Wireless Electricity billing cum theft detection system

Pardeep Mittal[1] (Assistant Professor),B.Tech Students of EEE[2],

[1,2]*Department of Electrical and Electronics Engineering, Lovely Professional University, Punjab, India.*

Abstract - *This paper proposes the wireless electricity theft detection and billing system using microcontroller. The wireless system reduces the cost of wires used to transfer the billing data as well as information regarding theft by someone. The striking feature of the proposed work is that no person goes home to home to note down the meter readings of electricity consumption. There is always a contract between the consumer and the supplier that the consumer will pay for the electricity consumed by him. In India near about 32 % of the electricity is consumed but not paid for it i.e. it is being stolen by the consumer hence such a system was required that would overcome this theft of electricity but mostly the electricity is being stolen via bypassing the energy meter hence this system recognizes such type of theft of electricity The proposed method has been simulated on proteus and implemented on hardware using microcontroller programming.*

Key Words: Current Transformer, wireless data transmission and receiving, tapping, meter tampering.

1. INTRODUCTION

The electricity is needed to be protected for efficient power delivery to the consumer because electricity is indispensable to domestic and industrial development activity. There are two types of losses technical and Non-technical losses. Every year the electricity companies fare the line losses at an average 20- 30% according to power ministry. T&D losses have been a concern for the Indian electricity sector. Since these have been very high when compared with other developed countries. The present T&D losses including unaccounted energy are about 30% and there is need to reduce these losses through efficient. When we talk about T&D losses it also includes the theft of electricity, although it is the part of commercial loss but there is no way to segregate theft from the T&D losses.

2. LITERATURE REVIEW

There are many factors that encourage people to steal electricity. Of which socio-economic factors influences people to a great extent in stealing electricity. A common notion in many people is that, it is dishonest to steal something from their neighbor but not from the state or public owned utility company. In addition, other factors that influence illegal consumers are:

- Higher energy prices deject consumers from buying electricity. Table II illustrates energy prices in different countries. In light of this, rich and highly educated communities also steal electricity to escape from huge utility bills.
- Growing unemployment rate show severe effect on the customer's economic situation
- Lower illiteracy rate in under developed communities has greater impact on illegal consumers, as they might not be aware of the issues, laws and offenses related to the theft.
- Weak economic situation in many countries has implied its effect directly on common man.
- In view of socio economic conditions of the customer, electricity theft is proportional to the tariff of electricity utilization.
- Countries with weak enforcement of law against electricity theft have recorded high proportion of theft.

2.1 Effects of Electricity Theft

Negative effects of electricity theft are severe and dangerous. Primarily, electricity theft affects the utility company and then its customers. In addition, electricity theft overloads the generation unit. In energy market, utility companies expect their money back from the customers for the electricity supplied, most of which is lost by them due to the shows that they could not invest on measures to reduce the electricity theft. These economic

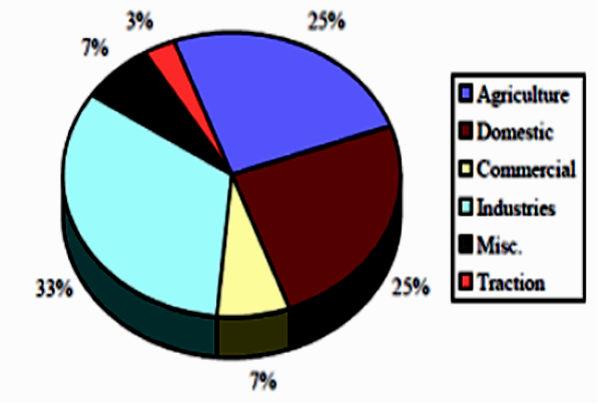

Fig -1: Electricity consumption in different sectors in India

losses affect the utility company's interest in development of the devices in view of improving the quality of supply or for electrification process. Earlier it was a case that

generally takes place in villages because they need more power requirement for their field to drive water pump and for motor. But now days it is not limited in villages but also industrial area as well as consumer side comes under power theft. There are various modes of power theft such as Bogus seal and tampering of seals, Meter tampering, meter tilting, meter interface and meter bypassing, Changing connection etc.

3. SCHEMATIC BLOCK DIAGRAM

In this paper we have described the various methods of electricity theft.. For wireless billing we used RF module that will send the readings or consumption from load side to substation side through microcontroller programming. Similarly for meter tempering and direct tapping methods we have different logics which are described in algorithm and flowchart section.

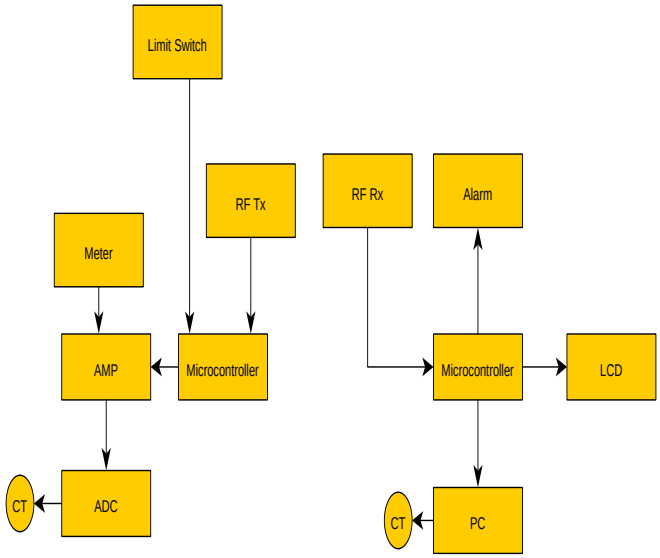

Fig -2: Block Diagram

This system of wireless meter reading is based on the same principle of wireless data transmission that is used in power theft detection. Utility company personnel will have a device consists of wireless data receiver with microcontroller and display. When that device is in the range of data reception it will receive the data sent by transmitter in the load side meter. For this one counter has to be installed in the load side meter .It will keep a record of power consumed by load over a given time. This recorded data will be send by transmitter wirelessly. Receiving device will receive the meter reading and keep its record with consumer serial number. For this, device should be in the range of transmitter.

3. ALGORITHMS

3.1 Algorithm for wireless billing system

M1= Microcontroller at load side
M2= Microcontroller at Substation side
CT1= Current Transformer at load side
CT2 = Current Transformer at load side

Step1. Start.
Step2. Initialization of port.
Step3. Wait for data to be received from meter pulse by M1.
Step4. Is data received = Transmit data through RF transmitter if no go to step 3.
Step5. Wait for data to be received from RF Transmitter by RF Receiver.
Step6. Is data received = Send Data to M 2 if no go to 5.
Step7. Wait for data to be received from RF Receiver by M2.
Step8. Is data received = display data to LCD and HMI if no go to 7.
Step9. Stop

3.2 Algorithm for Theft detection system

M1= Microcontroller at load side
M2= Microcontroller at Substation side
CT1= Current Transformer at load side
CT2 = Current Transformer at load side

Step1. Start.
Step2. Initialize the ports and set the tolerance
Step3. Get Reading of CT1 through ADC by M1.
Step4. Wait for data to be received from CT1 to M1.
Step5. IS data received at M1 = Send data to M2 through RF module if no go to 4.
Step6. Get Reading of CT2 through ADC by M2.
Step7. Wait for data to be received from CT2 to M2.
Step8. IS data received at M2 = step 9 if no go to step 7.
Step9. IS CT1 reading = CT2 reading if yes="NO THEFT", If no="THEFT DETECTED"
Step10. Send all channels data to PC.
Step11. Stop

4. FLOW CHART

4.1 Flow chart for direct tapping case

To program a micro-controller to detect a power theft on one line following flowchart is used. First of all initialize ports of micro-controller as input or output as per required. Set the tolerance in program depending on the loss of line for which this system is installed. Set the delay time (say 10sec) which is depending on after how much time interval system scan the line for theft detection. Take the data from wireless data receiver at preset time interval (10sec). It represents power consumed by load over given time. Take the data from meter installed on pole at the same time. It will represent the power sent over that line for preset value (10min).

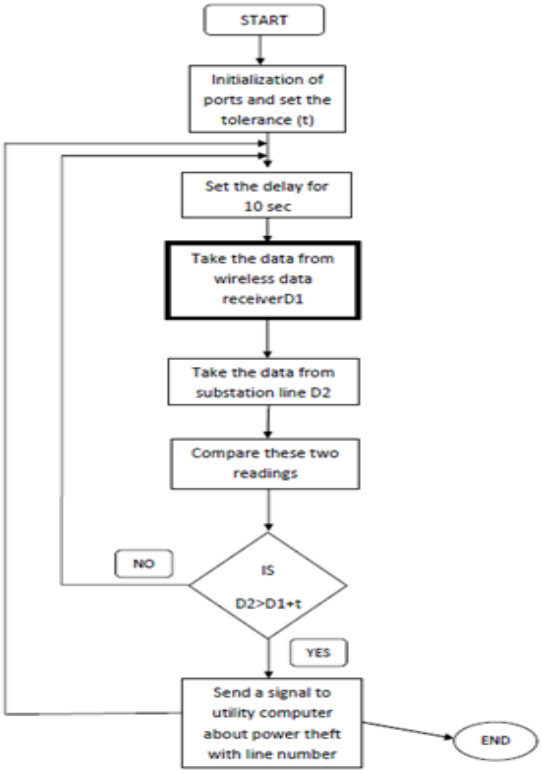

Fig -3: Flow scheme of direct tapping case

4.2 Flow chart for Meter tempering case

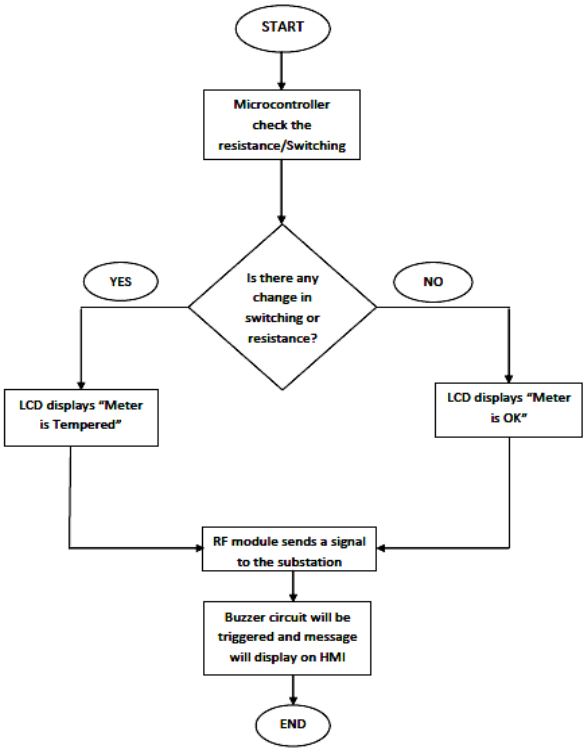

Fig -4: Flow scheme of meter tempering case

This flow chart shows that how the system is used to prevent the electricity theft i.e. it firstly the Microcontroller 89S52 checks for the switching/resistance and if there is the change in the value of the resistance or change in switching of limit switch, buzzer will be triggered at substation and message will be displayed at substation on HMI.

5. CONCLUSION

The evidence points to the increasing levels of power theft in many countries and the financial losses for some systems are so immense that the utility is in financial turn over. Investment in improving the system and adding additional capacity cannot be undertaken, loans and payments cannot be met, and the consumer faces increased electricity charges. Even in efficient systems, theft losses can account for millions of dollars each year in lost revenue. Electricity theft in its various forms can be reduced and kept in check only by the strong and assertive action of power sector. The strategy and the action should be based upon a thorough understanding of the specific nature of the theft problem.

Finally the proposed work is implemented on hardware. As the substation side there is data base master computer in which it keeps all the record of each house, also proposed work is capable of give the information regarding that particular address of home where electricity theft is occurring.

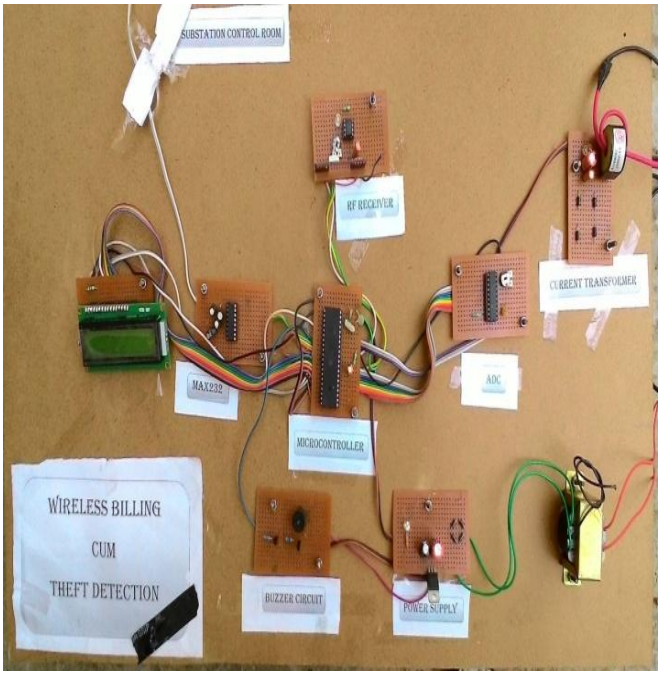

Fig -5: Connections on Substation Side (Receiving Section)

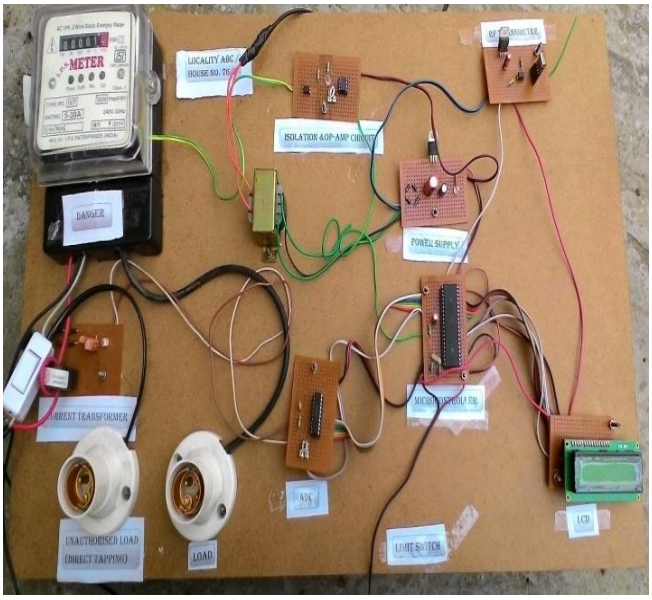

Fig -6: Connections on Load Side (Transmission Section)

6. FUTURE SCOPE

Instead of using wireless data transmission technique, one can use power line communication. In power line communication data signal is modulated on power signal and sent it through a same electrical distribution network. This will reduce the cost for separate communication line. One can decide the resolution of this system. Due to economic consideration, instead of installing this system for each consumer utility company can install one system for one colony. Then power theft on any line in that colony will be identified by this system. Using GSM module we can make a system that will be used for wireless billing. In today's scenario everyone is using net banking. So by GSM module authorities can send the electricity bill through GSM to the costumer's registered mobile number and then he can pay the bill online.

REFERENCES

[1] J. Nagi, K. S. Yap, S. K. Tiong, S. K. Ahmed, M. Mohamad, "Nontechnical loss detection for metered customers in power utility using support vector machines", IEEE Trans. Power Del., vol. 25, no. 2, pp. 1162–1171, Apr. 2010.

[2] A. H. Nizar, Z. Y. Dong, and Y. Wang, "Power utility nontechnical loss analysis with extreme learning machine model", IEEE Trans. Power Syst., vol. 23, no. 3, pp. 946–955, Aug. 2008.

[3] C. R. Paul, "System loss in a Metropolitan utility network" IEEE Power Engineering Journal, pp. 305–307, Sept. 1987.

[4] http://www.freshpatents.com/Power-theft-detection-system-and-method.

[5] http://www.freshpatents.com/Power-theft detection-system-and-method dt20080508ptan20080109387.php

[6] http://www.electronicsmanufacturers.com/products /electrical-electronic components/transformer/current-transformer

BIOGRAPHIES

[1]Pardeep Mittal is currently working in LPU as Assistant Professor. He is pursuing his Ph.D from National University Jodhpur. His area of interests are soft-computing, SCADA, intelligent control, Advance Process controllers.

[2]Deepak Soni (Reg. No:11103365)
Pawan Kumar Nagar (Reg. No:11103390)
Virendra Mehta (Reg. No:11103393)
Vaishali Purohit (Reg. No:11107073)

