GSM Based The Smart Energy Mater With Anti-Theft And Reliable Billing System

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Abstract- *Electrical energy is spine of domestic, commercial, agriculture and industrial consumers. Need of electrical energy increases day by day as electrical energy based equipment's are increased and it increases the use of electrical energy, obviously it increase burden on electric system. Electricity is one of the fundamental necessities of human being. Power theft is biggest problem in recent days which causes lot of loss to electricity board.in countries like India this situation are more often. The purpose of this paper is to provide automatic control and monitoring of the energy meter, without anyone visiting each house and prevent electricity theft with overload detection and tampering detection. Multiple choice of tariff provides reliable billing system to the consumer. That set mind of consumer to pay electricity bill. GSM provide instant information to utility & consumer about energy used or energy bill. By tampering and current matching at both the side of service wire protect from bypassing or theft. Traditional meter reading that creates a difference between actual and billed reading of the meter. Presently recovery of revenue is very slow, for faster revenue collection these system is very useful.*

Keywords- GSM, Traditional meter reading, Overload and tampering detection.

I. INTRODUCTION

Electric bill are prepared on the basis of consumption, which could be costly and time consuming. Due to absences of regular monitoring system, some consumer use electrical energy month after month without paying any bill. Energy mater monitoring and digital billing system able to avoid the traditional meter reading save human resources, Improve accuracy and prevent power theft. Digital billing system is done by using GSM. Programming related to methodology executes logical function, store data in database and send monthly bill to consumers cell phone and also to electricity board and finally can disconnect the unpaid consumer [3].

The main issues for which we have written this paper is step taken against anti-theft and reduce economical pressure on consumer as well as electricity board by providing multiple choice tariffs. How electricity theft through bypass is avoided is explained in this paper. In this system atactile sensor to detect if any tampering is being done with the meter [1], [2], [4].

In present system some consumers are undisciplined, that tries to take supply that will be bypassed from meter and also consumer try to open energy meter. Undisciplined consumer can do bypass from meter and also service wire that gives main incoming supply from main line to energy meter. In present system there is no any method that detect bypass and any tampering with energy meter. Due to this undisciplined work of consumer economic burden on system increases. Ultimately utility tries to overcome this loss by applying that loss into consumer's bill. That will set mind of consumer to do bypassing or tampering in meter and this will again increase loss of utility [1], [2].

Presently consumer has no any option to select tariff. As utility applied all consumer with same rate that are profitable for consumer but it is not profitable or uncomfortable to some consumer. Obviously that forces to consumer to do power theft and it makes consumer as undisciplined but this system provide multiple options of tariff [1].

Undisciplined consumers take bypass from meter also from unprotected zone of service wire that will not detected by any system. Also use maximum load that will cross the limit of use of energy, provided by utility. Now a days one employee come to consumer home and take data like meter readings. Then utility provide bill print that take 4-6 day delay to provide bill up to consumer. Consumer will pay bill by taking some time whether it will be online or offline transaction. Due to this it has very slow recovery of revenue. In this system, GSM provide instant information to both utility and consumer. Temperature sensor are also connected in the system so that system will able to sense the over temperature situation like overheating [1], [2].

1.2 Objectives

The main objective of this system is to set the mind of consumer to pay electricity bill by providing following feature

1. By tampering detection and current matching at both side of service wire protect from bypassing or theft.
2. Reduce time of billing and provide instant electricity bill to consumer and utility by using GSM module.
3. Overload detection.
4. The recovery of revenue should be faster compare to present situation.
5. Provide multiple choice tariffs.
6. Register all consumed energy by consumer, so that financial loss will be reduced.

II. WORKING & BLOCK DIAGRAM

When power supply is connected to the system then system initializes the hardware. First of all, all signals are sensed by the different equipment's and sensors which are connected to the system start to do their work and send the present situation signals to the micro controller. Firstly if there is input signal from tamper switch that is tactile sensor connected below the outer protecting cover of meter, then it sends the signal to the microcontroller. Microcontroller sendsthis signal to LED which result in glow and respective instruction will show on LCD display. At the same time if there is tampering detected the same message will send to utility as well as consumer through GSM module. Second case is the detection of bypassing, for this two CT's are used. First CT is connected at incoming side and other is at outgoing supply side of energy meter. When meter bypassed, there is difference between values of incoming current and outgoing current that will send to microcontroller by CT's. Microcontroller send this signals to LED which results in LED glows when bypass is detected and respective instruction will show on LCD display. At the same time GSM module send message to utility and consumer as bypass detected.

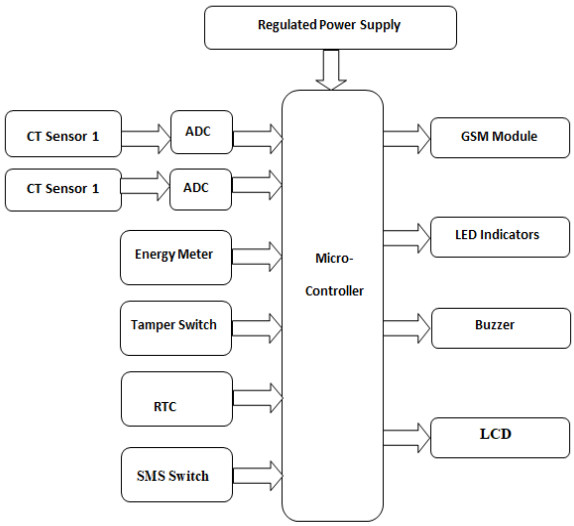


Fig 1: Block diagram of the system

Third case is the detection of overload. At a timethe consumer cannot use maximum power than the limit sanctioned by the utility. If consumer exceeds this sanctioned limit then signal of overload detection send to microcontroller and LED will glow also respective instructions show on the LCD display. GSM module sends this information to the consumer and utility that can take the respective action on it.

In the entire above cases buzzer used to alert the consumer. If overload or tampering or bypass detected at that instant buzzer will on and give the instructions to consumer. For calculating the bill of energy consumption the opt-coupler is connected in the system which works continuously and as per design of the tariff, system calculates the billing amount at the end of month. At the same time GSM send the text message to the consumer and utility with consumer ID, name and bill details(fig6). In case if there is any theft is with meter then respective message will be send with the electricity bill. In this way total working of the system will take place from sensing of different natural as well as man-made faults. CT sense the current and this sensed analog signal send to ADC. ADC convert analog signal form to digital signal form and fed to microcontroller. Microcontroller read data and displays its values as well as respective instruction whether meter bypassed or not. In case of large length service wire we can use three CTs and third CT is connected at initial point of service wire. Energy meter read energy consumed by the consumer and send continuously to microcontroller. RTC (Real Time Clock) used in the system, to classify the data

read by equipment's or sensors with respect to time require during the bill preparation. Also help in case of TOD tariff mode or etc. SMS switch is used to give different command to the microcontroller like to switch the mode of tariff, send message of electricity bill to consumer and utility also to reset or clear data read by microcontroller or other equipment's.

LCD display used to show some following information:

1. Title of the system
2. Mode of selection of tariff
3. Selected mode of tariff
4. Date and time
5. Present rate per unit
6. Current values per unit
7. Consumer details like name and meter ID
8. Bill details like no. of units and bill of consumption
9. Cell phone numbers during working of GM
10. Instructions like overload detection, tampering detection or bypass detection

2.1 Regulated power supply:in this system, microcontroller and all sensors require 5V power supply. AC 230V input power is taken from main supply line.

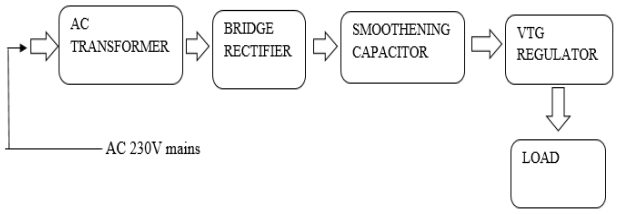


Fig 2: Block diagram of Regulated Power Supply

AC Transformer: Step down high voltage mains to low voltage AC.
Bridge rectifier: Convert AC to DC but converted DC output is varying.
Smoothing capacitor: Smooth the DC form varying greatly to a small ripple.
Voltage regulator: Eliminates ripple by setting DC output to a fixed voltage.
Load: Microcontroller and all sensors.

It is so easy to upload advanced feature in the system that makes it more flexible and is the main advantage of this system.

2.2 Circuit diagram of "GSSM – The Smart Energy Meter"

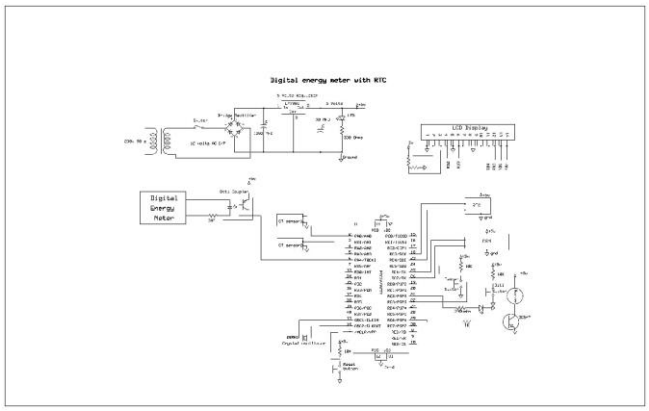
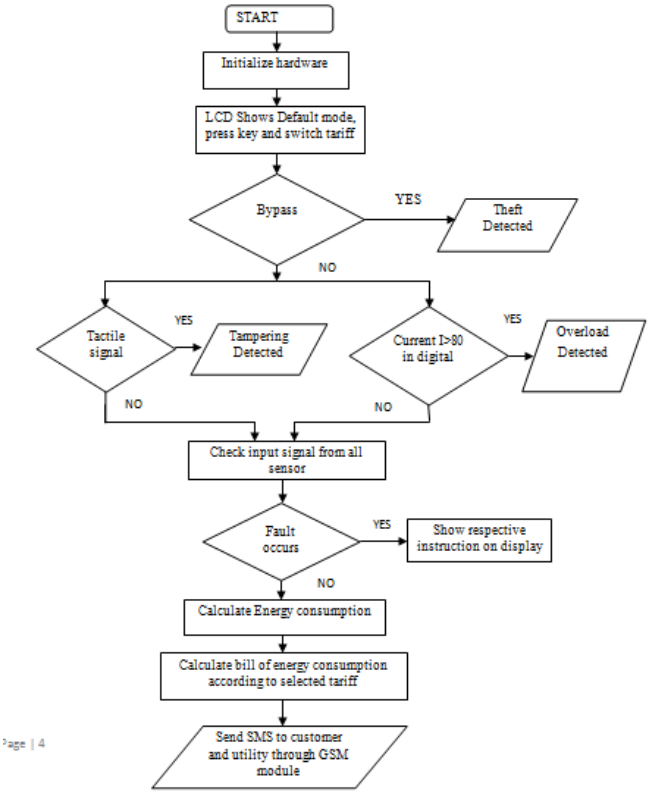


Fig 3: Circuit diagram

2.3 Working flow chart of the system



III. TARIFF

Simple tariff (uniform tariff), Flat rate tariff, Block rate tariff, Two part tariff, Maximum demand tariff, Power factor tariff, Three part tariff, Time of day, Time of use are the some types of tariff, out of that simple tariff, block rate

tariff and TOD are provided in 'GSSM – The smart energy meter'. Costumer can select any one option of tariff according to his use and profit.

1. Block rate tariff

Table.1:Block rate tariff

Unit consumed by the consumer	Rate (₹/unit)
0-100	5.48
101-300	9.26
301-500	11.76

2. Simple tariff

₹/unit = 5(for up to 100 unit)
= 7.37(if unit exceeds more than 100)

3. TOD tariff

Table.2: TOD tariff

Zone	Time of use		Rate (₹/unit)
Peak	6-10	19-23	9.25
Flat	10-12	17-19	6.10
Valley	12-17	23-6	4.20

(Above tariffs are calculated with reference of some observations, consumer's electricity bill and study of Load flow curve. Changes can be possible in this tariffs or it is possible to provide more options of tariff if required. [1])
The main objective of this multiple choice tariff is to change the mind of consumer to pay all electricity bills. For example, if Block rate tariff is not profitable to a consumer then he can go to another profitable and convenient option.as utility provide convenient tariff to the costumerthen costumer pay all bill of consumption. It is easy to collect recovery of revenue. In this way the multiple choice tariff system is profitable, reliable and convenient to both utility and costumer [1].

4. Outcomes from "GSSM – The smart energy meter"

GSM module is used to send all meter information to both consumer and utility. It is quick process that makes this system as timing consuming. It helps to reduce economic burden on electricity board.

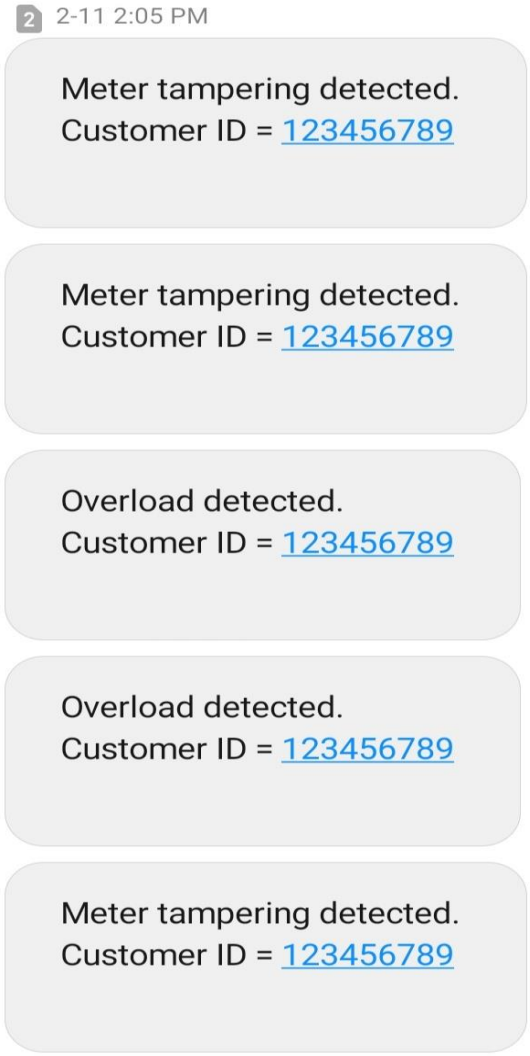


Fig 4: Screenshot of SMS detection of meter tampering and overload with customer ID sends to both costumer and utility.

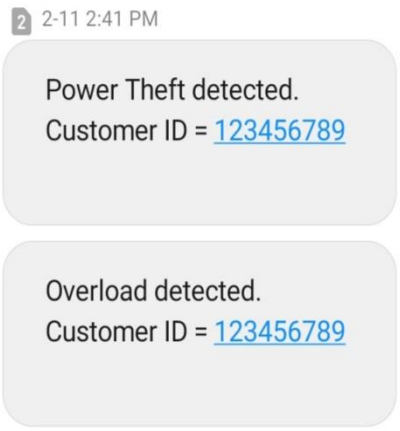
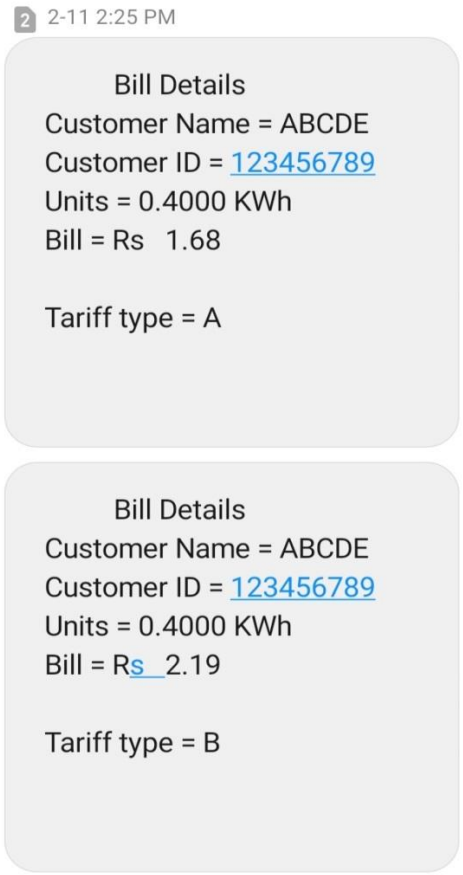


Fig 5: Screenshot of SMS detection of bypassing i.e. power theft



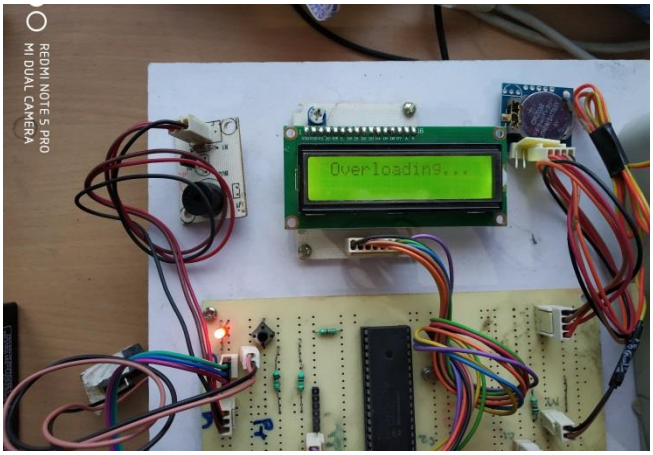


Fig 7: LCD shows overload detection

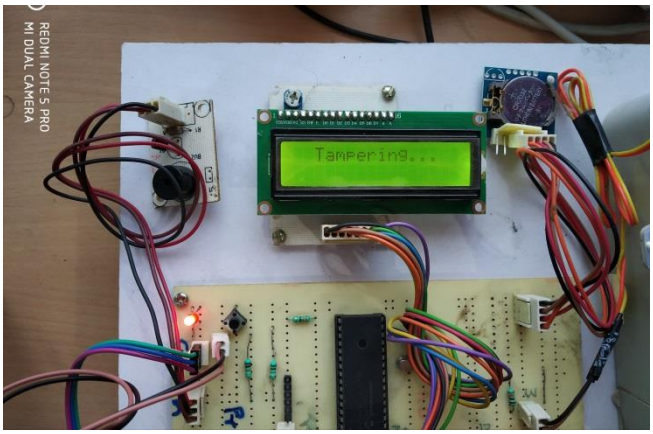


Fig 8: LCD indicates meter tampering

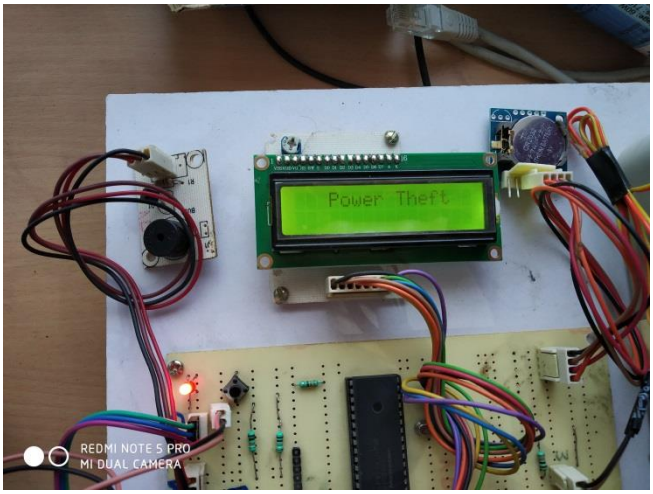
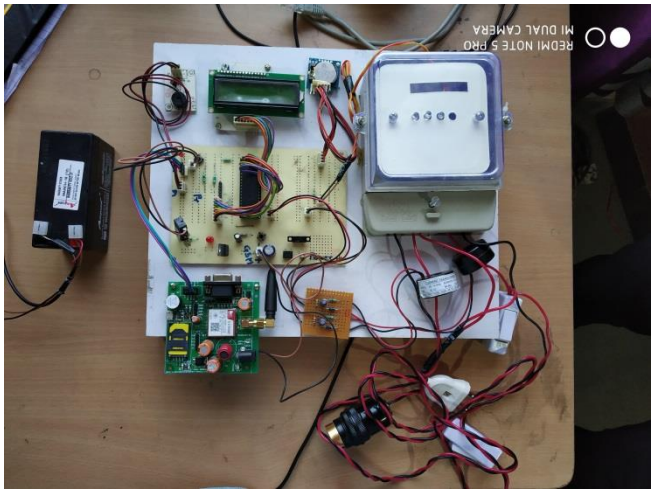
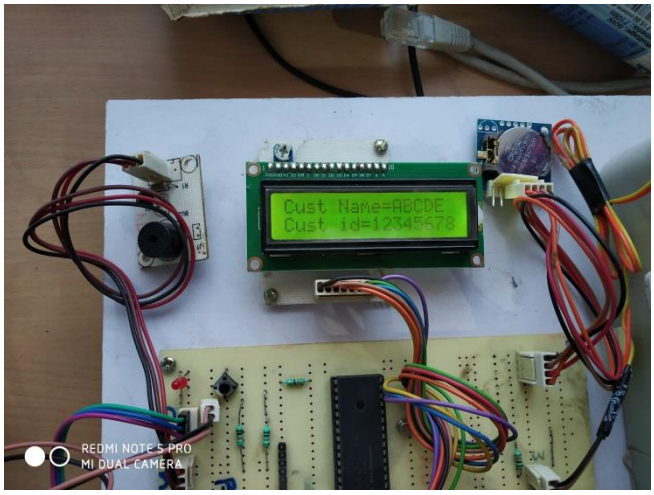
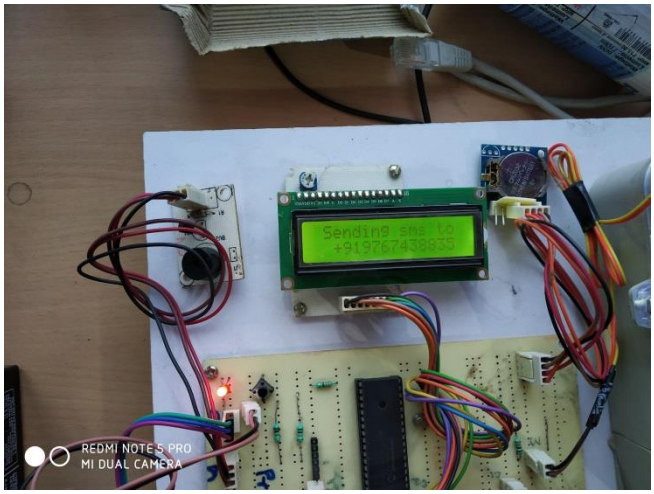


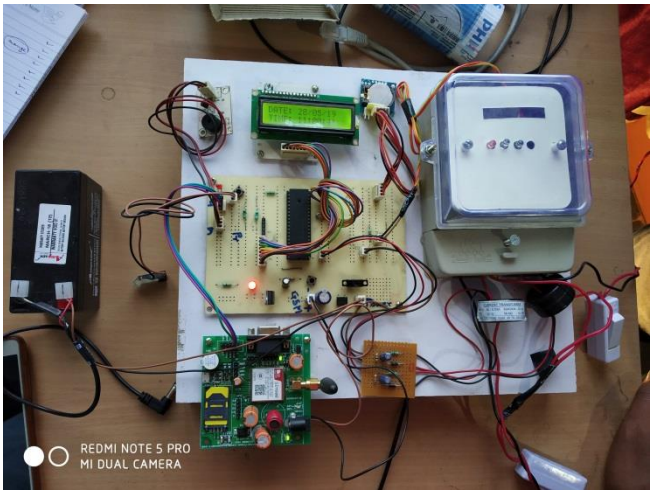
Fig 9: Indication of power theft i.e. bypassing Fig 6: Screenshot of SMS of electricity bill of costumer name ABCDE and ID-123456789 with 0.4000KWh energy consumed according to tariff A (TOD tariff) and tariff B (Block rate tariff).

5. Some glimpses of the "GSSM-The smart energy meter" with different features









6. Advantages

1. It avoid traditional meter reading i.e. average meter reading.
2. Multiple choice tariffs set mind of costumer to pay electricity bill and provide reliable billing that helps to reduce burden on the utility.
3. Energy meter billing with GSM module reduces the delay taken by costumer to pay electricity bill. GSM module reduces the employees work to distribute papers of electricity bill.
4. Overload detection flexibility to reduce burden on the utility.
5. The recovery of revenue should be faster compare to present situation.
6. This system helps to register all the consumed energy so that financial loss of electricity board will be reduces.
7. Cost effective energy meter system.
8. Could be beneficialto increase government revenue as register all electrical energy consumed by consumer and decrease delay time.
9. System helps in preventing the use of unregister electricity.
10. By tampering and current matching at both side of service wire protect from bypassing or theft. Hence this is anti-theft system.
11. GSM provide instant information to utility and consumer about energy used/ energy bill.
12. Consumer will not allow using more than sanction load.

IV. FUTURE SCOPE

The progress in technology about electrical distribution network is a non-stop process. So this system can get large modification according to future requirement. We can also use Thermal printer in this system [2].Features like bypass detection, overload detection, detection of meter

tampering, GSM module, reliable billing due to multiple choice tariff, etc. makes broad future of this system.

V. CONCLUSION

Hence we can conclude that the feature which are mentioned below give automation in billing and multiple choice tariff system.

1. Energy meter billing according to variable tariff rate
2. Overload detection
3. Antitheft system
4. Temperature sensor
5. GSM system
6. Detection of meter tampering

In this way this system is more reliable than present system of meter billing and time consuming that helps to collect recovery of revenue. It provides flexibility in selection of tariff with detection of power theft, overload and tampering that makes it more profitable to both utility and costumer.

VI. ACKNOWLEDGEMENT

This is to acknowledgement and thanks all the individuals who played defining role in shaping this system. Without their constant support, guidance and assistance this system would not have been completed. Coordinating, consulting reviewing and re-reviewing all such painstaking intricacy and detail, this task could be completed alone. We would personally like to thank and pay my respect and also the profound gratitude to Head of department of electrical engineering prof. S. A. Markad, DVVPCOE, Ahmednagar and group members Vikas R. Gawate and Suraj D. Sasane for his valuable role in making this system a success. We had gotten the success in completion of this system just because of all my teachers, project group members and their constant encouragement motivated me and gave me opportunity to study in this field. Last but not least, we would like to express our sincere thanks to all my colleagues and friends who have assuredly helped me a lot. - **Akshay S. Shinde**

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