

Development of Smart Grid for Residential Electric Power Distribution System

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Abstract— This research paper is focused on minimizing the large amount of power and capital losses that occur due to power theft by the users. Power theft can be effectively reduced by detecting where the electricity theft is occurred and inform the authorities. Contactor is integrated to the unit so as to remotely cut off the power supply of the respective house through GSM who is indulged in power theft.

Keywords— GSM, Hall Effect current sensor, PIC microcontroller, Energy meter, Contactor.

INTRODUCTION

Now a days power sector is an important factor to bring developing countries to developed countries. The overall economic growth of the nation depends on the development of power sector of the nation .Electricity is an important resource of the country which is used in industries, household chores and farming sector. This concludes that electricity is the basic need of human beings. Due to theft of electricity nation faces huge amount of revenue losses and this affects the economy of the nation. Government is not able to minimize the power losses due to deficiency of technology. There are countless ways by which theft can be done so we can hardly detect the theft which is occurred. This problem is needed to be solved as soon as possible.

In this abstract we have come up with an electricity theft detection system which can detect and control electricity theft which is caused by power theft practices like tampering of meter, reading alteration bypassing of meter and unpaid bills. An applicable action is to regularly visit the individuals meter to check whether any fraud has been taken place by user. For this operation they require a well trained team. So these visits are costly.

A government is aware of this power theft practices but still they cannot avoid this action taking place in a country, the reason behind this is tremendous amount required for initial investments in terms of manpower and technical equipments.

INDIA LOSES \$16.5b PER YEAR DUE TO THEFT

In the world India loses more economy on power stealing compared to other countries. Mumbai individually loses \$2.9b every year which more than 10 other countries in the world. Overall losses is up to 25% and in other states losses have been increased beyond 60%.Most of the electricity service provider company are economically unstable.

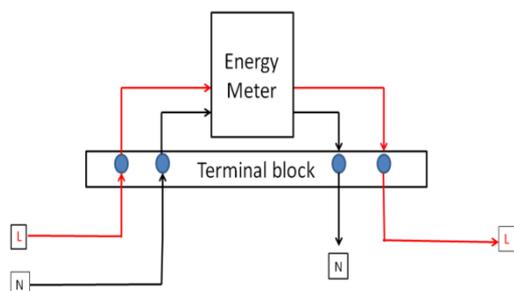


Fig1: Connection of Energy Meter

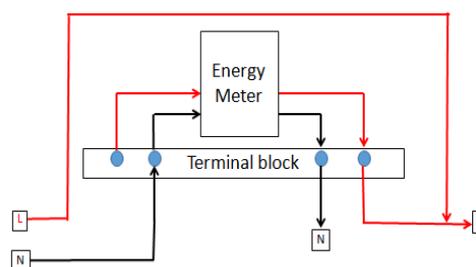


Fig2: Bypassing of Phase Line

II. DESIGN MODULE

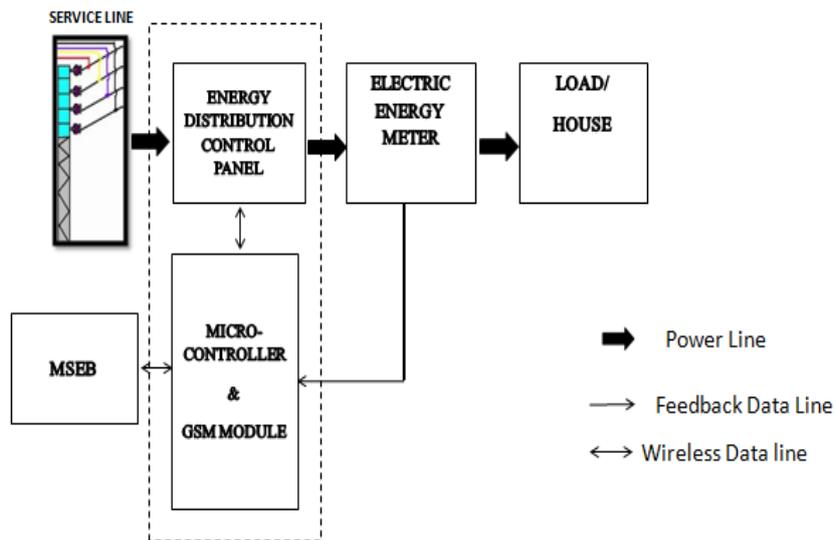


Fig3: Block diagram

There are three main sections in smart residential grid system:

- 1) The smart residential grid.
- 2) The user which are interlinked using GSM.

Main characteristics of the system

- 1) The proposed prototype requires lesser additional components than the currently present system.
- 2) Overall estimate of the prototype is comparatively less than the present system.
- 3) This system includes more advanced features than existing metering system.
- 4) This system can be fabricated without large machineries.

In this system Hall Effect current sensor and voltage divider is used, here Hall Effect current sensor and voltage divider is placed in input side. Other Hall Effect current sensor and voltage divider is placed at the distribution points of the house lines. The output of voltage divider and current sensor is given as input to PIC microcontroller convert analog inputs to digital. Then PIC compares the values of input & output current and voltage. If compared result has any negative values then theft is detected. The information will then be quickly processed by the microcontroller and a SMS will be send through the GSM technology. This compared value is transmitted to the authorities through GSM. Authorities will send control signal to the system and corresponding action will be performed by the system i.e. to power cut of the respective house or consumer. Power cut operation is carried out by automatic breaker circuit i.e. contactor. Contactor is used for switching purpose. When supply is given to the IR sensor, In case of black surface LED emits light but it is absorbed by the surface

hence photodiode detects nothing but in case of white surface light gets reflected from surface hence photodiode detects the light. This phenomenon is used in our system. If a fraud person tries to open the meter box then IR sensor detects the motion and data is send to authorised person through GSM.

III. FLOW CHART

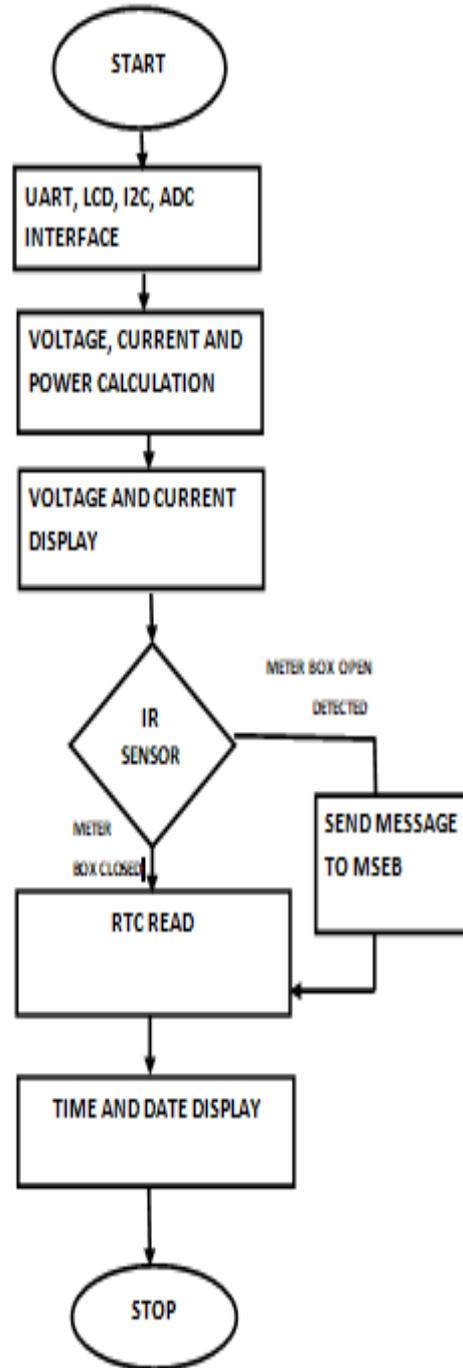


Fig4: Display and Working Algorithm Of Energy Meter

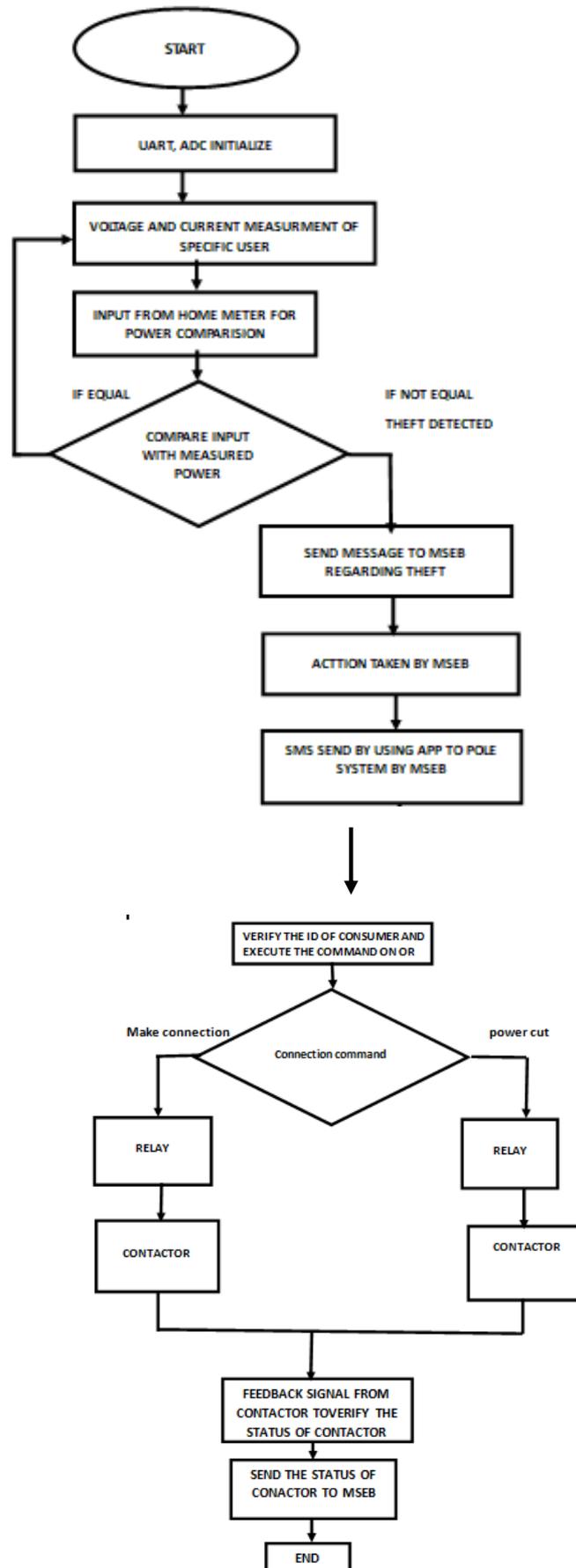


Fig5: Theft Detection and Control Algorithm

IV. HARDWARE IMPLEMENTATION

Before we begin coding of the program we need all the PIC controller libraries like: Analog to Digital Converter, Real Time Clock, Universal asynchronous receiver transmitter, Interrupt is necessary. Logic of the program should be efficient so that it takes very less time to complete the execution of the program and due to this the response time of the system gets less.

To check the performance of proposed prototype the system is tested for following conditions:

- 1) Bypassing the phase line.
- 2) Neutral line disconnection.
- 3) Opening meter chassis.
- 4) Disconnection if unpaid bills found.



Fig6: Hardware Implementation

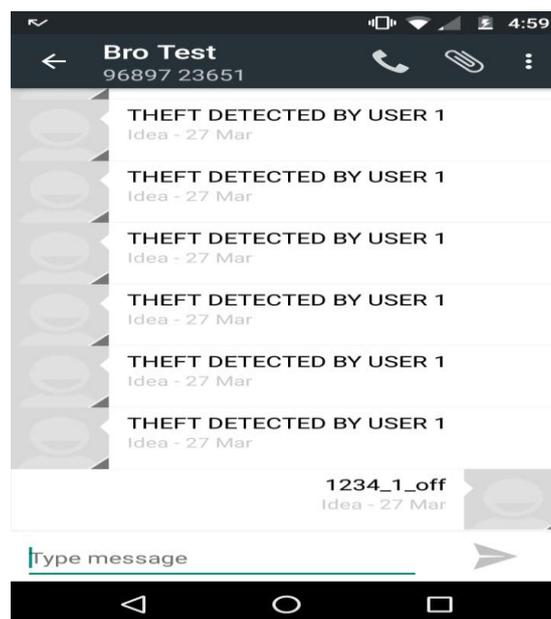


Fig 7: Theft Detected Message Received

V. CONCLUSION

In this research paper we have developed a prototype which is able to detect any type of power theft. This prototype uses GSM module which is familiar in India. The proposed prototype requires lesser additional components than the currently present system. This system aimed to facilitate low cost improvisation. This system detects meter tampering, bypassing the phase line of the meter and disconnection of the neutral line of the meter. This system has advance features than the existing system. A traditional method of theft detection requires large amount of man power and more capital investment on the technology but unfortunately performance of the currently present system is lower than 65%. The proposed prototype has effectiveness over 85%. Comparatively installation time of the system is very less than the current system. This system will help the service provider to minimize power stealing and increase the capital.

VI. REFERENCES

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