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Smart electricity consumption meter using LoRa Module

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ABSTRACT

LoRa is a long-range, low-power, low-bit rate, wireless telecommunications system, promoted as an infrastructure solution for the Internet of Things: end-devices use LoRa across a single wireless hop to communicate to gateway(s), connected to the Internet and which act as transparent bridges and relay messages between these end-devices and a central network server. This project provides an overview of LoRa and an in-depth analysis of its functional components. The physical and data link layer performance is evaluated by field tests and simulations. Based on the analysis and evaluations, some possible solutions for performance enhancements are proposed. Prepaid electricity billing system and automated smart meter reading have been widely adopted by electricity companies worldwide nowadays to reduce the error of human reading and improve the efficiency of the billing process. To activate the prepaid system, a robust and reliable network is essential. So we have designed this system to manage customers and prepaid bills by using IoT and GSM Technology.

Keywords— *LoRA Module, Electronic meter, Energy conservation, GSM module, Wi-Fi module, LDR, RTC*

1. INTRODUCTION

According to the International Energy Agency, world electricity demand is projected to increase by nearly 80% over the years 2012 to 2040. Modernization, expansion and decentralization of the electricity infrastructure for improved robustness and resiliency is a clear imperative, with the World Economic Forum recently calling for transformational investments exceeding $7.6 trillion over the next 25 years. There are many systems that exist in today's market which are capable of taking readings from a digital energy meter. Most of the mentioned systems are utilized to help the power company keep track of an areas electricity usage. We aim to make a system that provides data regarding electricity consumption of personal household using LORA module.

Our system includes counting the LED flashes emitted by the meter and storing them to accumulate enough counts to constitute 1KWhr. This is then transferred to a parent system that overviews the entire bank of meter-attached modules and acts as the link to the server. The most important feature of this system is the need to communicate wirelessly. We require a suitable communication protocol that will transmit almost instantaneously with high speeds of data transfer and will be suitable for transferring single digit unit consumption data. We settle on using LORA modules for their essential specifications of range of wireless -communication as well as their speed of communication.

The server houses database that stores the unit consumption and calculates the bill as well as certain other utilities. This system has a user interface at its end state that will regularly notify the users of their energy consumption and provide a cumulative analysis of their usage in comparison with the ideal usage. This should help every household stay within their idea l energy-usage limit.

Fig. 1: Smart electricity consumption meter

2. LITERATURE SURVEY

In [1], the hardware and the software interface are connected to each other to monitor the power consumption of the user and further, this will be monitored by server and will be uploaded to cloud from where the user can log on to the webpage in computer. Advantages of this system are financial losses of electricity board can be minimized, time delay that occurs due to manual metering can be avoided to a great extent. Disadvantages of this system are Issues in smart data analytics, Smart meter and big data, cannot be suitable for long distance. From this paper we concluded that the complete working model of a smart energy meter was built which uses existing WIFI Module system. The model satisfactorily worked with a Bulb. Automatic meter reading can be explained well using this system. Financial losses of electricity board can be minimized. Labor charges and effort can be reduced.

In [2], Energyhb, Agilewaves and Google Meter concept used for implementation of project. Advantages of this system are highly application is possible, Energy saving options. Disadvantages of the system are need to know different communication Protocols, cannot be used for long range. From this paper we concluded that In the paper a high-level application possibility has been proposed, which makes these meters useful not only for the utility, but for the consumers and through the encouraging the energy saving.

In [3], this paper presents communication through Ethernet to send data to the server. Arduino is used as controller. Advantages of the system are very cheap, collected data can be monitor by consumer and supplier at any time. Disadvantages of the system are cannot be used for long range. From this paper we concluded that this proposed system is cheap as compared to other communication protocols. The collected data about energy consumption is monitored by consumer and supplier at anytime, anywhere from any part of the world.

3. PROPOSED SYSTEM

Our aim is to design and implement a device that will enable a user to know their electrical unit usage without having to call on the services of their electricity provider. We will be going to design the system with following functionalities:

(a) To continuously monitor the electrical usage of appliances.
(b) To instantaneously provide the availability of consumption data.
(c) To record the history of consumed data available to the user.
(d) To provide the guidelines for reducing electric consumption.

4. BLOCK DIAGRAM AND DESCRIPTION

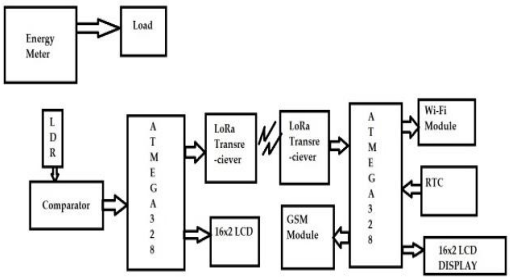

Fig. 2: Block diagram

The working of smart electricity consumption meter is explained based on the block diagram shown in figure. The 230V AC supply voltage is applied at input of energy meter. The output of energy meter is connected to the load. Here we are using induction as a load. The LDR is used to sense the blinking of LED at energy meter. After 25 blink of LED, 10 watt of consumption is transmitted on LCD of transmitter and receiver using LORA module.

After 100 watt of power consumption, the bill amount and consumption units are transferred to the user on his/her mobile phone and on the server using WIFI module. In this way, user will be able to receive the consumption of energy and billing using LORA module

5. FLOW PROCESS

Flow chart process is shown in figure 3.

6. COMPLEXITIES INVOLVED

(a) Taking reading from energy meter is difficult because we can't modify energy meter.
(b) LDR sensor sense any energy source and produce output for that source. It will introduce error into reading.
(c) Slow internet service will introduce delay to upload data on server.
(d) When distance increases from 50 to 100 meter error of not getting data occurs.
(e) Antenna produces error when both antenna of transmitter and receiver are not in line of sight.

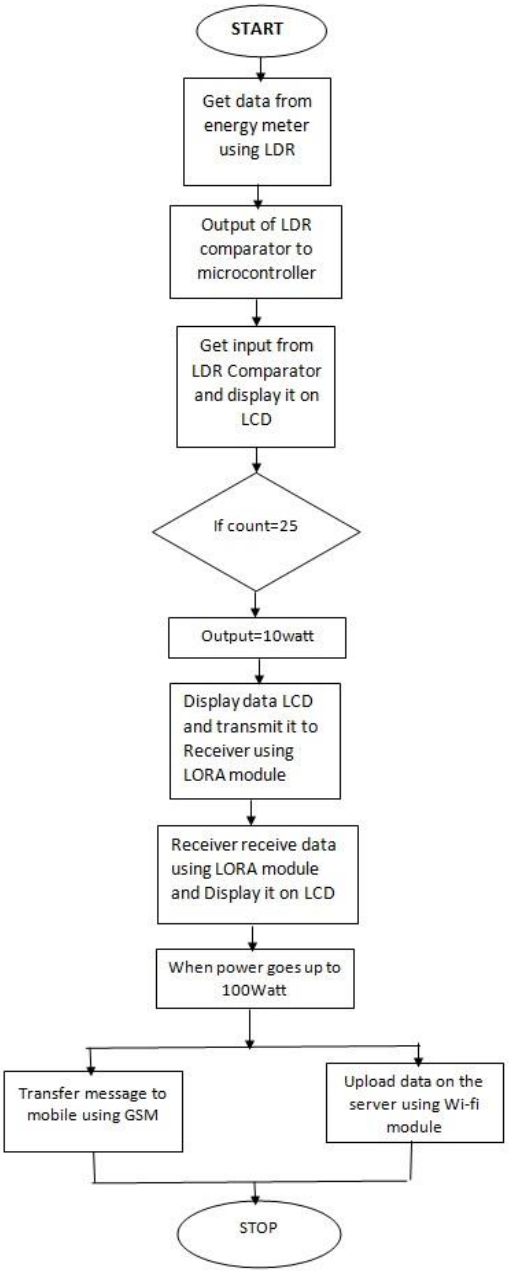

Fig. 3: Flow process

7. RESULT

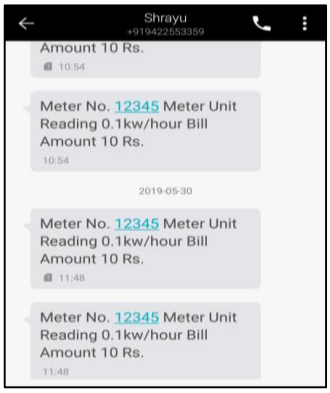

Fig. 4: Result on mobile

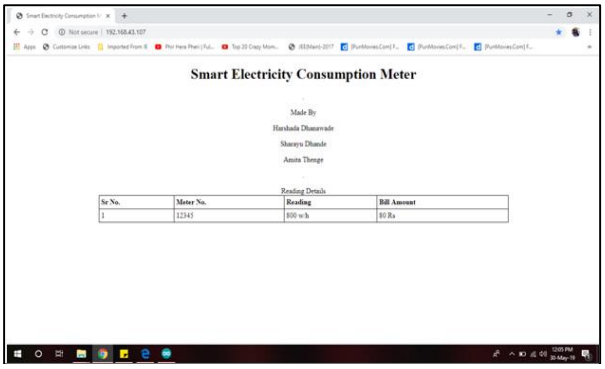

Fig. 5: Result on web server

7. CONCLUSION

There are numerous contemporary systems that exist to support the supplier's database maintenance and bill generation utilities. Our principal aim was to create a similar system but for the user end. It enables the user to take control of their electrical consumption for a variety of purposes. The main purpose is to check for irregularities and also to keep their electrical consumption within an optimized threshold.

In this project, we have implemented an electrical consumption monitoring system with equal emphasis and maintenance of the related database. This database is essentially handling all calculations related to the system while the principal function of the hardware is to monitor the pulses and equate them to commensurate consumption units.

We developed an interface that educates the customers about generation and usage of electricity along with providing real time consumption data.

8. REFERENCES

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