DESIGN AND IMPLEMENTATION OF SMARTELECTRICITY METER

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ABSTRACT : *Electricity is one of the fundamental necessities of human beings, which is commonly used for domestic, industrial and agricultural purposes. Smart Electricity Meter is an electric device having energy meter chip for measuring the electric energy consumed and a wireless protocol for data communication. Communication between user/household and substation is done using Wi-Fi. For decades now, manual energy meters are used to estimate every end-user's energy consumption. But there are lots of setbacks to these meters. These meters were unable to solve the problems of power loss and theft, giving necessity to developing a metering system that will serve as a solution to all issues emanating from the consumer end. In this meter energy utilized and the corresponding amount will be displayed on the LCD continuously and communicated to the controlling base station. It analyzes designs, microcontrollers, sensors, transducers, communication protocols, data storage accuracy, and maximum power capability. The proposed system replaces traditional meter reading methods and also can monitor the meter readings regularly without the person visiting each house.*

KEYWORDS : *Micro-Controller, Voltage sensor, Current sensor, Relay, Arduino*

I. INTRODUCTION

An electricity meter is a device that measures the amount of electric energy consumed by residence or electrically powered devices. Smart Electricity Meter is a concept in which we can recharge its balance like we do in our mobile phones. Smart Electricity Meter were found to be based on the instant billing capabilities system development, and the wireless communication protocols of the systems. It is designed for the electric consumers to have control over the electric bills.

II. SYSTEM ARCHITECTURE

A. Proposed System

The project is proposed for single phase residents only, it is not suitable for three phase residentsand buildings. Smart electricity meter is a technology of automatically collecting data from the current sensor and counting the number of pulses. It continuously monitors the electricity meter an sends the data to the user. In this system the users may recharge when they intended to use the facility. This puts forward a innovative electricity billing usage scheme. There is no need to pay extra charges and it saves time.

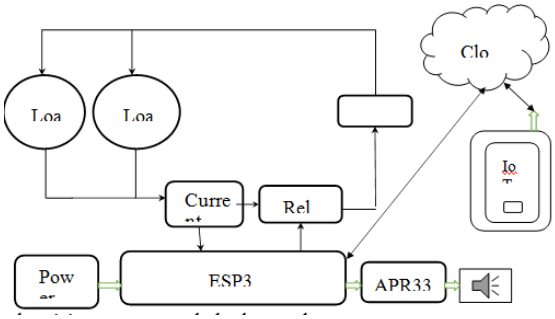

Fig.1 Block diagram.

B. Hardware:

The main hardware components used are

- **ESP32**

A feature-rich MCU with integrated Wi-Fi and Bluetooth connectivity for a wide-range of applications. ESP32 is capable of functioning reliably in industrial environments, with an operating temperature ranging from –40°C to +125°C.

- **Current Sensor**

ACS712 is a current sensor device that detects electric current in a wire and generates a signal proportional to current. The generated signal can be 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.

- **Load**

Load is an electronic component that draws electric power.

- **Relay**

Relays are switches that open and close circuits electromechanically or electronically. Relay control one electrical circuit by opening and closing contacts in another circuit.

- **APR33A3**

The APR33A3 series is a powerful audio processor along with high- performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The IC is a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing, and analog output functionality.

C. Software:

- **Arduino IDE** It is a type of software in which we write (or) edit code in order to make it work for different tasks (or) ways. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can beused with any Arduino board.
- **Blynk Library for Arduino IDE**

It is a type of library which consists of shortcut keys which are used while writing codes to make changes in the circuit in order to make it work for different purposes.

- **ESP32 Link**

The ESP32 provides a Wi-Fi connection for external devices. These devices can be computers, phones, tablets etc.

III.IMPLEMENTATION

This section contains the implementation of the proposed system. Smart electricity meter is a technology of automatically collecting data from the current sensor and counting the number of pulses. It continuously monitors the electricity meter an sends the data to the user. Meter Reading System continuously monitors the current in the current sensor, calculates the power and sends the data to the customer. The current reading is done by the current sensor. The current sensor transfers the information to node MCU. To recharge is done through the wi-fi module present on it. Whenever the

recharge is about to complete a message is sent to the user that the balance is low and also has voice module so that the user can recharge it when required. The current information sent to ESP32 is multiplied with the voltage which gives the power value. The relay acts as an ON/OFF switch. When the recharge is done, the Relay switch is ON and the power supply is given. When the recharge is completed, the relay switch is OFF based on the command by the ESP32. The value of current, voltage, power is displayed in the blynk app. The amount of power consumed is also displayed so that the user can recharge when necessary.

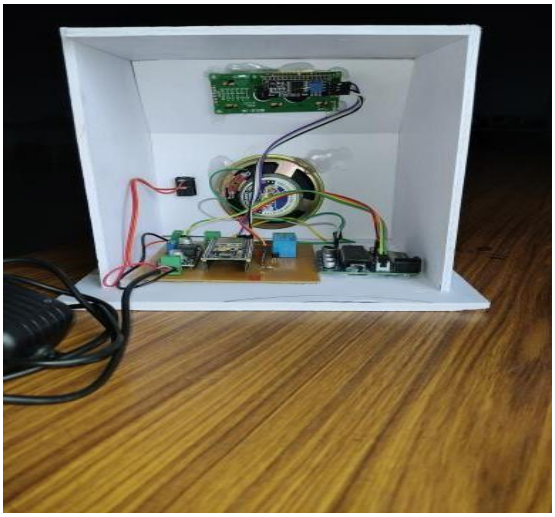

Fig. Smart Electricity Meter Model

IV.RESULT AND DISCUSSION

Smart electricity meter is a concept to minimize the electricity theft with a cost efficient manner. The design of smart electricity meter enables the user to pay the electricity bill before its consumption. The blynk app enables the user to recharge when the balance is low. This system has been proposed as an innovative solution to the problem of affordability in utilities system. This reduces the human labor and at time same time increases the efficiency in the calculation of bills used for electricity. Smart electricity meters will bring an awareness of unnecessary wastage of power and will tend to reduce the wastage of power.

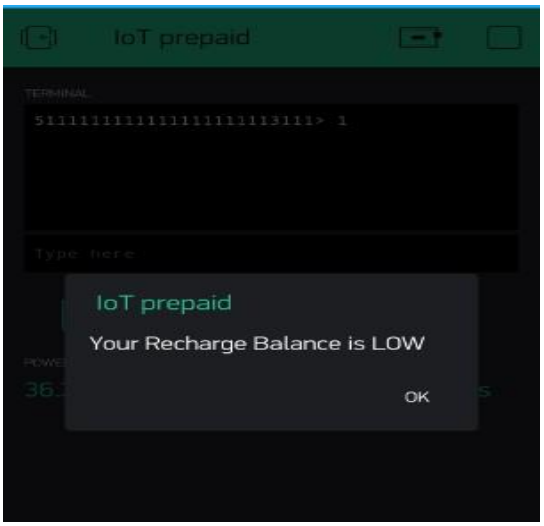

Fig : Indication of low balance

V.CONCLUSION AND FUTURE WORK

Using this meter we can reduce the manual efforts to take the readings from the energy meter which is a cost effective solution. It also controls the usage of electricity on consumer side to avoid the wastage of power. As for the future work the users can recharge the individual home appliances. Smart meters are connected through a web-based monitoring system which will help to

reduce commercial losses of utilities, enhance revenues and serve as an important tool in power sector reforms.

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