RENEWABLE ENERGY INTEGRATED REAL TIME ELECTRICITY MONITORING USING CLOUD COMMUNICATION

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***Abstract*: Consumption of energy is increasing exponentially paving the manner for energy effective technologies and revealing limited renewable energy sources. To overcome these problems, bi-functional system is proposed in which last meter smart grid using solar energy and energy efficient system in-home prototype is recommended. Traditional power grid are being revolutionized to smart grid in order to overcome obstacles such as uni-directional flow of energy and information, wastage of energy, authenticity and security. In this project, we are using solar panel as well as 230V AC supply source from electricity board. If in case of any fault in the battery or insufficient amount of energy in solar panel, we are going to use AC source. This project is designed with microcontroller, energy meter, Signal conditioning unit, solar panel, inverter circuit, boost converter, temperature sensor, keypad, driver relay circuit and IoT module. Power consumed by consumer in the home side module is monitored by Electricity Board through wireless technology using IoT. In the time of power failure or any other complaints, we can inform to EB office through IoT module with help of Keypad. A period of time, no usage of electricity will be informed via IOT module with help of Keypad, which is placed in consumer node.**

***Keywords*: IOT module, Solar panel, Microcontroller, LCD display, Inverter circuit, energy meter, Temperature sensor.**

INTRODUCTION

In the IoT server, we can monitor whether the consumer consuming solar energy or electricity board energy and control the load through Internet of Things. Based on our government system, first 100 unit of energy is not calculated by energy meter, which is used to calculate the electricity consumed unit in the consumer node. So that we can know, the consumed energy in the consumer node exactly with help of LCD displays. The controller unit is connected with the power line through power sensor. The status of electricity is sensed by the controller. In the time of power failure, the sensor sends signal to the controller. The microcontroller analyses the signal and accordingly it sends signal to the LCD display. The temperature sensor is used to sense the fire accident and it will update in cloud. The wireless energy meter monitoring system aims to minimize these difficulties by providing energy meter monitoring through wireless medium.

LITERATURE SURVEY

Saikat Saha; Swagata Mondal et al proposed "Design and Implementation of IoT Based Smart Energy Meter" – IEEE, 2021.

As a first step towards such cyber-attack related researches and searching for possible mitigation techniques, it is necessary that a smart meter be developed that has the feature of network integration. The existing contribution reports the design, fabrication, and operation of an Internet of Things (IoT) based smart meter using Arduino to serve as an integral part of a smart grid system.

P Kalyan Chakravarthi; D. Yuvaraj et al proposed "IoT–based smart energy meter for smart grids' – IEEE, 2022.

This existing system, an intelligent meter which works on IOT is implemented in this work. Instead of calculating power consumption with meter reading alone, can manage and calculate the consumption by uploading through cloud. Further the buyer can examine it. As a result, consumer power analysis becomes considerably easier and more controllable. This programmed also aids in the detection of energy fraud. As a result, it will initiate a new step towards digital India by taking smart meters in to the real time power consumption calculations.

Bibek Kanti Barman; Shiv Nath Yadav et al proposed "IOT Based Smart Energy Meter for Efficient Energy Utilization in Smart Grid" – IEEE, 2018.

The existing energy meter system has many problems associated to it and one of the key problem is there is no full duplex communication. To solve this problem, a smart energy meter is developed based on Internet of Things (loT). The existing smart energy meter controls and calculates the energy consumption using ESP 8266 12E, a Wi-Fi module and uploads it to the cloud from where the consumer or producer can view the reading. Therefore, energy analyzation by the consumer becomes much easier and controllable. This system also helps in detecting power theft.

Gitanjali Mehta; Ruqaiya Khanam et al proposed "A Novel IoT based Smart Energy Meter for Residential Energy Management in Smart Grid Infrastructure" – IEEE, 2021.

Smart Electricity Energy Meters can be considered as the basic fundamental component of the future intelligent network or smart grid, measuring the energy flow and exchanging information on energy consumption between utilities and consumers and also monitoring and controlling home appliances and devices with consumer information. In this paper, the authors propose an IoT

based Smart Energy Meter with Arduino and ESP8266 Wi-Fi unit which can provide information of electricity bill by SMS or E-mail and can also provide energy monitoring usage anytime and anywhere in the world.

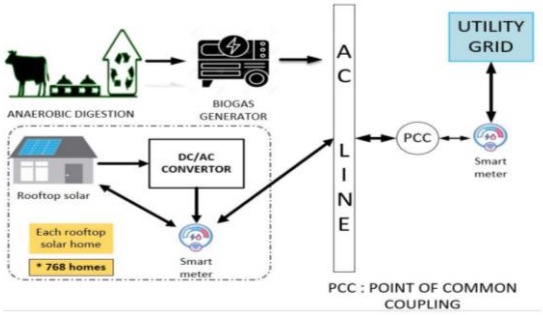
Md. Hasibul Islam; Touhidul Islam Talukder et al proposed " An IoT-Based Smart Energy Meter With Real-Time Power Tracking System: A Review" – IEEE, 2021.

The proposed system consists of a smart sensing unit that will detect the home electrical appliances used for daily activities by following different tariff rates. It will reduce costs for the consumers and thereby improve grid stability. For electricity tracking, there will be voltage and current sensors, microcontrollers, and Wi-Fi modules. Consumers will be able to access to see the power ratings through a smartphone app from anywhere and anytime. Finally, solar and grid power will be connected to the device as a power source.

EXISTING SYSTEM

In this existing system, the solar and bio-power plants and schedule their operation for maximum utility. A programmable smart meter connected with a central system having a user-friendly control algorithm has also been proposed at every home for end-user profitability. The smart meter will indicate energy consumption in local home, its solar energy generation, vicinity power demand, current tariff of power usage, energy imported/exported and other required details.

This existing model is discussed in detail for comprising of two adjacent villages named Gaddikheri and Tajamajra in Rohtak (Haryana), North India (having 768 houses). The technical and financial analysis at this location is done using RETScreen expert software and the results are presented. The system is found to provide 24-hr power supply and also be profitable with the capital cost being recovered in less than 8 years time



4.1. WHY WE ELIMINATED EXISTING SYSTEM

Our existing electricity billing system has major drawbacks due to manual work. In our existing system services of power companies are also not good and perfect. Customers are also not satisfied with the current system because many times they have complaint about to statistical error in monthly bills.

Thus we are trying to represent the idea about minimization of error, reduce the paper work, human dependency in the system.

PROPOSED SYSTEM

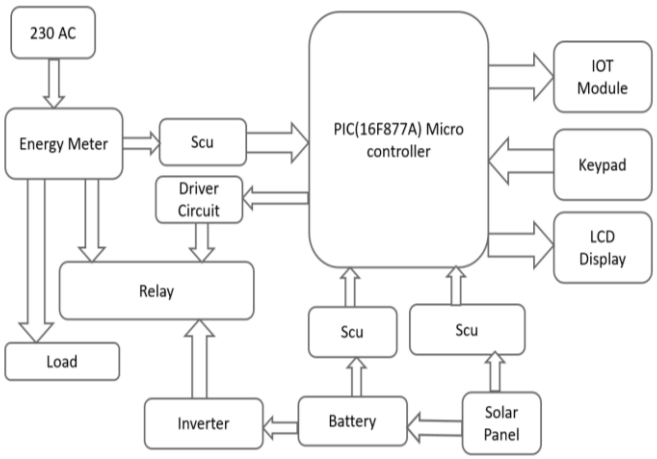
In the IoT server, we can monitor whether the consumer consuming solar energy or electricity board energy and control the load through Internet of Things. Solar energy is boosted by using boost converter and inverter is used convert the DC to AC and is given to grid.

In the energy meter, there is LED which blinks continuously. The blinking of 3200 blinks of an LED gives 1 unit of power consumption. As per this knowledge the microcontroller IC counts the number of blinks and according to the number of units consumed the bill get generated also the real time analysis can be accessed by the webpage.

Based on our government system, first 100 unit of energy is not calculated by energy meter, which is used to calculate the electricity consumed unit in the consumer node.

Power consumed by consumer in the home side module is monitored by Electricity Board through wireless technology using IoT. An electric meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

5.1. **PROPOSED BLOCK DIAGRAM**



5.2. WHY WE PROPOSED THIS SYSTEM

The users can be aware of their electricity consumption. The human work of collecting readings by visiting every home at the end of every month can be avoided by generating electricity bills automatically. Theft of electricity can be avoided by tamper proof energy meters.

The errors in the system can be identified quickly. It reduces the manual work and man power. Every month the person from electricity department has not to visit the consumer house for the note down the consumed energy hence labour work get reduced.

The cost of this device is not more because the system uses the low cost equipment and also the installed energy meter will not be replaced or tampered. From the installed energy meter by an authorized this system takes the input.

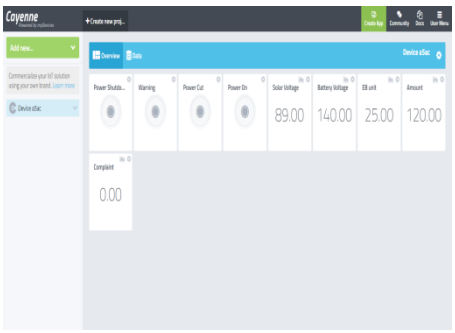
RESULT AND DISCUSSION

IoT-based SEMS can be used in a huge variety of situations where quality control and energy usage are needed. Various applications can be incorporated in the presented SEMS such as real-time monitor and control of power quality and energy usage.

Consumers, with the help of a middleware module, can enable/disable HVAC or lighting circuits for efficient power consumption. This will prevent the depletion of energy resources. Such smart solution, if adopted by mass industries, can help identify energy-intensive equipment and processes enabling them to develop energy savings strategies, eventually resulting in overall power consumption picture of a larger region (a city or a country).

This can help in reducing energy consumption in house as the owner is continuously being notified about the number of units that are consumed. It objective is to generate bill automatically by checking the electricity unit's consumption in a house and in a way to reduce the manual labor.

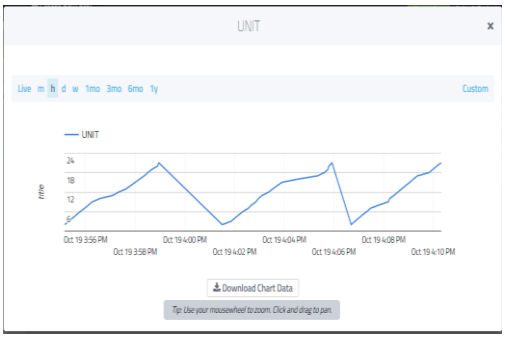
The calculations are performed automatically and the bill is updated on the internet by using a network of Internet of Things. The bill amount can be checked by the owner anywhere globally. The internet of thing allows object to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer based systems, and resulting in improved efficiency, accuracy and economic benefit.



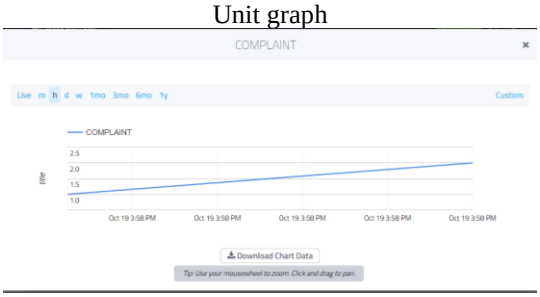
Iot Dashboard For Renewable Energy Integrated Real Time Eectricity Monitoring Using Cloud Communication

The operation of the calculating the power cost is simple and doesn't involve delays, PIC (16F877A) microcontroller along with serial communication has been used to interface with the virtual terminal. The IOT based Energy meter for calculating cost and displayed in LCD has been achieved using MPLAB and PIC 16F877A. The power cost is send through serial communication to the Virtual terminal constructed in PROTEUS.

This project can therefore enlighten management about wasted time, and unnecessary trips, book keeping and billing because it gives an accurate accounting of units. In our project we are displaying the information about the energy consumed in terms of units, about the bill and if any theft occurs that will be displayed in the website. Hence every user can check the information anywhere globally. Cayenne web page is used for displaying the information of the project.



Unit graph



Unit and Complaint online screen shot

CONCLUSION

Main goal of this research is to develop, plan, construct, demonstrate, and validate a low-priced SEMS solution to track daily electricity usage using an IoT-based technique using renewable solar energy. In the era of smart city advancement, this project is concentrated on the connectivity & networking factor of the IoT. In this project, an energy consumption calculation based on the counting of calibration pulses is designed and implemented using PIC16F877A MCU in embedded system domain.

In this proposed work, RENEWABLE ENERGY INTEGRATED REAL TIME EECTRICITY MONITORING USING CLOUD COMMUNICATION system is designed to continuously monitor the meter reading. Ease of accessing information for consumer from energy meter through IoT. The LCD displays energy consumption units.

Using IoT communication protocols, it collects and further transmits the gathered data to the middleware module, which manages and provides users with their electricity usage information via consumer application. For real time data collection, the installed SMs operate online. The presented system can be installed in smart homes or in other smart environments which require daily electricity consumption. Normally, people monitor their electricity usage manually or depend upon the measurements taken by electricity service providing companies, which are usually erroneous or have deficiencies.

Due to technological advance, consumers are now more educated and are much concerned about monitoring of their actual amount of electricity consumption and utilization. With the use of presented SEMS, consumers can monitor and conserve their energy consumption efficiently as now they can monitor their real time data on energy usage. This will eventually minimize their power consumption, thus saving both money and energy. This has been validated in this work through a thorough assessment of the presented SEMS using an extensive case study-based analysis.

In this work, it has been proven that IoT is an essential part of the presented SEMS, as it not only provides motoring of the real time data, but two-way control of the connected devices for efficient power management, both at the consumer and service provider ends.

In short, using IoT gives an intelligent solution for daily based power monitoring and control. Based on the case study provided in this work, it is concluded that the presented SEMS helps consumers to easily, effectively, reliably, and accurately track their power consumption, thus, helping them to understand and control the unwanted use of power, hence, resulting in energy conservation. Furthermore, this work justifies the use of emerging information and communication technology (ICT) needs

7.1. FUTURE ENHANCEMENT

In future SEMS, IoT-based smart energy meters will be able to share usage as well as energy quality with power grids thus enabling them to improve their performance and billing. To enhance the SEMS further, the consumer side data measurements and their power consumption behaviors can be combined with machine learning and deep learning techniques to predict efficient power grid configurations for efficient power distribution. Nevertheless, there is a lot of room for improvements due to limitations, such as standardization of communication protocols, redesign of safety rules, plug and-play assistance and improvement of the existing power grid infrastructure.

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