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Smart Grid using IoT Platform

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Abstract—This paper aims to explain the part of smart system in the future of electric grid. It is a deadly job for the electricity board officials to take meter readings by hand and compute the bill as it is more time consuming and requires man power. It is a difficult job to get meter readings of big industries. Drawback of existing system is that the person has to go area by area and monitor and take the meter reading of every house. Because of this many times errors occur similar to extra bill amount or disconnection of the electricity even if the bills are paid. In this prpject smart grid with IoT platform is implemented using ATmega Microcontroller. In view of all such factors, it is possible to design a smart grid that will give automatic metering and billing system. Load management is a further benefit of this system. When their is variation in voltage of one feeder, we will shift the load to the other feeder. This will enhance reliability and overall efficiency of the grid. The bill generated can be shown on the webpage through the wi-fi module.

Keywords—Smart Grid, Energy Monitoring, Internet of Things, WiFi, Webpage.

I. INTRODUCTION

Energy meter billing is an essential element of energy distribution. Every time a person from the electrical utility comes and save the meter reading and make the bill to the end user. The difficulty with this system is that it requires man power. It is time consuming and causes error. Therefore a scope of a smart energy meter which will provide detailed information about the energy consumption . The present sys-tem only provides feedback to the customer at the end of the month that how much power is consumed in the form of a bill. The consumer has no way to track their energy usage on a more instant basis. In this system we are relating energy meters to the IoT concept. This system eliminates the human contribution in electricity maintenance.

Making the grid infrastructure and meters more connected

The Internet of Things (IoT) is required to develop to 50 billion associated gadgets by 2020 (Cisco, 2011) giving significant data to customers, makers and utility suppliers. Inside the IoT, gadgets over an assortment of businesses will be interconnected through the Internet and shared associations just as shut systems like those utilized in the keen lattice infrastructure.[8]

The grid needs to change to face todays challenges In the least difficult terms, fabricating a shrewd frame-work implies verifying the fate of vitality supply for everybody in a quickly developing populace with a constrained power creation limit. A savvy framework lessens the misfortunes, expands efciency, upgrades the vitality request dispersion and furthermore makes huge scale sustainable power source, for example, sunlight based and wind arrangements a reality. With a maturing foundation, the framework is confronting serious difficulties incorporating repeating power out-ages in major industrialized urban areas around the world, in excess of 30 percent electrical vitality lost from creation to homes in nations like India, and 35 percent drinkable water squandered in spillages in France and Australia. The lattice topology needs to adjust and move from a concentrated source to a disseminated topology that can retain diverse vitality sources in a dynamic manner. There is a need to follow realtime vitality utilization and request to the vitality supply: this goes with the sending of progressively remote detecting gear fit for estimating, checking and conveying vitality information that can be utilized to actualize a self-mending matrix, increment the general efciency, and increment the dimension of selfmonitor-ing and basic leadership. The associated shrewd matrix gives a correspondence organize that will interface all the distinctive vitality related gear of the future.[8]

II. Literature Review

Internet of Things (IoT) can be utilized to outfit insight-ful administration of vitality appropriation and utilization in heterogeneous conditions. In the ongoing years, by the devel-opment of IoT and computerized advances, keen lattice has been getting to be more brilliant than previously. The future power matrix should be executed in a circulated topology that can powerfully ingest distinctive vitality sources. IoT can be used for different uses of the keen framework including dispersed power plant checking, control age and utilization expectation, control utilization observing, energy stockpiling checking, brilliant meter, electric vehicle charging, control request side administration and different zone of energy gener-ation. By utilizing the IoT abilities, we can plan and execute a keen energy metering stage comprising of shrewd attachments, portal and cloud server[1]

The multiplication of brilliant network explore, the Ad-vanced Metering Infrastructure (AMI) has transform into the underlying everpresent and changeless stage for performing computational activities. Then again, because of the confined uniqueness of AMI, for example, difcult organize structure, information with protection affectability and savvy meter with asset obliged instrument it is an especially testing issue for the AMI security. Power burglary is a standout amongst the most signicant concerns associated with the execution system of brilliant grid.[2] The innovation of e-metering (Electronic Metering) has experienced fast mechanical progressions and there is expanded interest for a solid and efcient Automatic Meter Reading (AMR) framework. This paper shows the plan of a straightforward minimal effort remote GSM vitality meter and its related web interface, for computerizing charging and dealing with the gathered information comprehensively. The proposed framework replaces conventional meter perusing techniques and empowers remote access of existing vitality meter by the vitality supplier. Additionally they can screen the meter readings consistently without the individual visiting each house.[3] Electronic vitality meter has various focal points over the customary electromechanical meter and because of this numerous nations of the world have changed to electronic metering framework. In any case, sadly Pakistan is as yet denied of such meters. The paper depends on the nal year undertaking of the plan and amp usage of paid ahead of time electronic vitality meter which we are structuring so as to take out the issues being looked by the Pakistani individuals. By the presentation of prepaid framework in Pakistan the issue of cheating and over charging and the inconvenience being looked by the clients in paying the bills will be expelled all together.[4]

The improvement of a GSM programmed control meter perusing (GAPMR) framework is introduced in this paper. The GAPMR framework is comprises of GSM advanced power meters introduced in each shopper unit and a power ebilling framework at the vitality supplier side. The GSM advanced power meter (GPM) is a solitary stage IEC61036 standard consistence computerized kWh control meter with installed GSM modem which use the GSM system to send its capacity use perusing utilizing short informing framework (SMS) back to the vitality supplier remotely. At the power supplier side an ebilling framework is utilized to deal with every gotten Sm meter perusing, process the charging cost, update the database, and to distribute charging notication to its individual purchaser through SMS, email, Web entryway and printed postage mailing. A working model of the GAPMR framework was work to exhibit the adequacy and efciency of programmed meter perusing, charging and notication using GSM network.[5]

Power factor observing is a significant test in deregulated condition to keep up quality in conveyed control just as tax appraisal. In this paper, an exceptional power factor estimation strategy has been recommended that can quantify the prompt power factor of a non-sinusoidal singlephase framework pre-cisely at each example moment. The wavelet change (WT) has been used for multiresolution investigation (MRA) of current waveform.[6]

The client area of the shrewd framework normally mixes with brilliant home and savvy building frameworks, yet run of the mill proposed approaches are merchant driven as opposed to client driven, undermining client acknowledgment, and are regularly ineffectively adaptable. To take care of this issue, we propose a point by point engineering and an execution of a last-meter brilliant network the bit of the keen lattice on client premises-installed in a web ofthings(IoT)platform.Ourapproachhasfouraspectsofnovelty and focal points concerning the best in class: 1) consistent reconciliation of savvy framework with shrewd home applications in a similar foundation; 2) information gathering from heterogeneous sensor correspondence conventions; 3) secure and modified information access; and 4) univocal sensor and actuator mapping to a typical reflection layer on which extra simultaneous applications can be built.[7] The author provide an outline of the potentialities of the sensing system and IoT to monitor efficiently the energy flow among nodes of an electric network. The described power meter uses the matrix proposing the IEEE standard to analyze and process voltage and current signal. Information concerning the power consumption and power quality could aloow the power grid to route efficiently the energy by means of more suitable decision criteria. The new scenario has changed the way to exchange energy in the grid. Now, energy flow must be able to change its direction according to needs.[8] Approximate dynamic programming (ADP) driven versatile stochastic control (ASC) for the Smart Grid holds the guarantee of giving the independent insight required to hoist the electric lattice to efciency and self-recuperating abilities progressively practically identical to the web. Keeping that in mind, we show the heap and source control important to advance administration of dispersed age and capacity inside the Smart Grid.[9] Sending of information age gadgets, for example, sensors and brilliant meters have been quickening toward the vision of keen lattice. The volume of information to be gathered increments massively. Secure, efcient, and versatile information accumulation turns into a difficult errand. In this paper, we present a protected and versatile information interchanges convention for brilliant framework information gathering. Under a various leveled design, hand-off hubs [also known as information gatherers (DCs)] gather and pass on the information safely from estimation gadgets to the power administrator. While the DCs can check the honesty, they are not offered access to the substance, which may make ready for outsider suppliers to convey esteem included administrations or even the information accumulation itself.

We further present improvement answers for limiting the complete information accumulation time.[10]

III. PROPOSED SYSTEM

1) Block Diagram: We implemented smart grid on IoT platform. This model includes the implementation of ATmega microcontroller connected with IoT server.This includes the interconnection of different components like LCD, ESP8266, grid, Relay. A bulb is used as load. current sensor is interfaced with the load and microcontroller. Current sensor senses the current from load and give that value to the microcontoller. To view the energy consumption of the load, LCD is interfaced with the microcontroller on which energy consumption is displayed. Relay, feeder 1 and feeder 2 are also interfaced with the microcontroller. Relay switches the circuit to the another grid whenever there is voltage drop across the current grid. Switching of grid is also displayed on the LCD. ESP8266 is interfaced with the ATmega16. At the end, all the information gathered through microcontroller is send to the webpage using ESP8266 WiFi module. This project is the result for the problems faced by consumers and distribution companies. This system can be used in housing and industrialized centers. It will determine the sum of energy consumed by consumers. It can be used to calculate the energy consumption of the end user. Energy meter gives the energy consumption reading and it is send to the server through IoT using controller.

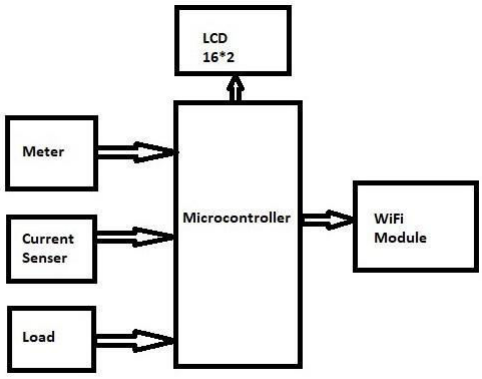

Fig. 1. Block Diagram

2) Webpage: Our framework can be utilized to show the vitality meter data regarding Watts and the relating bill created for the measure of vitality expended. Each client would most likely access the data from anyplace on the earth. Thingspeak.com is one such page which takes the assistance of the MathWorks MATLAB examination to introduce the gadget data in a progressively nitty gritty investigation in both portrayal and representation. Thingspeak.com gives the client the capacity to add any number of channels to one record and in each record data can be sustained into 8 elds.

A record can be alloted to one division of a territory and n channels can be made to a suite of n meters in the area. The examination can be seen by both the customer and specialist co-op .MATLAB perceptions can be added to the investigation to give an exhaustive investigation of the vitality utilization.

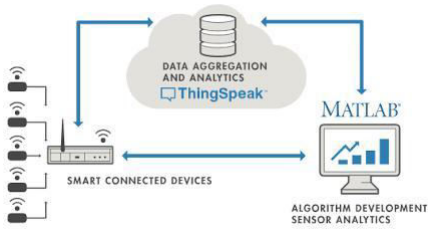

Fig. 2. Webpage

IV. IMPLEMENTATION RESULTS

ATmega16 microcontroller is interfaced with current sen-sor, LCD, load and Esp8266 wifi module to read and proces energy consumption of a consumer for the further action. This system is developed for reading the energy meter and display the unit and cost of the consumed energy. Hence as load increases, the increased cost along with the number of unit is displayed through LCD. WiFi unit performs IoT operation by sending energy meter data to webpage. Data is uploaded on thingspeak. Using thingspeak.com the analytics can be equally view by the consumer and service provider.

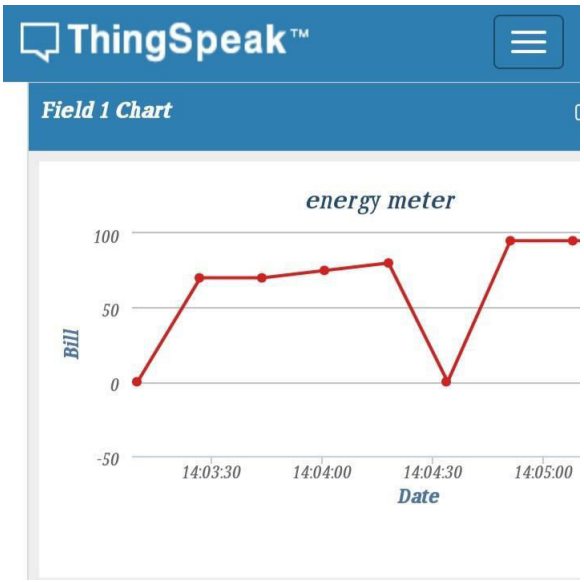

Fig. 3. Energy usage profile on thingspeak.com

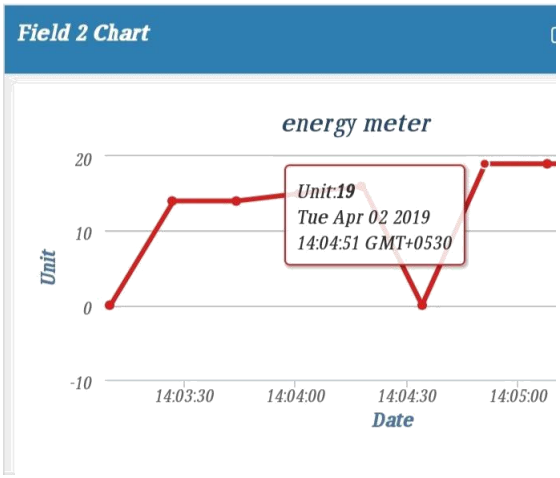

Fig. 4. Unit of energy usage profile

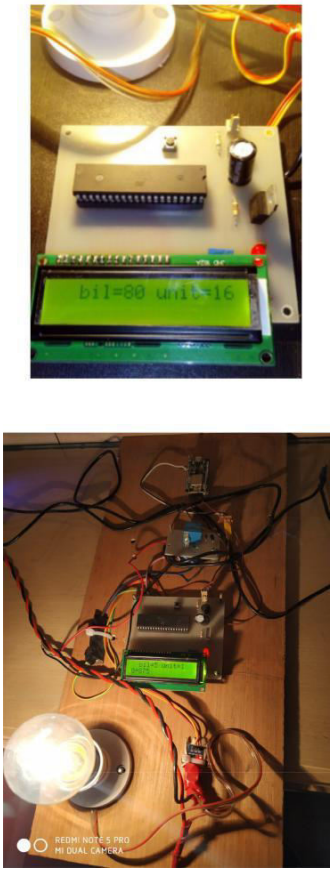

Fig. 5. System Implementation

V. Conclusion

In this system, an energy consumption is calculated on the counting pulses of calibration is designed and implemented us-ing ATmega16 Microcontroller unit in embedded system. IoT and microcontroller based meter reading system is designed to constantly monitor the meter consumption. It eliminates the human involvement, delivers effective meter reading and avoid the billing mistake. Simplicity of accessing information of consumer energy from energy meter through IoT. LCD displays energy consumption unit and cost. This paper suggests more reliable and transparent system of energy billing. Also, load shifting during a voltage fluctuation is suggested for stable system. Because of which the condition of blackout may be minimized.

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