MODERN TECHNOLOGY OF GSM BASED REMOTE MONITORING AND ANALYSIS SYSTEM

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Abstract - *Nowadays most of the people are tends to adopt for a modern technologies and most of the problem required modern solution in that list we are still using the traditional energy meter for taking the reading. So obviously this paper is going to discuss about the modern solution for the old energy meter by automatize it. We need to consider one thing that if we fully modified with modern technologies people may struggle to use that so we need to add some of the known technologies for better understanding. In this Project we used the GSM for taking energy meter reading. Our proposed method will automatically send the information of the advanced vitality meter to the service provider with the help of the GSM modem once in a day and consequently the framework will generate a report and send to the service provider once in a day through SMS. The whole process will be displayed over the LCD display. The consumer will be able to monitor their unit consumption through the app and they also able to pay their bills through the same app and it will store the activities done by EB in the log till the end of the month .A same framework can be used to check the last perusing devoured by the consumer, when the demand request send by the user through the same methodology. It will greatly reduce the workload of the workers while taking the readings and it will also eliminate the human errors and improve the accuracy. It can also be used to control the load from both the finishes with the assistance of hand-off circuit which means the consumers load can cut on/off from the working station by simply sending a message without visiting the customer place. It is acquire energy Meter Reading from a Remote location and infer the Power details of Home using a mobile App.*

Key Words: **Remote Motoring AMR (Automatic Meter Reading) GSM Modem, Demand Request, Periodic Analysis**

1. INTRODUCTION

At present, the vast majority of the houses in India have the conventional mechanical watt hour meters and the charging framework isn't computerized. The main aspect of the paper is to convert the conventional energy meter into smart energy meter[1].Towards the finish of every month an individual from the power board goes to each house and takes the meter perusing physically. These meter readings are utilized for power charge computation and this bill sent to purchaser house by post. Client goes to power division for taking care of this tab sum. So as to reduce the workload the energy meter has to be updated with the future techniques [2]. Be that as it may, right now are required incredible numbers of people for perusing the meters. The strategies of sending the bills to client are arduous and bulky. Be that as it may, the invention named as Automatic Meter Reading Framework is used [3]. Aside from being a blast, AMR clears out all the cons of ordinary frameworks. Programmed Meter Reading System is an advanced framework which permits organizations to gather the perusing without visiting the site. AMR incorporate different innovation for information assortment, for example, power line correspondence, Zig-honey bee, Radio Frequency (RF Method) and GSM arrange yet GSM organize is best among this innovation. So this paper will talk about as it were GSM based AMR framework [4]. Programmed meter perusing framework enables the client and vitality to specialist co-op to get to the exact and refreshed information from the vitality meter. AMR System can send vitality utilization in hourly, month to month or on demand. This information is sent to focal framework for charging and investigating. This information's are put away into the database server for handling and recording. Another advantage of the meter is that is helps for the efficient use of energy [5]. This innovation mitigates work cost, assortment time, vitality burglary, maintains a strategic distance from late installment. By taking the amount of unit consumed at the end of each day it helps to detect the thefts [6]. Adding to this it builds information security, improved client support, decrease income misfortunes. This framework isn't just sending the information yet in addition it provides power detach/interface include, power cut element and hardening ready element. Every one of these focal points give this item an edge over other sober- mindedly winning gadgets.

This paper presents the advancement of a completely Automated Energy Meter which is having capacities like remote checking and controlling of vitality meter. It is designed in such a way that it displays every unit consumed through app so it make easier to monitor the current [7]. Programmed Meter Reading framework (AMR) consistently screens the vitality meter and sends information on solicitation of specialist co-op through SMS. The hole process can be controlled with the help of the microcontroller [8]. It spares immense human work. The information got from a vitality meter has been put away in database server which was situated at power Board station through SMS passage for additional handling by vitality supplier. Vitality supplier sends power bill either by email, SMS or by post. This framework permits to the clients to take care of tab online either with Master card, platinum card or by net banking. This framework gives opportunity to power organizations to

make a move against indulgent clients who have exceptional levy, in any case organizations can disengage the intensity of client .Companies can re-associate the force after testimony of duty. This framework additionally gives the force cut data and hardening alert. So GSM based AMR framework is increasingly effective relevant show charging framework. The overall outcome of the project results in easier controlling and monitoring of the energy meter with user notification system [9].

II. EXISRING SYSTEM

Power is the main thrust behind the advancement of any nation. With the quick increment in private, business, and modern shoppers of power all through the world, it has now gotten basic for utilities organizations to devise better, non-meddlesome, earth safe procedures of measuring utilities utilization so right bills can be created and invoiced. Generally, the power meters are introduced on consumer's premises and the utilization data is gathered by meter-per users on their fortnightly or month to month visits to the premises. This technique for checking power utilization has the accompanying burdens: (I) Sometimes the meters are introduced inside people's homes and, if the purchaser isn't at home, the meter-per user can't record the fortnightly or month to month utilization and afterward the utilities, company needs to turn to considering the normal bill-measure of the earlier months as a pointer of the conceivable utilization for the present month. This outcomes in trouble for both customer and the power supply organization. May be the customer has not used comparable measure of power and the present month as in the earlier months for reasons, for example, holidaying somewhere else or being in the medical clinic, and so on during the month, and sending him a bill for a bigger sum dependent on his history of power utilization tangle bring about his/her monetary hardship. This technique for charging is likewise not reasonable for the power supply organization since it gives wrong in the consumer's region and may at last outcome in blunders in future arranging by the organization. (ii) Hiring of various meters per users by utilities "Organizations and giving methods for transportation to them is a costly weight on the companies" spending plans. Additionally, these guests of the may utilize vehicles to come to the consumer's premises, produce contamination noticeable all around which has negative effect on nature and the nursery impact. (iii) Dissatisfaction of certain clients who may consider meter-readers" access to their homes as a type of intrusion of their protection. This is particularly relevant in towns, where during the day most men are outside of their homes winning a living and just ladies are at doing the housework. (iv)The meter per users may commit some error in perusing the expended unit which will prompt bogus charging because of human mistake. The SMS has stretched out their support of substance suppliers to convey a wide of administrations to cell phone clients.

III. PROPOSED SYSTEM

Compared to that of earlier existing meters, we are going to implement it in an easier way by interfacing the energy meter with GSM based module by interlinking each other. Now a days SMS is using as major tool for PLC communication which enhances the accuracy and reduces the man power requirement. By changing the conventional electro mechanical meter into digital meter we have various advantages like automatic meter reading technique which records the daily or monthly usage of unit and that will be sent to the consumer and Electricity board through SMS. Here there is a two way communication between consumer and Electricity board, either PC or Mobile phone act as a receiver. Basically SMS is used to cover large area coverage capability and cost effectiveness. Adding additional feature to this we can OFF/ON the meter by command through SMS. Every modern monitoring device need GPRS which helps in quick response, meter reading collection, Fault detection or power monitoring services. Normally electro mechanical energy meter measure the unit consumed by sensing the speed of rotating disc which is directly proportional to the amount of current flowing through it but digital meter involves current pulse for the calculation of consumption of load. Current pulse given to the static energy meter can be given by CAL LED. For reference we have coupled the digital meter with microcontroller using OPTO coupler. Then the CAL LED is replaced by OPTO coupler led. Consumption of the load can be measured by blinking of the LED. When the meter is turned ON it will initialize the each entire module connected to it. After consumption of certain unit then the server which send the reading request to the meter through GSM modem. When the server gets the reading, it will store the data in the database and sends the consumption to the user via SMS.
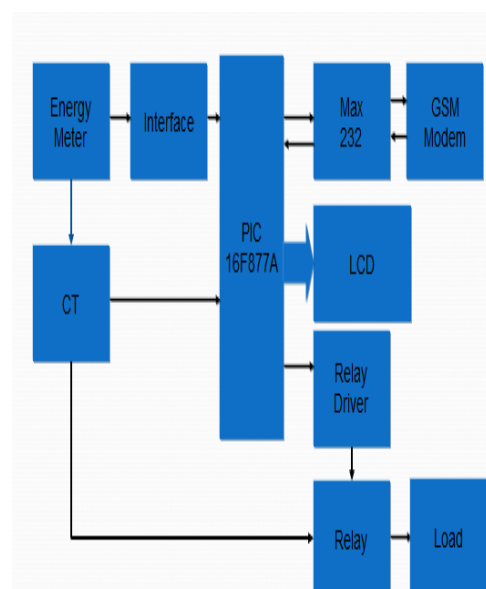
IV. BLOCK DIAGRAM AND WORKING

Fig 1: Block diagram of Smart Energy Meter

The block diagram of the energy meter is shown above Fig 1. The construction is very simple and it is user friendly. It additionally contains the SIM slot, microcontroller, relay and the voltage regulators. The current process will be displayed over the LCD display.
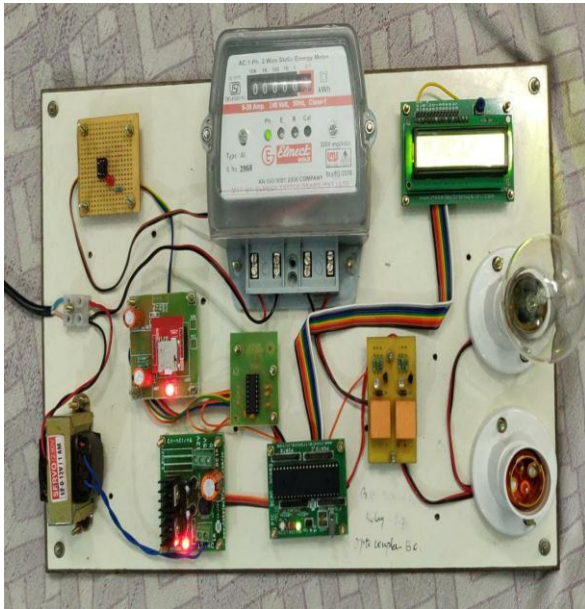

Fig 2: Hardware Setup of Smart Energy meter

The experimental set-up of our proposed model is shown in Fig. 2.The working is start with the 12-0-12 step down transformer which convert the incoming 230v Ac into an 24v Ac and it is converted into Dc by using the bridge rectifier and the harmonics where reduced using the capacitors then the 24v Dc. The 24v Dc is further reduced to 12v and 5v by giving the output of the transformer to the voltage regulators 7812 and 7805 to give the supply for relay, relay drivers and microcontroller, GSM respectively. The energy meter is powered with 230v Ac and in that each impulse makes a unit, which is detected by the optocoupler and the detected information will be sent to the interrupt pin of the PIC microcontroller. Here microcontroller plays a vital role in our project. The only device can monitor and control the whole process in this project. GSM module is connected with serial port of the PIC microcontroller but there is an logic mismatch between GSM and PIC microcontroller. The GSM uses the RS232 logic where the PIC microcontroller uses the TTL logic. The MAX232 IC is used to interface these two different logics.

The relay is used to ON/OFF the load based on the command which is sent through the GSM and relay can't be controlled directly which is done with the help of the relay driver and all these devices are connected with PIC microcontroller. Liquid crystal display is used to monitoring a current running process. LCD is interfaced with microcontroller. The controller drives the LCD and shows the current consumed and also the command which is sent through the GSM.

V. SYSTEM DESIGN

In the proposed work the components used are as follows:

1. Microcontroller PIC16F877A

Peripheral Interface Control (PIC 16F877A) is an 8k programming memory microcontroller with 40 pins. Because of its low cost, high application support and wide availability it is widely utilized. The microcontroller is fundamental to the proposed system. It performs various tasks from processing all sensor inputs to alerting the driver. Due to low power consumption, high performance flexibility and easy availability of its supporting hardware and software resources such as compilers, debuggers, and simulators, PIC microcontrollers are currently used extensively for industrial purposes. The microcontroller is shown in Fig 3.

Fig 3: Microcontroller PIC16F877A

2. CURRENT TRANSFORMER

Since the chip unit handles little extent of voltage and current, voltage and current which are should have been institutionalized must be ventured down before being sent to the microchip. Right now, current transformer which offers yield to a limit of 2.5 mA is utilized to take the examples of current qualities. For venturing down the fundamental stock voltage, a potential transformer is utilized. It ventures down the inventory voltage to 12 V. The current transformer is shown in Fig4.

Fig 4.Current Transformer (230/12 v)

3. GSM

GSM (Global framework for portable correspondence): It is utilized for Send a notice SMS to the purchaser .It works either 850/900/1800/1900 MHz dependent on the nation. In India it is a 900 MHz's. The sign from the PIC to the GSM is through RS232 link with MAX232. The link is for sequential correspondence to associate the .GSM can Receive and transmit the sign from cell phone. Programmed load control is finished by GSM by means of SMS from Mobile. It requires 12 v supplies which are taken from 12 v connector to the Power Jack and afterward the Antenna is for Receiving and imparting a sign. The GSM is shown in Fig 5.
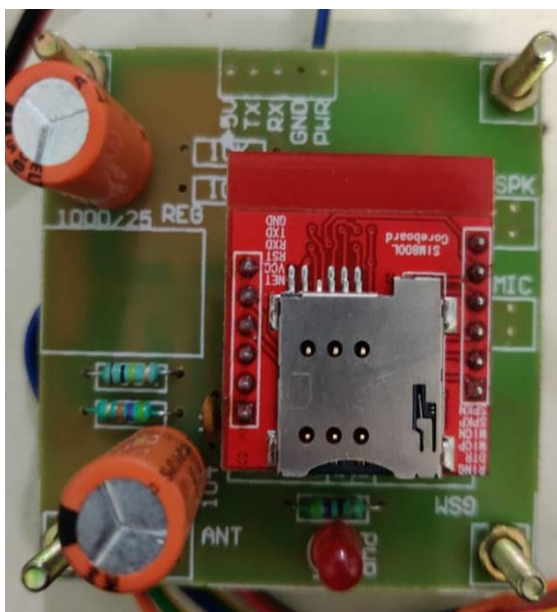

Fig 5.GSM Module SIM900

4. ENERGY METER

Energy Meter: A Energy meter (1phase,2 wire) is a gadget that is utilized to quantify the vitality of power devoured by the customer in KWhr (units).It interface with PIC by means of opto coupler. Opto coupler comprises of LED and SCR type combination. Opto coupler move the sign as LED flicker (beats) in a moment of meter to the PIC and afterward the beat depends on the heap utilization or use .It is a solitary stage two wire meter implies it comprises of stage and unbiased and afterward the heap is straightforwardly associated with the meter .Based on shopper utilization the power charge (EB) is increment or decline. The energy meter is shown in Fig 6.

Fig 6.Single Phase Energy Meter

5. MAX232

Maxim Integrated Products that changes over signs from a RS-232(TIA-232) sequential port to signals reasonable for use in TTL-good advanced rationale circuits. It is a double transmitter /double recipient that ordinarily are utilized to change over the RX, TX, CTS, and RTS signals. The MAX232 is shown in Fig 7.
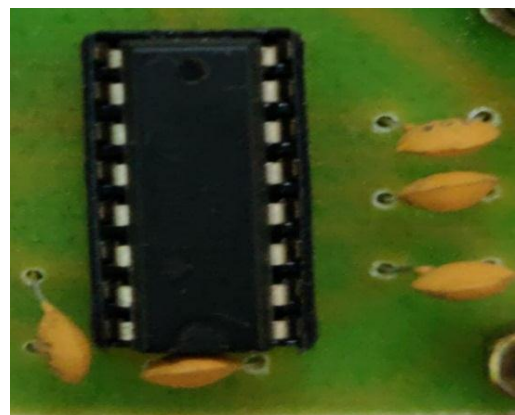

Fig 7.MAX232 IC

6. RELAY

Relay is an electrically worked change used to control the on/off condition of a circuit utilizing a low force signal. Right now, 1-channel 5 V transfer is utilized to remove the force association when vital condition is satisfied. The relay is shown in Fig 8.
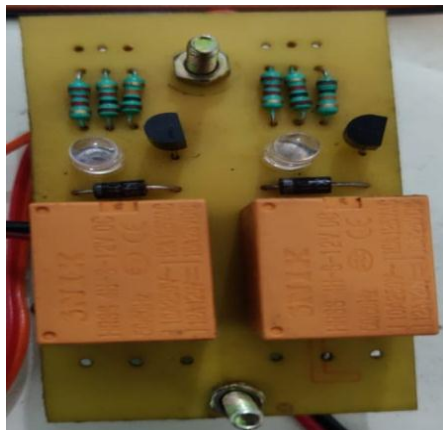
Fig 8.Relay Module (5V)

7. LCD Display:

Fig 9.LCD display(2*16 Line)

The LCDs are lightweight with a thickness of just a few millimetres. Since the LCD consumes less power, they are compatible with low-power electronic circuits and can be powered over long periods of time. This gives the message about the vehicle whether it has been identified or crossed, on time and time. The two polarisers and the liquid crystal rotate light rays while the LCD is in the off state, so that the light rays come out of the LCD without any direction, and thus the LCD appears transparent. It displays the speed breaker status whether it is in state or off condition and also indicates that the emergency vehicle is identified and the road is traversed. The LCD is shown in Fig 9.

VI. EXPERIMENTAL RESULTS

It is the combination of both hardware and software implementation. Both of them are connected as a digital meter which enhances accuracy, reduces man power required and error. Designed digital meter is interfaced with PIC and GSM module. Sequence of C++ program is formulated and changed into micro controller code for compilation. Here we use the atmega328 most commonly used AVR which used to count the input signal and calculate the unit consumed. The Image of Received and Sending SMS is shown in Fig 10.

Fig 10.Sending and Receivingof SMS request

Fig 11.OFF Process of Energy Meter

The following Fig 11 shows the giving supply to the consumer once the bill is paid off.

Fig 12.ON Process of Energy Meter

GSM module the message request has been initialized that is shown in fig 12.Then the controller unit will receive the command and turn ON/OFF the meter that is shown in fig ON and OFF process. When the consumer arise the consumed unit request through GSM. Again meter will initialize and send the calculated amount, consumed unit to consumer that is shown in the Fig 13.. We can monitor meter on daily/monthly basis by the help of real time clock. LCD unit will display the unit and amount for that.

Fig 13 Amount and Consumed unit

If the consumer want to know the bill at end of the day he has to send the formulated command as "UNIT" through registered mobile number so that it will send the data to them and it will displayed in app also. Every time we arise a request the consumed data will be calculated, added in a row as a log in designed app that is shown in Fig 14.APP Display of Smart Energy Meter.
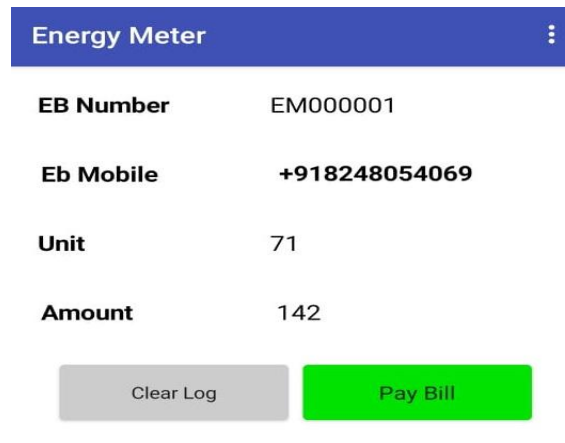
Fig 14.APP Display of Smart Energy Meter

In future it may be changed to cloud storage to store the data on cloud. Accessing of meter is given to both administrator as ELECTRICITY BOARD and CONSUMER. For those is not paying a bill before the due date the connections will be cut off by Electricity Board. Only after payment of bill, meter will be turned ON by administrator. This is simplest way of interfacing the digital meter with GSM module which helps the administrator to work easily and in effective way of communicating with consumer

CONCLUSION

This is paper describes the design and implementation of GSM based energy monitoring system and shows how it will record the data of consumed load by automatic meter reading technique. It is the economical way of implementing AMR and enhancing the technology through it which reduces the manpower required and increases the accuracy of billing .This will shows consumer about the daily usage of load through message request. It gives a easiest way to take meter readings, accuracy, detection of faulty conditions, power factor calculation, less operation cost and removal of possible corruption related to meter reading. GSM based monitoring is the most effective as well as less economical for provider and consumer .It is one of the possible way to overcome the complexity in other meters.

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