IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

IOT based Smart Energy Meter and Cost Monitoring System for EV Charging Station

S. M. Ingale[1], Gaurav Ramesh Pathare[2], Onkar Madhav Puri[3], Nikita Sampat Mandlik[4], Parashram Ashok Dagale[5]
Professor. Department of Electrical Engineering[1]
Students, Department of Electrical Engineering[2,3,4,5]
Amrutvahini College of Engineering, Sangamner, Maharashtra, India

Abstract: *The airport electricity utility meter reading Internet of Things (IoT) is an innovative solution that allows for wireless transmission of energy consumption information and detection of electricity usage. This project aims to address the major power consumption of EV charging station and automated billing through the use of IoT technology, the IoT can be applied to various aspects of the smart grid including distributed energy plant metering, energy generation and consumption, monitoring, smart metering, energy demand management and other areas of energy production. Electronic meter have become a crucial component in cost efficient power consumption and their reliability and productivity make them ideal for future use this paper proposes a simple and effective IoT based meter reading system.*

Keywords: IoT

I. INTRODUCTION

The rise of electric vehicles has made electricity a crucial component in their operation, as it is a renewable energy source that enables them to run efficiently while emitting zero carbon. Two main methods for recharging electric vehicles include direct plugin, which connects the battery to an electricity supply, and battery swapping, where rechargeable batteries are replaced with discharged ones. Charging stations that provide electricity for electric vehicles face challenges in monitoring electricity usage and calculating costs. To address this, we propose a smart meter that can calculate the amount of electricity consumed per week, as well as the real-time voltage and current, and transmit the data via IoT devices to the Internet. This data is accessible to both the electric vehicle owner and the charging station operator, increasing transparency. The smart meter relies on sensors such as current and voltage sensors to measure the current and display the readings on an LCD screen. A GSM module with a SIM card is used to transfer the calculated data of current, voltage, and consumed energy cost per vehicle to a website. The EV owner can receive this data via SMS on their mobile phone. The main goal of the smart meter is to calculate the current, voltage, and cost of EV charging and transmit this data to a website using IoT.

II. LITURATURE SURVEY

Anitha et al., [1] proposed "Smart energy meter surveillance using IoT" about IoT, internet of things as an emerging field and IoT based devices have created a revolution in electronicsand IT. The foremost objective of this project is to create awareness about energy consumption and. efficient use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit using IoT. The Arduino esp8266 micro controller is programmed toper form the objectives with the help of GSM module. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are sent to the consumer's mobile through the IoT and the GSM module and it is also displayed in the LCD. It is a time savings and it helps to eliminate the human interference using IoT.

Devadhanishini et al., [2] "Smart Power Monitoring Using IoT" that energy Consumption is the very important and challenging issue. Automatic Electrical Energy meter is used inlarge electric energy distribution system. The integration of the Arduino WIFI and SMS provides the system as Smart Power Monitoring system. Smart energy meter provides

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

data for optimization and lessthe power consumption. This system also includes a motion sensor such that if there is no human in houseor house it will automatically turn off the power supply

Himanshu K Patel et al., [3] demonstrated "Arduino based smart energy meter" that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes in India. The system consists the provision of sending an SMS to user for update on energy consumption along with final bill generation along with the freedom of reload via SMS. The disconnection of power supply on demand or due to pending dues was implemented using a relay. The system employs GSM for bidirectional communication.

Bibek Kanti Barman, et al., [4] proposed "smart meter using IoT" on efficient energy utilization plays a very vital role for the development of smart grid in power system. Hence proper monitoring and controlling of power consumption is a main priority of the smart grid. The energy meter has many problemsassociated to it and one of the key problems is there is no full duplex communication to solve this problem, a smart energy meter is proposed based on Internet of Things. The smart energy meter controls and calculate the consumption of energyusing ESP 8266 12E, a Wi-Fi module and send it to the cloudfrom where the consumer or customer can observe the reading.

Therefore, energy examine has been by the consumer becomes much easier and controllable. This system also helps in detecting energy loss. Thus, this smartmeter helps in home automation using IoT.

Garrab et al., [5] proposed AMR approach for energysaving in Smart Grids using Smart Meter and partial Power Line Communication" on the raising demand of energy. Smartmeters are one of the proposed solutions for the Smart Grid. In this article, an AMR solution which gives detailed

end-to-endapplication. It is based on an energy meter with low-power microcontrollerMSP430FE423A and the Power Line Communication standards. The microcontroller includes an energy metering module ESP430CEl.

III. PROPOSED METHODOLOGY

The energy meter used in this system is a clamp energy meter that measures live current, voltage, and power in KW-h units. The input is 230V AC mains that is transformed into low voltage. The microcontroller reads these parameters and sends them to the cloud for data storage. The Node MCU is a Wi-Fi device with a built-in microcontroller that connects to the local router using IoT. The user can access the parameters' status from a mobile phone or laptop, and data communication is achieved through WIFI. The WIFI is configured with an Arduino to transmit and receive data from the cloud. The energy meter's data is sent to the Arduino, and then to the WIFI module, which sends it to the user's mobile phone. The system also allows the user to switch on/off mains or home appliances from their Android smartphone app. The WIFI module transmits and receives data from the cloud and sends it to the Arduino, which controls the relay to switch on and off the home circuit. The smart energy meter monitoring system is shown in figure 1. The block diagram consists of Arduino, energy meter, WIFI module and IoT, Relay and transformer.

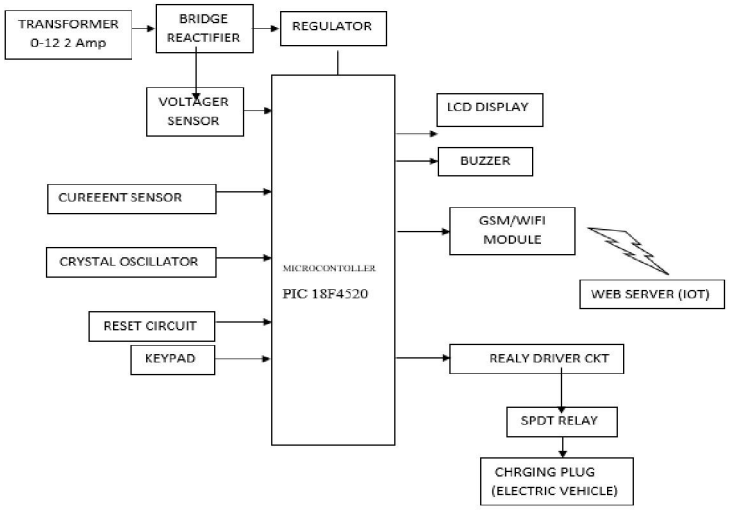

Fig1. Block Diagram

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

TRANSFORMER

The selection of a transformer is crucial, and the key factors to consider are its current rating and secondary voltage. The current rating of the transformer depends on the load's required current. In this system, the input voltage to the 7805 IC should be at least 2 volts higher than the required 2-volt output, meaning it needs an input voltage close to 7V. Therefore, a 6-0-6V transformer with a current rating of 500mA is being used.

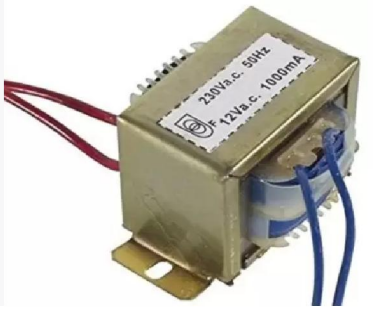

Fig2. Transformer

GSM

GSM stands for Global System for Mobile Communication, and it's a digital cellular technology designed for transmitting mobile voice and data services. Some important facts about GSM include its widespread acceptance as a global standard in telecommunications. GSM uses a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. It operates on mobile communication bands of 900 MHz and 1800 MHz in most parts of the world, while in the US, it uses the bands 850 MHz and 1900 MHz.

Fig3. GSM

IoT

The Internet of Things (IoT) connects various devices and objects worldwide, allowing them to communicate with each other and exchange data. This can include control signals or other types of information. IoT uses different methods of communication, including wireless and wired networks. By collecting data from automated devices and sensors, IoT enables machines to learn and improve their performance. The collected data is often stored in the cloud and can be used to control various objects, such as energy meters, to switch them on or off remotely

MICROPROCCESOR

The 8-bit enhanced flash PIC microcontroller is a popular choice for various electronic applications due to its Nano Watt technology and RISC architecture. It is widely used in home appliances, industrial automation, security systems, and other end-user products. This microcontroller has gained significant popularity in the market and is often used by university students for there project designs.

Fig4. Microprocessor

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

LCD

An LCD display is an electronic display module that uses the properties of liquid crystals to display information. A 16x2 LCD display is a type of LCD module that can display 16 characters per row and has 2 rows. It is commonly used in a wide range of electronic devices such as calculators, digital clocks, and consumer electronics. Unlike seven-segment displays, LCD displays are programmable and can display custom characters, graphics, and animations. They are also more economical and use less power than other display technologies.

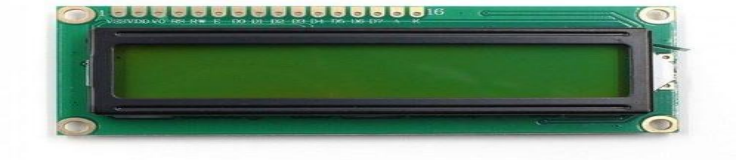

Fig 5. LCD

RELAY

To provide an overview, a relay is an electromechanical switch that uses an electromagnet to mechanically operate a switch contact, either to open or close a circuit. It consists of a coil, a set of contacts, and a spring-loaded armature. When voltage is applied to the coil, the magnetic field created pulls the armature towards the contacts, closing the circuit. When the voltage is removed, the spring returns the armature to its original position, opening the circuit. Relays are used in various applications, such as controlling high voltage or current circuits, switching between two or more circuits, and interfacing low voltage circuits to high voltage circuits. In the context of the mentioned project, the relay is used to switch on and off the circuit of the home appliances based on the signal received from the Arduino.

Fig6. Relay

FINAL MODEL

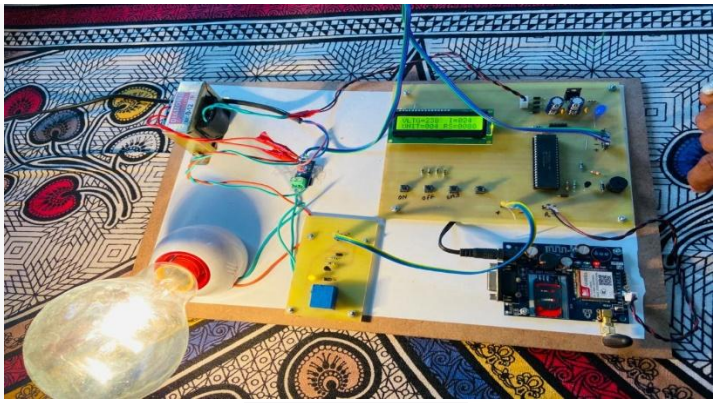

Fig7. Final hardware

DOI: 10.48175/568

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 6, April 2023

IV. RESULTS AND DISCUSSION

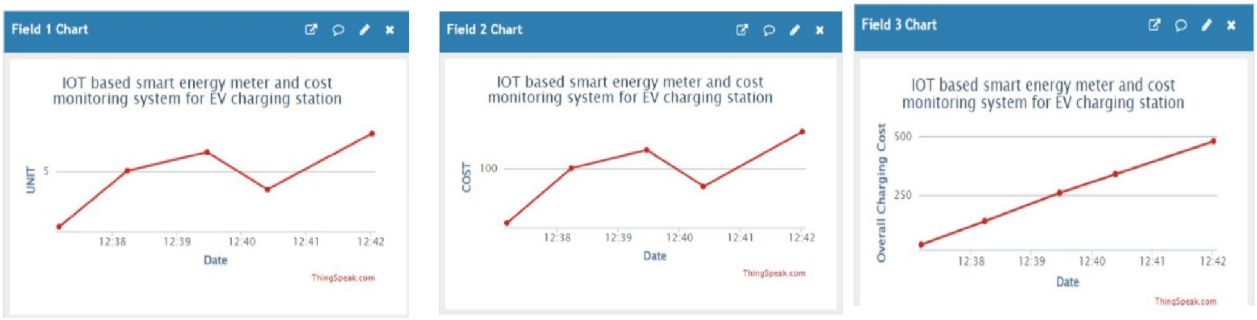

Fig8. Output

V. CONCLUSION

Smart energy monitoring system includes Microprocessor, WI-FI, energy meter, LCD. The system automatically reads the energy meter and provides billing of charging cost and consumed units towards website through IoT. The proposed system consumes less energy and accurately measuring the charging station parameters. Also increasing the efficiency of meter.

REFFERENCES

[1] Anitha.k ,prathik, "Smart Energy Meter surveillance Using IoT" ,Institute of Electrical and Electronics Engineers(IEEE), 2019.

[2] Devadhanishini, et.al" "Smart Power Monitoring Using IoT"5th International Conference on Advanced Computing & Communication Systems (ICACCS) 2019.

[3] Mohammad Hossein Yaghmaee Design and Implementation of an Internet of Things Based Smart Energy Metering" 6th IEEE International Conference on Smart Energy Grid Engineering 2018.

[4] Himanshu kpatel "arduino based smart energy meter" 2nd Int'l Conf. on Electrical Engineering and Information &Communication Technology (ICEEICT) 2018.

[5] Manivannan, S., & Kaleeswaran, E. (2016, December). Solar powered electric vehicle. In 2016 First International Conference on Sustainable Green Buildings and Communities (SGBC) (pp. 1- 4). IEEE. • Kannan, R. (2016), "Interplay between electricity and transport sectors – Integrating the Swiss car fleet and electricity system", Transportation Research Part A: Policy and Practice, Vol. 94, pp. 514- 531.

[6] Rauen, Z. I., Anjomshoa, F., & Kantarci, B. (2018, October). Gesture and Sociability-based Continuous Authentication on Smart Mobile Devices. In Proceedings of the 16th ACM International Symposium on Mobility Management and Wireless Access (pp. 51-58). ACM.

[7] Nasution, T. H., Muchtar, M. A., Siregar, I., Andayani, U., Christian, E., & Sinulingga, E. P. (2017, April). Electrical appliances control prototype by using GSM module and Arduino. In 2017 4th International Conference on Industrial Engineering and Applications (ICIEA) (pp. 355-358). IEEE.

[8] Mwasilu, F. et al. (2014), "Electric vehicles and smart grid interaction: A review on vehicle to grid and renewable energy sources integration", Renewable and Sustainable Energy Reviews, Vol. 34, pp. 501-516