

# IOT Based Smart Energy Meter Monitoring With Theft Detection

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**Abstract**—India is the world's third largest producer and third largest consumer of electricity[1]. The per person energy consumption in India in 2019 is 1181 kWh .With increasing demand and value for energy, it has become tedious to keep track of consumption of energy units. Smart Meters can override these difficulties by providing a more appropriate solution which includes accurate billing, better information on energy consumption thus leading to better utilization. These Smart energy meters are beneficial to both the consumer and the supplier. They provide a more efficient solution in determining tariffs for the latter. Internet of Things is an emerging technology and IoT based devices have revolutionized the field of electronics and IT. The proposed project is an Iot Based Smart Energy meter system developed to efficiently manage the energy consumption in households by avoiding wastage ,to provide accurate information to small scale users and to avoid manual meter reading and automate bill data entry process.

**Index Terms**—Introduction,Block Diagram, Components, Code, Circuit Diagram, Output, Conclusion, Reference

## I. INTRODUCTION

Energy crisis is one of the major problems that the world faces today. The energy crisis can be reduced to a certain extent by properly monitoring our energy consumption and avoiding energy wastage. Nowadays people face many problems like power theft. Power theft may be a measure crime and it also directly affects the economy of our country. This system will find energy theft easily.The demand for energy is increasing because of tremendous increase in the population growth and the industrial development. But not many people are getting their piece of energy as the natural resources have also started depleting faster than it can replenish so we all have to become more aware of our day-to-day energy consumption and how we can minimise it or stop it from overusing it. Also, human presence is still required for noting down the meter readings and hand over us the bill which is indeed a very tedious task and errors are bound to happen due to which the user has to pay extra amount of bill or sometimes

less than the actual bill. Many users have busy schedule due to which they cannot crosscheck the meter reading with the reading mentioned in the bill. But with the smart method which our group came up eliminates the third party between the user and the service provider. It allows the user to track the electricity consumption of his/her house on daily basis on his/her mobile phone by using Blynk Application which our group is developing and can also predict the future consumption by analysing the trends.

## II. LITERATURE REVIEW

IoT based devices have created a revolution in electronics and IT. The foremost objective of this project is to create awareness about energy consumption and. efficient use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit using IoT.

Smart Power Monitoring Using IoT that energy Consumption is the very important and challenging issue. Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Arduino WIFI and SMS provides the system as Smart Power Monitoring system. Smart energy meter provides data for optimization and less the power consumption.

## III. OBJECTIVE

The devices connected through the IoT concept can be analyzed remotely. The IoT concept provides the essential infrastructure and opportunities to make a connection between the physical world and computer-based systems [2]. The concept has been gaining importance with more and more wireless devices that are increasing rapidly within the market. Hardware devices are connected with one another over the

web(Internet)As the demand from the newer generations of population for electricity is increasing so along with it the technology improvement is needed. The proposed system provides a 180 degree technical curve to the traditional energy meters using IoT technology. Also, there are other issues that we've dealt with like power theft which successively generate economic loss to the Country.

This project is intended to present an overview of smart energy meter which can control the usage of electricity on consumer side to avoid wastage of power. Smart energy meter is a concept to minimise the electricity theft with a cost-efficient manner. A system that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes chaos and energy related corruption. With that being said, to implement such a system we will aim to do the following:

- To develop a system that analyses and controls power consumption efficiently.
- To modify available smart meters and provide real time updates regarding consumption.
- To provide a bidirectional flow of information between consumers and suppliers.
- To reduce manual labour and therefore human errors in the distribution system.

#### IV. PROBLEM ANALYSIS

Our task is to detect fraud in electricity consumption. The data set is a collection of real electricity consumption samples and was released by the State Grid Corporation of Tamil Nadu.

The data is a sequence of daily electricity consumption, which we characterize as a time series. The basic assumption that guides the analysis of time series is that there is a causal system more or less constant, related to time, which influenced the data in the past and can continue to do so in the future. The purpose of time series analysis is to identify nonrandom patterns in the daily electricity consumption behavior.

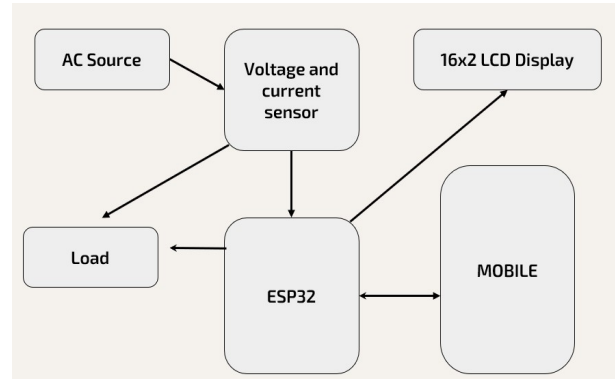
Since IOT is cost effective compared to traditional methods , monitoring of energy usage at lower cost is possible. Daily consumption reports are generated which can be monitored by the user through an Android application and/or web portal. It is a more reliable system and accurate reading values are collected from energy meters using devices. Live readings of devices can be viewed using an Android application. Also, the readings can be viewed online. Human interference is avoided and everyone's values are kept maintained in the central server.

The communication medium is secure and tampering of energy meters or theft of electricity can be identified easily. If a mistake occurs within the system, the value in the central server will not be updated. Since the values are stored within the central database, the reports are made accessible from anywhere on the world. Also, the server is online 24x 7 available.

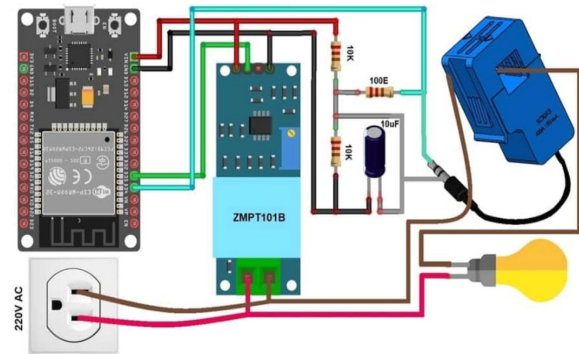
#### V. COMPONENTS

- ESP32
- Voltage Sensor
- Current Sensor
- LCD Display
- NodeMCU
- Blynk App

#### VI. BLOCK DIAGRAM



#### VII. CIRCUIT DIAGRAM



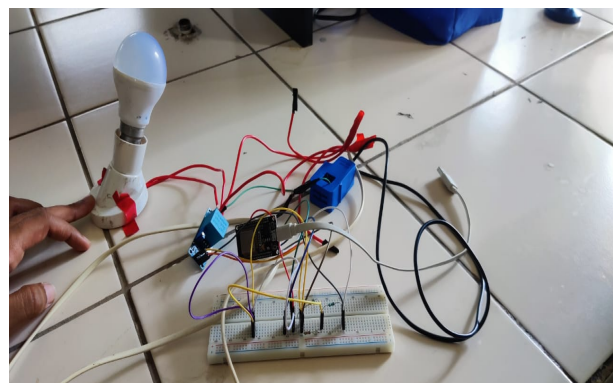
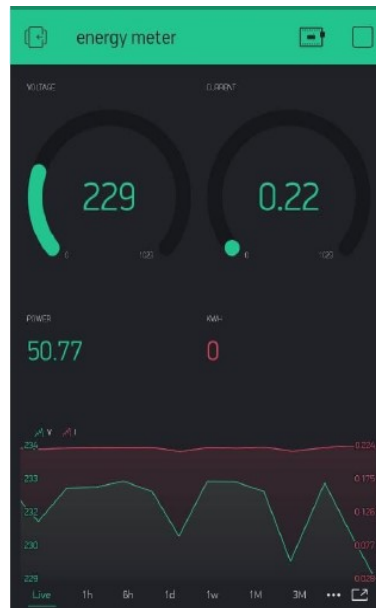
#### VIII. BLOCK DETAILS

- ESP32 - The ESP32 is a powerful 32 bit micro-controller with integrated Wi-Fi, full TCP/IP stack for internet connection and Bluetooth 4.2. It is the device That help us to interface the hardware with software and also helps in to upload the Data in cloud.
- Voltage Sensor -(ZMPT101B) The Voltage Sensor is a simple module that can used with Arduino (or any other micro-controller with input tolerance of 5V) to measure external voltages that are greater than its maximum acceptable value i.e. 5V in case of Arduino.
- Current Sensor - (SCT-013-030)A current sensor is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

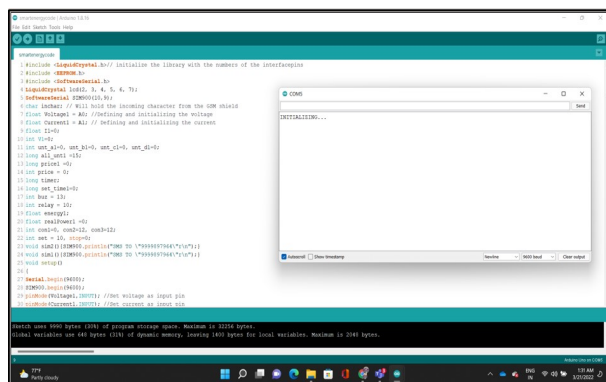
- LCD Display- 16x2 LCD is a 32 digits display screen for all kinds of CMOS/TTL devices. This word comes from the liquid crystal and 16X2 represents its screen size. In Liquid crystal display 16x2, there are 2 rows and 16 columns.

#### A. Function of the Components

- ESP 32 Wifi module is used for IOT display connections.
- ESP 32 has bluetooth in built which helps in cloud computing the data.
- We have also used the Current sensor SCT-013-030 which sense the current reading to the micro processor.
- We are also using the blynk app to configure information to the customer regarding the cost of the meter, real time monitoring of the meter as well as alerting the customer about theft detection.
- We have used blynk app for our cloud storage as well as data monitoring and display.



#### IX. CODE COMPILATION



#### XI. CONCLUSION

Energy Monitoring using IOT is a very innovative application of the internet of things which plays a vital role in upcoming years. It is used to control home appliances remotely over the cloud from anywhere in the world. In the proposed project, a current sensor is used to sense the current and display it on the web using IoT. The system updates the information every 4 to 3 seconds because it has some delay due to the relay module connecting with the appliances to make the appliances home automated.

In this new system, load consumption of the appliances is accessed using Wi-Fi technology and it will help consumers to avoid unwanted use of electricity. An IoT system where a consumer can monitor energy consumption and pay the bill online. Also, a system where a user can receive SMS, when he/she crosses the threshold of electricity usage slab can be equipped. We may further enhance this system where a consumer receives a text message whenever someone is trying to steal the electricity within a 100m of area. Also, using cloud analytics, we will predict future energy consumptions. This system can also perform home automation, which is another advantage of making this project.

#### X. RESULT

The Application takes care of retrieving and displaying data to the user and also takes data to the cloud from the user. The purpose of the interface is to make user's interaction simple and efficient. It acts as a medium for two-way communication in cases like controlling appliances, getting consumption threshold as inputs and for displaying consumption patterns and billing details. Consumption data is presented in the form of graphs for better understanding and interpretability.

## ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

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