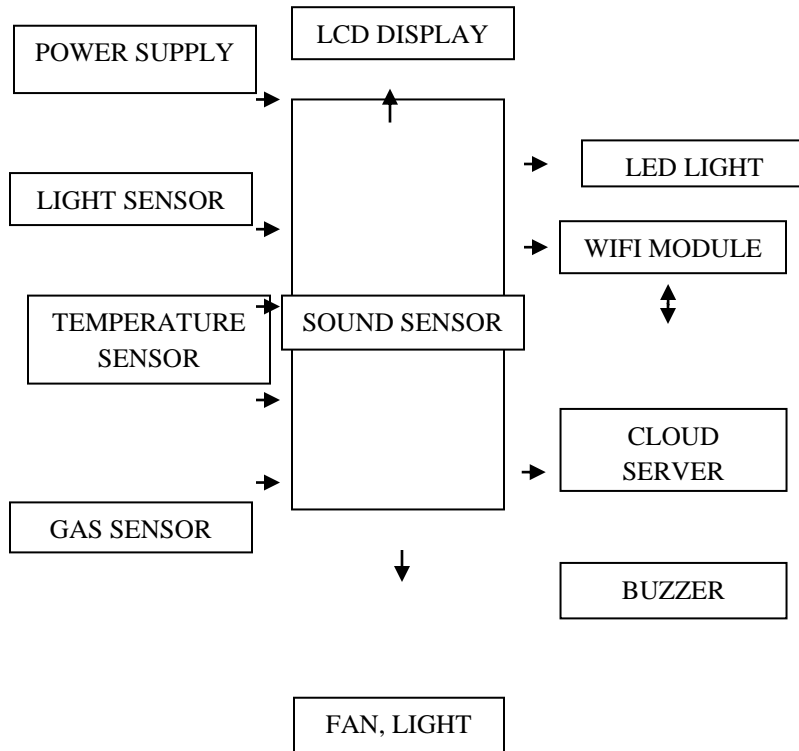
3. BLOCK DIAGRAM

Figure 1. Block diagram

The power supply unit represents the energy meter component that is connected with Arduino. The energy meter is used to make the energy usage reading and used to find the cost of the readings for conservation. In this system, the conservation of light and fan are controlled by the microcontroller in the Arduino which is used to calculate the energy usage. The readings from each sensor unit are given to the Arduino that calculates the differences in energy usage and wastage using IoT and stored in the cloud server through a Wi-Fi module. The Arduino is connected with the display which shows the energy consumption and the cost of the readings in units. Through the Wi-Fi module, the cost of the readings can be monitored and controlled through an electrical device. The cloud server acts as a storage medium that stores the energy consumption readings and can be retrieved later. The programming is made to find the difference between the usage loads before the change and after the change. In the house energy management system, it creates a security system in which alarm is triggered and provides an advanced solution to make them energy-efficient. The wear and tear indicator are used to monitor the motors in the industry which works at the rated speed. And these can be identified by the dangerous LED light connected at this indicator which is helpful for the industry persons.

The readings of various loads are taken to the Arduino system which finds the difference between energy usage and energy wastage to improve energy conservation. Readings are taken in two forms; the first form takes the readings without any change in the load and the second form takes the readings with some changes in the load. These forms of readings are taken to the

Arduino in which is programmed to find the difference between the energy with a creative solution. With the help of this solution, the turning on and off of an electrical device can be done for the conservation of energy. The result from the Arduino shows the difference between the energy of load consumption and their cost of consumption can be monitored and controlled by the user through mobile phones, laptops at their remote locations with the help of a Wi-Fi module. And these readings are retrieved from the cloud server for later use.

The industry protection system is used to monitor the temperature, light intensity to maintain the same atmospheric condition in all the industries. The Arduino system is used to achieve system functionality by sensing. This system is used to detect the low lighting level to prevent the industry persons from accidents by light intensity sensor. The gas sensor and temperature sensor are used to monitor the system from temperature rise and gas leakage; it sends the information to the user which reduces time consumption. The sensed data are scanned continuously and sent to the cloud server for later check by the industry person. This recorded data can be transmitted online by a Wi-Fi module and controlled automatically by the IoT device.

IV. COMPONENTS

The components used in the industrial production system and indicating the problems in industries require:

ARDUINO

The Arduino UNO is a microcontroller board that has 14 digital input/output pins. Arduino is a firm that develops open-source computer hardware and software. The Arduino is the main controller of the system; it controls all the activities of the system. All the activities of the devices in the system are programmed into the Arduino. The code is written in the Arduino IDE and uploaded to the Arduino UNO R3. The Arduino is connected to a Wi-Fi module that connects to the cloud to show and store the system's data that has been recorded. The project is a user community that creates and manufactures single-board microcontrollers and microcontroller kits for use in the creation of digital gadgets and interactive items.

BLYNK

Blynk is an IoT platform featuring white-label mobile apps, private clouds, device administration, data analytic, and machine learning that is hardware agnostic. Blynk was created with the Internet of Things in mind. It can be used to control hardware remotely, display sensor data, save and visualize data, and perform a variety of other tasks. There are three major components in the platform:

- **Blynk App** -This app allows you to create interfaces with your projects using various widgets that you use.

• **Blynk Server** - This server is responsible for all the communication between software and hardware. This device can be used to handle multiple devices at a time.

SENSORS

The sensor is a device that is used to sense these devices can detect and control items in both the physical and digital worlds. The sensors act as the input medium for the device. There are various sensors used in the system the sensors are,

• **Light Sensor:** The light sensor is used to detect the light intensity in the particular space within the place where the sensor is fixed.

• **TemperatureSensor:** The temperature sensor is used to define the heat and humidity in a specified room.

• **Gas Sensor:** The gas sensor is used to detect the pollution rate or gas mixture ratio in the air.

• **Sound Sensor:** The sound sensor is used to detect sound waves through their intensity and convert it to electrical signals

LCD DISPLAY

LCD (Liquid Crystal Display) is a type of flat panel display which displays the data that is being sensed by the sensors or the reading that is been taken. It acts as the output medium for the device.

LED

LED is a device that emits light when current flows through it. The LED acts as the output medium in the device. The LED is used as an indicator to detect the problems of the motors.

BUZZER

Buzzer is a device that emits beeping sound. This buzzer can be used as output device or indicating device.
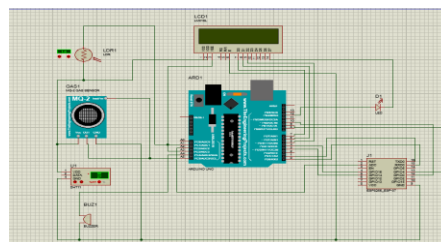
V. SIMULATION AND ANALYSIS

Figure 2. SimulationDiagram

This stimulation modeling is for IoT-based industry protection systems with energy management. This simulation analysis was carried by the Proteus Software which is used to add and modify the components after compiling the program source code.

VI. RESULTS AND DISCUSSION

The LCD shows the output of energy consumed by the system in the total number of hours.

Figure 3. LCDDisplay

The details of the energy consumption can be viewed and monitored through Arduino using the cloud server.
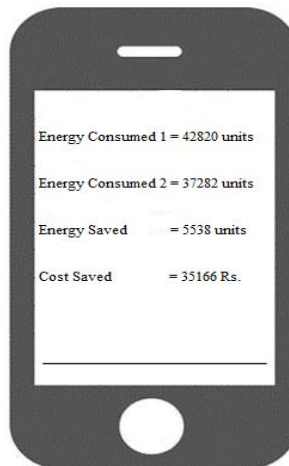

Figure 4. PhoneDisplay

The below graph represents the details of the temperature, Gas, Light Intensity of the system is calculated and controlled to improve energy conservation. The monitoring of the system is based on these analysis to avoid the wastage of energy and these details are stored in the cloud server for later use.
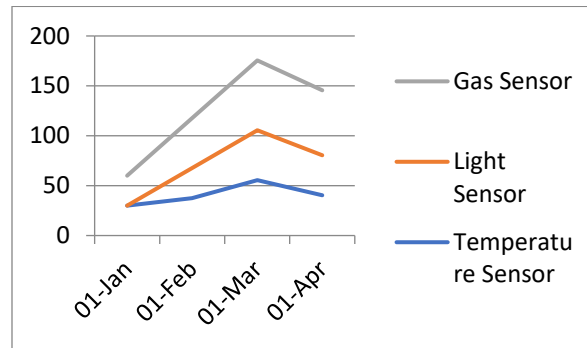
Figure 5.SensorsResult

VII. CONCLUSION

The energy management system works for the development of power using IoT. The working of appliances in the industry has been reported to the cloud server through the Wi-Fi module. The monitoring and controlling of the system have been increasing day by day and its energy efficiency has been calculated regularly. More amount of energy has been conserved by monitoring the system. Arduino system is used to measure the light intensity, temperature, and noise connected with the microcontroller used for calculating the wastage of energy and energy consumed. This can be implemented by sensors for energy conservation, through the energy management system using IoT.

REFERENCES

1. Suresh Sankaranaryanana, Aida HarayaniPusac, 2014, "Smart Home Monitoring using Android and Wireless Sensors", 12-30.
2. Suresh S, Anusha H.N.S, Prathyusha V, "Automatic Lighting and Control System", 2016, IEEE (pp.1-6) on ICT in Business, Industry, and Government.
3. S. K. Vishwakarma, P. Upadhyaya, B. Kumari, and A. K. Mishra, "Smart Energy Efficient Home Automation System Using IoT", 2019 at 4th International Conference.
4. Garrab A, Ben Abdallah, "A new AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication", 2017, IEEE(pp. 263-269).
5. Vinay Sagar K, Kusuma S, "Home Automation using Internet of Things", 2015, IRJET – Vol:02.
6. Benzi N, Anglanu E. Biasi, Frosini L, "Electricity Smart Meters Interfacing the Households", 2011, IEEE (pp. 44874494).
7. Rashed Mohassel A, Raahemifar K, F. Mohammadi, "A survey on Advanced Metering Infrastructure", 2014, pp. 473-484.
8. Ejaz W, Naeem M, Shahid A Anpalagan, "Efficient Energy Management for the Internet of Things in Smart Cities, 2011, IEEE pp. 374-391.
9. Victoria Moreno M, Jose Luis Hernandez Ramos, Antonio F. Skarmet, "User Role in IoT based Systems", 2014, IEEE.

10. Fernandes F, Silva M, Faria P, Morais H and Ramos C, "Real-time Simulation of Energy Management in a Domestic Consumer, 2013, IEEE, Europe.

11. Dae-Man Han and Jae-Hyun Lim, "Design and Implementation of Smart Home Energy Management Systems based on ZigBee", 2010, IEEE, pp. 1417-1425