

# Energy Metering Solutions for Industrial Equipment

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**Abstract** - So as for sustainability to be performed, economic increase, environmental protection, and social properly-being must be balanced. When it comes to sustainability, one of the first activities to be done is to monitor the energy that is being consumed. The consumption of electricity contributes notably to the costs of operating a business and to the emissions of carbon dioxide. There's a want to boom electricity performance through more advantageous transparency of metering facts with a view to increasing power efficiency. There is no question that energy intake is a sizeable contributor to operational charges as well as carbon dioxide emissions. Organizations of a wide variety are increasingly worried about achieving and demonstrating sound environmental overall performance by controlling the impact in their activities, merchandise, or offerings at the environment. Basically, a smart meter is a meter that measures how plenty electricity is being consumed by way of a tool the use of the superior era. The device collects data and stores it in the cloud so one can offer customers with get admission to to it. Later, these records may be analyzed to help optimize electricity intake.

**Index Terms** - LORA, NodeMCU, THINKSPEAK, Energy Meter, ZigBee, MQTT

## I. INTRODUCTION

The key to lowering electricity costs and improving the power efficiency of your machines and electric property is to be aware of the energy consumption. Electric meters make it possible to identify the energy consumed thereby producing development opportunities and produce advantages for property owners, facility managers, and the users. They make it possible to operate smarter buildings more efficiently and cheaply. You can also divide the invoice you received from the software into different families using these meters. A detailed picture of the energy consumption and the precise areas where electricity is consumed is provided by metering.

Today, the population's demand for energy is increasing steadily and is used for a variety of purposes, including those related to agriculture, industries, families, hospitals, and many other things. So, dealing with the needs and maintenance of the power grid is getting harder.. Therefore there is an immediate requirement to store as a whole lot electricity as feasible.As the demand from the newer generations of the populace for energy in growing so in conjunction with it generation improvement is needed. The proposed product does this by smart metering it.

Smart energy meter using a wireless device and is designed totally on three essential objectives. They are:-

1. To instantly deliver an automated load energy reading
2. To use the electricity in an optimized manner
3. Reduce the power wastage

## ENERGY METERING SYSTEM

In general Smart energy metering for Industrial equipment consists of sensors like voltage sensor and current sensor. All these are deployed into one device for the voltage and current data collection. A gateway device is installed based on the requirements of the industry. A definite number of devices' data will be sent to these Gateway devices through which the data is sent to cloud. Later these data sets are analyzed based on the algorithm and Energy optimization is done based on the analyzed trend.

Figure 1 shows the block diagram of Energy metering solution for industrial equipment

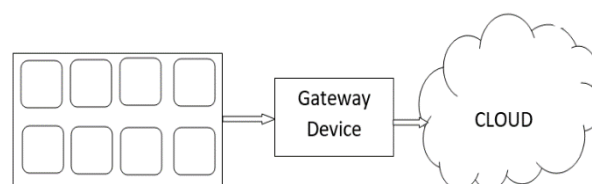


Figure 1: General Block Diagram of Energy Metering Solutions

## II. LITERATURE SURVEY

M. USMAN SALEEM et.al [1] which have a smart meter architecture consisting of three main components,

1.MSP430F67641 MCU (Microcontroller unit) which is designed for grid parameters monitoring, it gives the precised data of voltage, current, power, power factor and frequency, etc.

2.TM4C129x which is Tiva C series microcontroller having ARM-Cortex-M architecture, is a Texas Instruments SoC (System on Chip), this moudule has features such as controlling loads remotely, real time tracking of humidity, temperature, PV sensors. Through UART this is connected to nodeMCU, it uses MQTT protocol to wirelessly communicate with IOT middleware.

Abhiraj Prashant Hiwale et.al [2] This proposed system has energy meter, current sensor, OLED display, ESP32 along with relays to switch the loads. This system starts to function after connecting to wifi, it gives information regarding energy consumption by user. If there are pulses coming to the system from energy meter, it shows data on OLED displays and if it doesn't receive pulses indicates that there is a power theft going on and alert is sent. The data obtained from system is uploaded to an open IOT platform "ThingSpeak", to store and analyse the data, if there isn't any load is connected no data is uploaded to the cloud, whenever load is connected data gets uploaded to the cloud.

C. Herrmann et.al [3] to Improve Energy Efficiency in Manufacturing. Here they provide the information about smart metering along with how diversification is present in energy which flows in manufacturing, that is it starts from factory, process chain to machine tool level. From this we get to know how to account and tracking of energy flowing is done. This is done with the goal to save energy consumption by knowing how it is spent in particular industry, which is taken into consideration. With detaield discription of every level of data acquisition done.

L.C.Moreira et.al [4] This paper represents an overview of the significance of the key parameters of energy consumption, which helps in developing effective analysis and optimization approaches. The key parameters are sampling rate and component of frequency which improves the accuracy of power measurements.

Abhiraj Prashant Hiwale et.al [5] developed an IoT-Based Smart Energy Monitoring system. This paper makes use of the current sensor to get the data of the current consumed and the data is sent to THINGSPEAK. Data acquisition is the process where it measures the physical conditions into digital numeric values. Access to a wide variety of embedded devices and web services is made possible by IoT. Energy load consumption is accessed using Wi-Fi and helps to unwanted use of electricity. THINGSPEAK is a cloud platform where the data is collected, stored, analyse, and visualise from the sensor.

Yao Cheng et.al [6] Long-range metering is accomplished via LoRa. LoRa is a wireless technology with a communication range of about 22 kilometres. According to statistics, the data sends 12 bytes per message and 48 messages per day. It is a Gateway component that interacts with the smart metre and responds to requests for data collection sent by the computer to locations where the data is kept. The suggested designed model consists of various sensors that calculate energy metering characteristics in real-time. The created model is also precise and cost-effective.

E. O'Driscoll et.al [7] It gives an overview of the methodology facilitating the effective installation of energy meters on a large scale in complex manufacturing facilities: mainly on Irish based case study. It explains the importance of energy consumption transparency, which is achievable only by monitoring the power consumption. The proposed solution uses RS-232 as a medium to carry signals, RS-485 to eliminate the interference problems as well as to support for multiple drop applications and Ethernet communication for safer and cost-effective data transmission. The main drawback, or future work to be done is implementing this proposed method on a larger scale with additional measuring parameters such as sags, dips, and harmonics and make it more cost-effective.

V.Preethi and G. Harish [8] developed a solution for Energy metering with theft control. The proposed system has an energy meter which can meter/monitor the on its own, and display it on an LCD board. This meter, being pre-paid or post-paid, automatically calculates the amount for the consumed units based on the standards fed by the government and cut down the same amount within the user's bank account. The feedback which the user gives will be compared with the energy consumed and calculates for any thefts. If any, then automatic SMS will be sent to the user and the responsible person, whomsoever it may concern. This system uses Zigbee communication protocol to communicate between the data centre/substation. GSM network is also used to send SMS to the concerned people whenever the system is at the risk of power thefts. The proposed system replaces the traditional reading methods and aslo enables the remote access for the energy provider.

### III. CONCLUSIONS

This literature survey provides what are the existing solution for industrial energy metering. The key factors that affect and better solutions to overcome the problem in the coming energy metering solution. The different communication such as LoRa, MQTT protocol, ZigBee working, and data storage systems. MSP430 microcontroller gives precise data on voltage, current, power, power factor, and frequency. TM4C129x microcontroller used for controlling loads remotely, and real time tracking of humidity, temperature, and PV sensors.

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