Journal of Science and Technology
ISSN: 2456-5660 Volume 06,Special Issue 01, August 2021,

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*

Prepaid Energy Meter Using GSM

Sonal Mule[1], Snehal Kanase[2], Vaishnavi Dhumane[3], Vishal Ghadage[4], Prof.Sharad Patil[5]

[1234]*Student, Dept of EE, NBNSTIC, Maharashtra, India*
[5]*Head of Department, Dept of EE, NBNSTIC, Maharashtra, India*

To Cite this Article

Sonal Mule , Snehal Kanase, Vaishnavi Dhumane, Vishal Ghadage, Prof.Sharad Patil "Prepaid Energy Meter Using GSM", Journal of Science and Technology, Vol. 06, Special Issue 01, August 2021, pp169-176

Article Info
Received: 15.07.2021 Revised: 24.07.2021 Accepted:10.08.2021 Published:16.08.2021

Abstract:-*The outdated way for deposition of a bill of energy consumption results in unwanted fault and wastage of time. Thus this paper imposes a completely new idea of "Prepaid Energy Meter using GSM" to facilate power utility and minimize the labor work. Proposed system is good for electricity distribution board, non-public companies, IT parks & in residential areas also. The motive of this paper is to develop and design a Prepaid Energy Meter based on SMS technology using GSM. In this technique some threshold data is set for unit consumption and it stops the energy supply when amount of unit consumption goes below the threshold value. After it reaches the threshold limit an alert message is sent via GSM i.e. as it reaches the subsidy unit. After it reaches it's monthly limit, it gives an alert message which indicates the bill amount. If the bill amount is not reimbursed then electricity will automatically be shut down after a period of time. Here only registered SIM card number is used to get information about the bill. If the consumer changes the mobile number and fails to register that changed number then the information won't reach the consumer.*

Keywords: *GSM Technology, Prepaid Energy Meter, Threshold Value, Microcontroller, Auto Power Cut-off, Power Monitoring*

I. Introduction

Over few decades if we overview the vast improvement in electrical metering instrument technology we would simply understand how revolutionary it is. We were successfully able to replace the heavy bulky magnets and coils with reduced weight and size resulting In many new innovations with much more improved features and specifications. Later in the last century the introduction of digital meter has completely modified how the Electric variables are measured. Owing to simplicity of interpretation, better intent and rugged assembly; the use of Voltmeters and Ammeters overpowered the entire spectrum in measuring instruments. Here, we suggest a technique which make use of GSM system removing the requisite of cyberspace. A "Prepaid Energy Meter" system comes with Energy Meter and GSM network. The consumer get notified as soon as the balance become low when GSM modem make use of GSM network for delivering equivalent unit of the recharged amount to the Arduino alerting the Consumer. In order to update the consumer account as well as database the system uses the Energy provider side. Whereas in Prepaid electrical Meter it is ease for the user to use the energy even if the balance is more than threshold value. Now when the system gets recharged with a specific amount then the system will allow you to use specific amount of energy regarding your recharge & After a specific particular value the system will cut off the Supply.

The Prepaid electricity meter is mostly used in order to give a neoteric more modified electrically billing system in order to strengthen the use of facility. It also has GSM module which helps the operator to brace the meter with an SMS message. This helps in the innovative electricity billing eliminating the need

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*

of manual Meter reading work. Now everything is getting automated so the automation of energy payment is necessary. The most common and equally important resource is "Energy" hence we have to use it in a proper manner because on the other hand the resources of it are rare. The Prepaid energy Meters are used to avoid the wastage of power in our daily lives. So in order to monitor the consumption and theft we have to use advanced energy Meters.

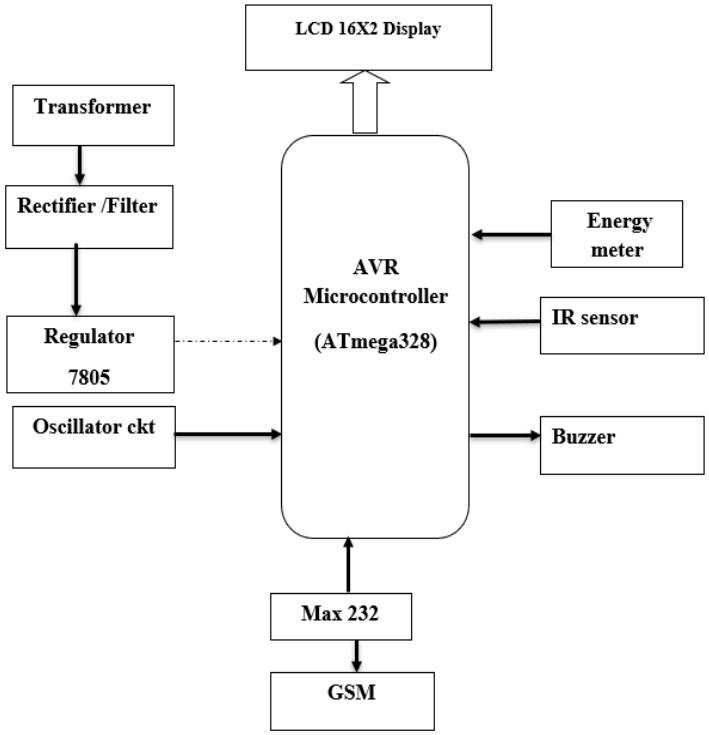
II. Literature survey

" Prepaid Energy Meter Using GSM " proposes the a simple design, reliable and cost effective wireless GSM based electricity meter and automatic billing system which manages the data collected globally. A new concept of energy meter is put forth in this paper; where maximum energy consumed by a customer will be displayed in the energy meter of customer. When the recharged amount exceeds the threshold value set in the microcontroller then the connection will automatically be disconnected to the meter. Interface is given to the user in the hardware so that user will interact with the hardware, through a user interface user can set a definite value. GSM MODULE SIM 800 is used to communicate between load circuit and the utility side. The microcontroller AT Mega 328 is in co-ordination with whole system with the help of its different components interfaced to it. The major disadvantage of present system is that these systems provide postpaid service. Electricity board provides the service before collecting payment from consumer and it is somewhat tidious task for the Electricity board to collect the payable amount from the consumer and on the contrary Electricity board cannot stop providing the facility. The current system of electricity consumption and billing is prone to errors and also more time is consumed. In this current system there is a problem of theft to electricity and there is no such control provision which applies on the theft and reduces it. In the current meter reading system, a person from electricity board comes and takes the readings and records the number of units consumed by the customer and monitors the electricity consumption at consumer end and submits the bill to the Electricity Board billing department. There are many disadvantages which lead to suffer from collecting readings manually so there is requirement of large number of meter readers.

So there is need of a system which provides service after payment. This project implies on providing the facility to measure the electricity consumed and monitors the number of units of consumed by the consumer's electricity meter. It establishes a two way communication between the electricity meter and the electricity board via GSM.

III. Block diagram

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*



IV. Working

Now to affiliate or to connect the prepaid energy meter to GSM modem system a step down transformer is required. The transformer will step down the 220 V ac to 12 V ac. The Prepaid energy meter with gsm modem has electronic components which are actually dc operated components so in order to convert the ac voltages into dc the rectifier is used. The rectifier will convert the ac voltages into dc voltages connected at transformer output. Later the rectifier voltages will pass through a voltage regulator to give Voltage of 9V. Now in order to provide the frequency pulses to microcontroller the oscillator is used. So the purpose of LCD displays the power consumed units remaining &balance as well as to display zero message balance. After the power up of system it will read the last value of rupee & restore it. It will also check the available balance & will take actions according regarding it. For example assume the balance is greater than 10 rupees then the microcontroller will turn on the Electricity whereas if the balance is less than ten rupees the microcontroller will send SMS alerting & same time requesting to recharge soon also delay in this can cause the power cut is well. The process of sending or receiving of the SMS can be done with help of GSM system.

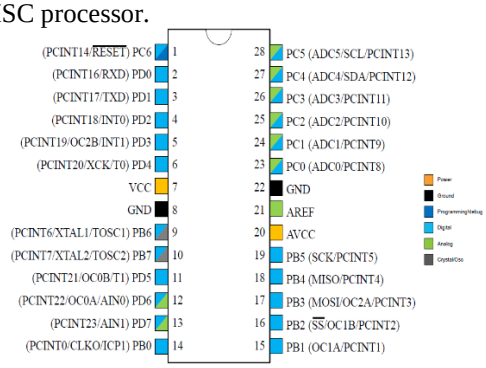
A microcontroller & GSM unit are interfaced to energy meter of every house. The modem will collect data in command form & will inform controller for readings. Later the modem will send data to other end. The microcontroller is programmed in c language with a software. The data or messages send by the consumer are collected in microcontroller & further works referring to it. Also the energy meter readings are displayed on LCD display. Also there is energy meter interfaced with microcontroller & has no moving parts along with low energy losses. The GSM modem has only purpose to communicate between mobile phone and system. An acknowledgement will be sent on user's mobile by SMS after every successful operation. The coding will minimise the human labour increasing the efficiency of calculating bills used for imposing electricity. The system will be helpful to come over the bourdon of electricity usage by providing stabilized connection simply with no theft of electricity taking place.

V. Circuit requirements

www.jst.org.in DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176

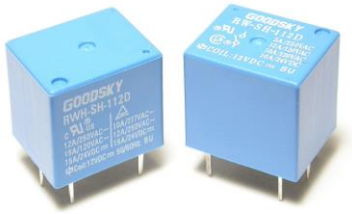
- Energy Meter :-An energy or electric meter is used measure electricity consumed by domestic, industrial agriculture and other applications. The energy is nothing but the total power consumed or utilized by load. Unit consumed by energy meter given in kilo watt hour. It is used in residential, commercial, and industrial purpose for measure AC power consumed. The energy meter is less expensive and accurate

- Microcontroller AT Mega 328 :Microcontroller AT mega 328 is a general purpose high performance device which has 32 no. of 8 bit General purpose registers. It has on chip RAM, ROM. It has Harvard architecture of 8 bit RISC processor.



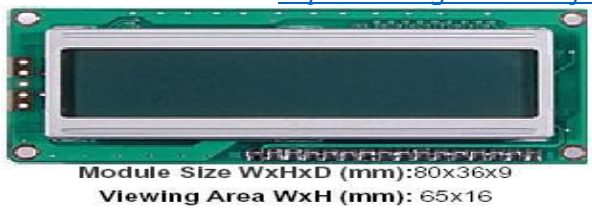
- GSM Module :The GSM technology is nothing but the Global System for Mobile Communication. It is module developed by European Telecommunication Standard institute to communicate with mobile phones. In GSM module Sim card holder is available which allow to use sim card for long period of time. It just like one type of mobile phone. The modem RS232(max 232) is used to interface microcontroller with GSM module.

- Relay :A relay is Electromechanically operating switch which can used to connect or disconnect circuit. Relay can be used by manually and automatically. Relay used automatically by connecting electrical supply to it which connect or disconnect the circuit.



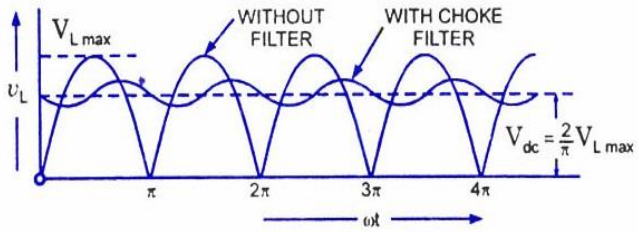
- LCD :Most common LED's connected with microcontroller are 16*2 and 20*2 displays. It means that 16 character for one line and such 2 lines are there similarly 20 character for one line and such 2 lines are used..

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*



- Transformer :It is static device which works on principle of electromagnetic induction. It is used to transfer electricity from one device to another without changing its frequency.

- Rectifier and filter circuit: Rectifier is device which is used to convert the Alternating current into direct current. Filter is used to remove all the ac component present in a waveform and output of the filter is pure dc is obtained.



Output Voltage Waveform

- Regulator : Regulator is device is used to maintain the voltage within predefined acceptable limits. Th regulator is necessary to adjust the voltage within predetermined range allowed by electrical equipment to maintain constant regulated voltage.

- Oscillator Circuit :Oscillator are used to generate continuous , repeating and alternating waveform can be used to convert DC current from source to the alternating current.

- IR Sensor :Infrared sensor is nothing but IR sensor Is used to detect the waves nearby object. It can be used for security purpose by setting alarm and lighting.

- Buzzer: A buzzer is electrical device used to making noise and is used to send signal. Buzzer can be mechanical, electrical, electromechanical and piezoelectric type.

VI. Advantages

1. By using this system we can manage our loads through mobile phone apps.

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*

2. The consumer is in control of how much and how frequently to top up i.e. consumer don't need to worry to build up the debt as the consumer purchases the electricity before using it creating awareness on consumption of electricity and consumed energy costs.
3. Consumer will have an idea regarding remaining balance as it will be indicated clearly on the LCD display and energy meter screen helping consumer to avoid undesired surprises.
4. Consumer doesn't receive bills, rather consumer pays to electricity board in advance also in this system we can easily operate it simply by on and off switch through mobile phone via GSM.
5. It can be extensively used for residential, industrial and IT parks.
6. Prepaid energy meter is a convenient provision to manage all of consumer's electricity costs. As name of project itself implies; it asks consumer for payment of the energy in anticipation i.e. in advance. By installing this proposed system it is indeed easy to avoid to build up debt for consumer's electricity.

VII. Future scope

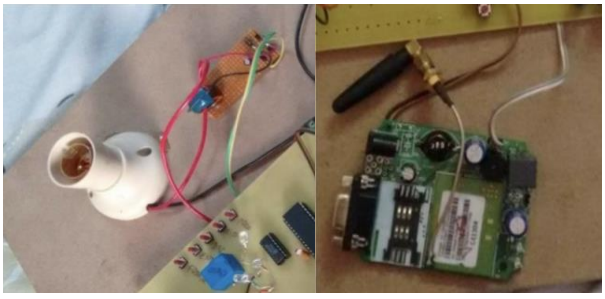
Now Future Aspects is one of the main aspect regarding any projects. Now here "Prepaid Electricity Meter" provides you smooth as well as better capital processing with the management of energy utilities. It simplifies the problems approaching in billings & electricity by lowing the obstacles or difficulties faced by user in the respective living areas. Also it reduces the big amount of time along with manpower while taking or noting the readings. The consumer having "Prepaid Electricity Meter" can recharge to desirable amount like Rs20, Rs30. It lowers the transportation cost as it is possible to recharge the account of user all over the Asia. Also if needed we can set a mini printer to "prepaid electricity meter" to get printed bills.

This project can be executed properly in remote areas is well. Considering the future magnifications or improvements the system will easily acceptable for 3 phase electricity distribution administration. Escorted by introduction to new architectural modules the administration will be completely suitable to optimize the electricity utilization. As stated it lowers the electricity misspent & will liberate plenty of electricity for further use to measure different parameters such as power line current, power line voltages in order to optimize and manage power network. Also with the help of present methodologies we can look on to better options to find theft to power.

VIII. Result

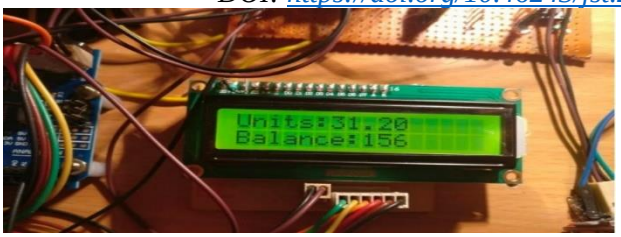
The exerted prepaid energy meter with GSM module is delineate within the figure. The project asserts a system that will diminish loss of power caused by electricity thefts and supple mentary unauthorized venture. The proposed approach embraces an utterly neoteric apprehension of "Prepaid Electricity". The GSM mechanism is employed with the aim that the user will be able to perceive messages concerning the utilization of power (in watts) and if it approaches its pre-determined brink amount, it'll exigently circumspect the customer to revitalize.

This technology can be often used in schools and colleges, apartments, domestic houses, MNCs, banks, hospitals etc. The toil of this project will facilitate better energy administration, prudent use of electricity and further dealing with avoidable quarrels with faulty for billing. The Prepaid electricity meter system helps keeping the track of the daily power usage whereas it will leave little space to circumspect the power consumption along with its billing.

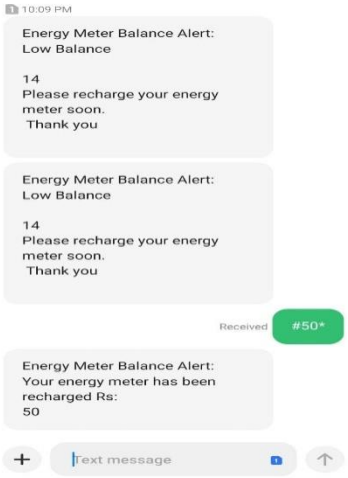


Load connection and GSM module

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp169-176*



LCD Display displaying number of units consumed and balance left



Screenshot of messages received

IX. Conclusion

It demonstrates concept to put an end on misuse of energy also the issue of load shedding is dealt very easily. In today's era however half of India yet does not receive electricity which will be no longer true after implementing this system. Labour required will be bounded as there vanishes the need of personally giving visit to each and every residential meter because this system is carried out since many decades. This type of power distribution vend throughout world is gradually evolving into a successive competing marketplace. Divergence in the ongoing facility is setting off to be the key antagonistic factor to enhance market shares. In unconstrained power markets; prepaid energy meters along with unique lead over traditional energy meters can assist power distributors to metamorphose and also provide some increment all facilities to user end. It will also uplift user to opt for liquidated energy meters on a discretionary basis and will also imply on offering dues impetus to those users who pre pay their electricity invoice would help out the services to impose this facility. In this way, this system makes the user to pay for the electricity before consuming it and also consumer holds the credit himself and use power untill prepaid recharge amount is over. When available recharge amount is depleted the supply of energy is terminated by the relay. This system will bring perception on redundant misuse of electricity and will impose on reducing it.

X. References

[1] A.Vijayarajet al "Automated EB Billing system using Ad-Hoc wireless routing" published at International Journal of Engineering and Technology Vol.2 (5), 2010, 343-347.

[2] M. Trejo-Perea"A real time energy monitoring platform user-friendly for buildings" Elsevier journal Procedia Technology 7 (2013) 238 – 247.

[3]Abhinandan Jain "Smart and Intelligent GSM based Automatic Meter Reading System" International Journal of Engineering Research &Technology (IJERT)Vol. 1 Issue 3, May - 2012 ISSN: 2278-0181.

[4] Abhinandan Jain " Design and Development of GSM based Energy Meter" International Journal of Computer Applications (0975 – 888) Volume 47– No.12, June 2012. [10] S.H. Shete "GSM Enabled Embedded System for Energy Measurement & Billing" International Journal of Scientific & Engineering Research Volume 4, Issue 1, January 2013 1 ISSN 2229-5518.

[5]Dr. K. Sheelasobanarani1, S. Dinesh Raja2, B. Dhanaraj3, K. Manickam4, K. KarthickRaja5. "A Prepaid Energy meter for efficient Power Management", International Journal of Emerging Technology and Advanced Engineering,Volume 4, Issue 3, March 2014

[6]Bharat Indorey, M.Lokhande, "ZigBee Based Advanced Energy Prepaid Meter", International Journal of Innovations in Engineering and Technology (IJIET), Volume 3 Issue3 February 2014

[7]Prepaidenergy meter with gsm technologyAvailableat:prepaid+energy+meter++with+gsm+technology+wikipedia&oq=prepaid+energy+meter++with+gsm+technology+wikipedia&http://en.m.wikipedia.Org/wiki/Electricity meter

[8]K.Sheelasobanarani, S.Dineshraja, B.Dhanaraj, K.Manickam, K.Karthickraja, "An Integrated Prepaid Energy Meter using gsm", International Journal of Industrial Electronics and Electrical Engineering,Volume-2, Issue-5, May-2014

[9] Bhavna Patel, ShrikantMhaskar, "Voucher Based Prepaid Electricity Supplier With Auto Cut Off", IJIIT|Volume-II|Issue-I|2013-2014 July |Paper-03.

[10]AradhanaSontake, Jharna Agrawal GSM based monthly energy meter billing via 'SMS' (International Journal of Computer Science and Network, May 2014.

[11] Kanthimathi ,Krishnammal, GSM based automatic electricity billing system International Journal of Advanced Research Trends in Engineering and Technology, vol. 2, Issue 7, July 2015.

[12] Syed Khizar Ali Zaidi I, HuraMasroor I, Syed Rehan Ashraf I and Ahmed Hassan, "Design and Implementation of Low Cost Electronic Prepaid Energy Meter", NED University of Engineering and Technology, Karachi, Pakistan, 2010.

[13] Ganurkar, S., &Gour, P. (2014). Prepaid Energy Meter for Billing System Using Microcontroller and Recharge Card. International Journal Of Core Engineering & Management (IJCEM) 1, Issue 1, April.

[14] Pradeep Mittall 2015, Wireless Electricity billing system, International Research Journal of Engineering and Technology (IRJET) Volume: 02,pp.21-34.