



Smart Energy Meter Monitoring over IoT

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ABSTRACT

With the advancing technology, every field is shifting towards making systems automated, portable and easy to use. Supporting the change in time, the project proposes a technique for real time monitoring of energy consumption using smart energy meters connected with each other in a smart network and for the theft analysis using IoT. Here, we present ingenious energy theft detection with the boon of predicting consumer's ungenerous consumption pattern. To bring awareness among the people, we alert the consumers by a notification. IoT operation is performed by Wi-Fi device, which sends the meter data to the web page through the IP address. This is used for Electricity board to continuously monitor the consumption of power billing information that is calculated using microcontroller.

KEYWORDS: Automated system, Power billing information, Energy Monitoring, Smart Energy Meter, IoT device, Real Time Monitoring.

INTRODUCTION

About the project

In the present billing system, the distribution companies are unable to keep track of the changing maximum demand of consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly.

The remedy for all these problems is to keep track of the consumers load on timely basis, which will be held to assure accurate billing, track maximum demand and to detect threshold value. These are all the features to be taken into account for designing an efficient energy billing system.

The present project "Energy Meter Monitoring Over IoT" addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems i.e.

combination of hardware and software in order to implement desired functionality.

The paper discusses comparison of Arduino and other controllers, and the application of Wi-Fi modems to introduce 'Smart' concept. Wi-Fi modem the consumer can monitor his consumed reading and can set the threshold value through webpage. This system enables the electricity department to read the meter readings monthly without a person visiting each house.

This can be achieved by the use of Arduino unit that continuously monitor and records the energy meter reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer on request. This system also can be used. PURPOSE A Smart Meter helps consumer to know the information of consumption of electricity for appliances in their respective houses. The aim of

this research work is to measure and analyze power consumption using Smart Meter which are connected with one another using an IoT device which provides data by conducting case study on various households.

SCOPE:

- Electricity theft is a social evil and which is increasing day by day that has to be completely eliminated.
- It also suggests a method for power theft detection and disconnection using the automatic metering infrastructure (AMI).
- If there is any illegal connection it can be detected.

LITERATURE REVIEW:

1) **Seema More et. al (2019)** made a paper "**Smart Energy Meter Billing, Monitoring and Controlling system**". This journal explains about IOT based energy meter billing, controlling and monitoring system proposes and analyse a system which is used for energy meter billing, controlling and monitoring. The system is fully Internet Of Things based and highly desirable in field of energy. In this system consumer can do power management by knowing energy usage time to time. The customer needs to pay the bill on schedule, if couldn't the electric power connectivity can be turned off autonomously. This system uses energy meter with microcontroller system to monitor energy usage using a meter. The meter is used to monitor units consumed and transmit the units as well as cost charged over the internet. This allows user to easily check the energy usage along with the cost charged.

2) **A. Berouine et. al (2017)** made a paper in "**A Smart Metering Platform using Big Data and IoT Technologies**". This paper explains autonomous monitoring of electricity consumption requires a metering platform for recording and processing electrical data. In this paper, they shed further more light on the integration of these technologies into a holistic platform for realtime sensing, processing, and data visualization. A platform prototype was developed and tested for detailed profiling of energy consumption in buildings. It allows measuring and monitoring the electric power consumption of

individual appliances.

SYSTEM SPECIFICATION

3.1 HARDWARE SPECIFICATION

1. Energy Meter
2. Microcontroller

3. Wi-Fi Modem
4. LCD Display
5. LED's
6. Transformer
7. Resistors
8. Capacitors
9. Diodes

SOFTWARE SPECIFICATION

1. Arduino Compiler
2. MC Programming Language: C
3. IOT Gecko

SYSTEM ANALYSIS

EXISTING SYSTEM:

Most traditional power meters nowadays are currently installed in household's displays the total real time usage of its power at each month end. There is no real way to see what the day's, week's or month's utilization of electrical mechanism in home. "Advanced model of smart home metering" is to build up a framework with the end goal that it will be able to screen each appliance in the home and the user will be probably know the consumption of every electrical appliances. The Smart Meter is implemented with AMTV algorithm. This algorithm is used to reduce power consumption of every electrical appliances.

PROPOSED SYSTEM:

In the proposed system to eliminate the manual work and the human involvement in the meter reading we are using the concept of Internet of Things (IOT).

This system which makes it possible for Tamil Nadu Electricity Board (TNEB) to collect unit readings without using the manual involvement. The data, the unit consumed by the consumer which is collected at the consumer premises is loaded to the separate TNEB official web server. A database at the server, that stores all the details including the consumer number, units consumed which will be only accessible to the authority. This is achieved by connecting the Arduino microcontroller with energy meter.

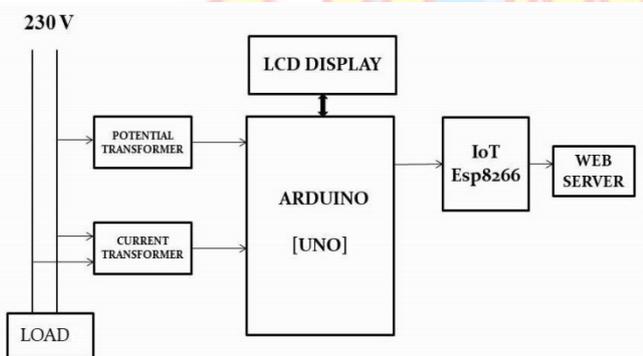
In this paper we also suggest a method for effective energy management, to bring awareness to consumer on billing pattern of TNEB and enables them to monitor the daily electricity consumption by using an android application and a website.¹⁷

The android application can monitor the power usage and can warn the users when power usage is getting close to the prescribed threshold energy level and alerts the consumer by a message if it exceeds. If the user fails to pay the electricity bill or

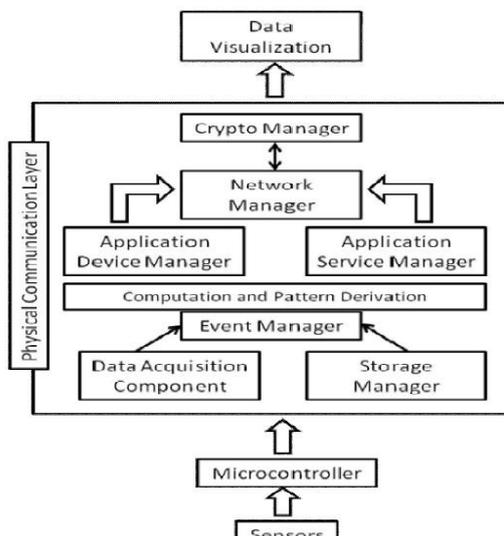
if the consumer is against of the rules and regulation of TNEB, then the TNEB server will automatically cut the power supply to the consumer. Electricity theft is a social evil and which is increasing day by day that has to be completely eliminated. This paper suggests a method for power theft detection and disconnection using the automatic metering infrastructure (AMI). If there is any illegal connection it can be detected.

In this proposed system, the design which helps to the consumers to know their day to day power consumption to better control of their usage and user to manage the power consumption to their own. This meter records consumption of electrical energy in intervals of hour or less. Every appliances of the household consume power will be reading continuously and this consumed load can be seen on the meter. In this system we use, Arduino UNO acts as main controller which continuously monitor energy meter. By using the microcontroller, we can able to set the threshold value. If it reaches the threshold value it sends the notification to the user.

BLOCK DIAGRAM:



SYSTEM DESIGN:



DATA FLOW DIAGRAM:

System design is the process of planning a new system or to replace the existing system. Simply, system design is like the blueprint for building, it specifies all the features that are to be in the finished product. System design phase follows system analysis phase. Design is concerned with identifying functions, data streams among those functions, maintaining a record of the design decisions and providing a blueprint the implementation phase.

Design is the bridge between system analysis and system implementation. Some of the essential fundamental concepts involved in the design of application software are:

- Abstraction
- Modularity
- Verification

INPUT DESIGN:

Input design is one of the most expensive phases of the operation of computerized system and is often the major problem of a system. A large number of problems with the system can usually be traced back to fault input design and method. Needless to say, therefore that the input data is the life block of a system and has to be analysed and designed with the most consideration.

The decisions made during the input design are:

- To provide cost effective method of input.
- To achieve the highest possible level of accuracy.
- To ensure that input is understood by the user.

System analysts decide the following input design details like, what data item to input, what medium to use, how the data should be arranged or coded data items and transaction needing validations to detect errors and at last the dialogue to guide users in providing input. Input data of a system may not be necessarily a raw data captured in the system form scratch. These can also be the output of another system or sub- system. The design of input covers all phases of input from the certain of initial data to actual entering the data to the system for processing.

OUTPUT DESIGN:

Output design generally refers to the results and information that are generated by the system. For many end-users, output is the main reason for developing the system and the basis on which they evaluate the usefulness of the application.

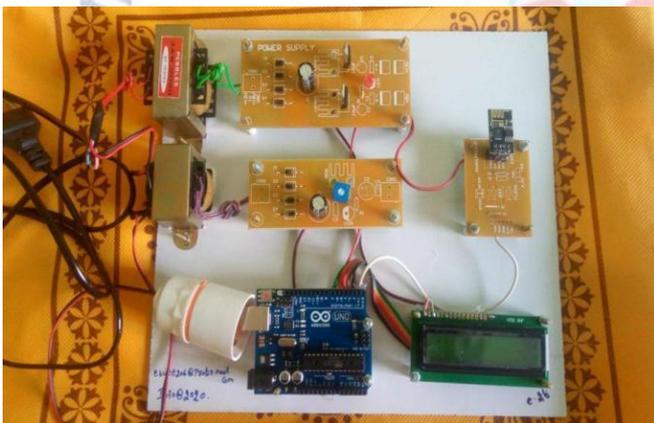
The objective of a system finds its shape in terms of output. The analysis of the objective of a system

leads to determination of outputs. Outputs of a system can take various forms. The most common are reports, screens displays printed form, graphical drawing etc. the outputs vary in terms of their contents, frequency, timing and format.

The users of the output, its purpose and sequence of details to be printed are all considered. When designing output, the system analyst must accomplish things like, to determine what information to be present, to decide whether to display or print the information and select the output medium to distribute the output to intended recipients.

Internal outputs are those, whose destination is within the organization. It is to be carefully designed, as they are the user's main interface with the system. Interactive outputs are those, which the user uses in communication directly with the computer.

HARDWARE



SYSTEM IMPLEMENTATION:

System Implementation is the stage of the project when the theoretical design is tuned into working system. If the implementation system stage is not carefully controlled and planned, it can cause chaos. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the users a confidence that the system will work and be effective.

The implementation stage in a project involves

  Careful Planning investigation of the current system, checking constraints and the implementation.

  Training the staffs in the newly developed system.

FUTURE ENHANCEMENT:

The project mainly aims at providing overall infrastructure of the energy meter presently used for the smart city concept. The main improvement for the future is going to make energy meter readings, tampering identification techniques, and connection and disconnection and also the pre information providing to the users all is going to happen on Wi-Fi internet.

Where we are going to develop some Wi-Fi hotspots in each area through which all the energy meters are get connected and set 4 to 5 parameters which is also going to be monitored. And the overall improvement information will be providing to the energy meter i.e. KPTCL will be easy for them to handle the things.

Also, in future we can go with some standard apps or standard tools, where in which it makes work easy for KPTCL people by reading the meter readings faster than the fastest method. And connect and disconnect of every meter on the on – payment and non – payment that will be fast as compared to the present method.

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