

## Wired Communication based Smart Energy Monitoring system

Suman Parui, Rahul Samanta, Nilarghya Jana, Rupak Das, Pubali De

**Abstract**— Our world's population is growing daily; however, the most used energy resources are finite. The tariff rate on energy is rising in response to falling GDP and high inflation, which has a direct impact on household expenditure. Monitoring energy use has become one of the most significant duties in today's life in this environment. Even though there has been a lot of study done on this topic, the most of it is focused on Wi-Fi or gsm technologies. In metropolitan locations, Wi-Fi and gsm technology may function without issue, however in rural areas, Wi-Fi and gsm technology become less dependable due to network connection instability. Prepaid meters have also received a lot of attention, and many businesses have begun to use them. Prepaid meters have also received a lot of attention, and many businesses have begun to use them, but they come with their own set of issues. Consumers that use prepaid meters must pay money up front, which can be challenging for low-income households, and the user interface can be confusing at times. We have developed a revolutionary energy monitoring concept in this work. We created the smart energy meter with the concept of wired communication in mind, so that it does not require any labour to monitor individual energy use for residential or business applications. This suggested smart energy meter, when used in combination with the IoT module, enable easier user access to energy consumption data at any moment during the day. Our research shows that our suggested meter has the potential to surpass other traditional smart energy meters already available on the market. The communication technology we suggest in our research is extremely reliable and secure.

**Keywords**— ARMS (Automatic Meter Reading System), Smart Grid, Energy Meter, Smart Energy Meter, Wired Communication, Arduino IDE.

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### I. INTRODUCTION

Smart energy meter is the energy consumption monitoring system where energy meter data does not need to be collected manually. Manual meter reading system requires every meter reading data to be collect individually which is a west of resources. Smart energy meter uses a two-way communication system which can collect data of energy meter and send it to any required server. Smart energy meter reduces error made by humans during billing and increases efficiency.

This proposed smart energy meter provides us real time data from the meter. The real time data from the meter can be helpful for many other purposes like theft, disconnection of power for unpaid bill etc. It also provides opportunity to the consumer to check their consumption for any period of time. Consumer can check the current load, voltage, current, and consumption through website and the mobile application. Smart energy meter solvers most of the problem faced by conventional meters and provides us many other useful advantages. This energy meter is very user friendly. It may solve the problem of energy monitoring in the near future.

### II. LITERATURE REVIEW

Most of the system similar to our proposed system uses a either GSM module or a WIFI module for the purpose of transferring data. GSM and WIFI based modules can work smoothly in enpermental basis but thoes system faces some problem in practical application which are discussed below.

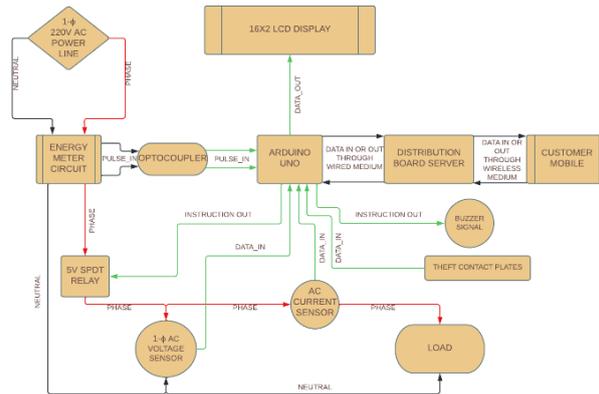
Tooes proposed system which uses the GSM module for communication can be challing for practical application. GSM modules requires subscription or recharging which can be challenging for the meter provider or the consumer for monitary reasones. GSM modules also requires GSM signal which may not be available in every places espically in ruralareas.

Smart energy meter with WIFI modules for communication faces the similar problems. Though WIFI connection is nowadays available in every urban areas it's still quite rare in rural villages. Thoes who does not have a WIFI connection can not use this WIFI based Smart Energy Meter. Also if any consumer loses his wifi connection the meter willbe useless because the communication system will be disabled.

For thoes above reason and to solve thoes problems ourproposed Smart Energy Meter uses a wired based communication system. This proposed system can be implimented in urban and rural areas without any problem. Our proposed system will also provides a very secured communication system. With this communication medium when the data reaches to near server then it can be connectedto internet using IoT.

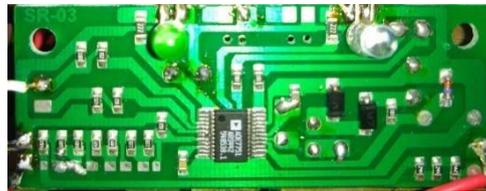
### III. PROPOSED SYSTEM

Our proposed Smart energy meter made with combination of various hardware and software which are explained within this section. This proposed system collects the pulse data from the ADE7751 and send it to Arduino uno through 4n35 opto-coupler. The data then processed and calculated by the Arduino uno and then it sends the data to a server through wire. In our proposed system When the data is received in the server center then it can be connected with internet through IoT based blynk application. The authority and the consumer can access and monitor all important data through the blynk.io website and the blynk application. If the consumer doesn't pay the electricity bill within given time his connection can be disconnected through a relay by the responsible authority. In our proposed system if anybody tries to temper with the meter it sends a signal to the responsible authority.

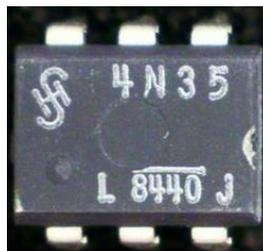


#### A. Hardware Description

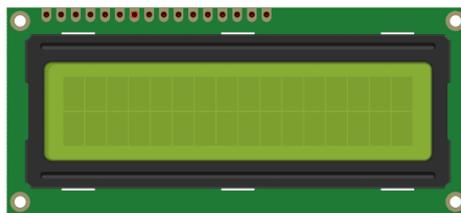
ADE7751 based energy meter circuit- It measures the actual energy consumption and gives output data as a pulse signal. This ic gives 3200 pulses for 1KWh or 1 unit of energy consumption.



4n35- It is an optocoupler it isolates the dc circuit of Arduino from the live ac circuit during the transfer of pulse data and provides safety to the circuit from live ac current.



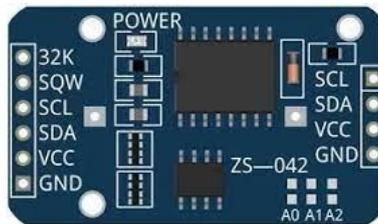
16\*2 LCD display- It is attached outside the proposed smart energy meter and used to display the important data of the energy meter.



Arduino ATMEGA328p microcontroller- It is the main microcontroller in our proposed system which collects all the data like energy consumption (in unit), live voltage, current and calculate it and sends the output to the server.



DS3231 RTC- It is a real time clock it syncs the energymeter time with the server time to eliminate any error.



ZMPT101b voltage sensor- It detects the voltage in the supply line and send the data to the Arduino uno. It can measure voltage up to 250 volts.



ACS712- It is a hall effect current sensor. It sends thecollected data to Arduino uno.



SPDT 5v relay- It is used in our proposed smart energy meter to cut the supply line if the consumer does not pay the bill in a given period of time.

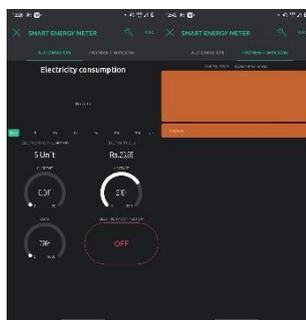


12V buzzer- It is used in this proposed meter as a signal to show that meter is under theft.





Mobile application- It is quite similar to the website. It is an open source application named blynk iot. User can log in with their id and password. All the required data like energy consumption, voltage, current, previous billing data, current and upcoming tariff plan can be accessed through this application. From here he can also pay their electricity bill online.



## **V. RESULTS AND DISCUSSION**

Our proposed smart energy meter was tested in basic electrical engineering laboratory and we received most of the desired data through the test. The user was receiving all the data through website and application. User was also receiving notification and e mail if bill was generated and if tariff plan slab was about to be change. And also authority was receiving notification if anybody was thying temper with the smart energy meter.

## **VI. CONCLUSION**

Most of our research aims were met. We received all the required data. Our relay module and warning system was working properly. The main challenge for our proposed project is initial infrastructure because it needs a wide network of wired communication line. If this proposed smart energy meter gets implemented it can serve many purposes besides energy consumption monitoring. Also this proposed project can be implemented in place either in city or in rural area.

## **FUTURE SCOPE**

Our proposed Smart energy meter can be implemented in every Household and industries. In future it can change the way of energy consumption monitoring and can also provide us data which can be used for many purposes like smart grid system. We can also add water and gas measurement sensors with this, which can help us for billing of consumed water and LPG gas.

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