IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Prototype Model Of Smart Energy Meter Utilizing Iot Technology

Divyang Raval[1], Suvas Vora[2], Dharmesh Patel[3]

Assistant Professor[1], Assistant Professor[2], HOD[3]

Electrical Engineering Department

Shree Swaminarayan Polytechnic, Gandhinagar, India

Abstract: The rapid growth of the human population coupled with an increasing reliance on electrical energy has led to a significant surge in electricity demand resulting in shortages during peak hours. to work these Send challenges it is important to develop the electric base. The Applyation of Internet of elements (IoT) Tech can Improve energy consumption and distribution across various scenarios. this report mainly examines reflex charge force board facilities larceny espial force optimization and the supply of pertinent Send use information to Operators. The IoT-based smart energy meter system comprises three important Parts: a controller Wi-Fi connectivity and a theft Findion device. inch the case of larceny or amp break the larceny espial Findor identifies the effect and responds fitly. The controller is decisive for ensuring the proper Roleing of all Parts. away connection Send meters to the cyberspace done the iot frame this unit minimizes the take for man interference inch electrical energy direction. The proposed IoT-based meter reading system is Layouted to continuously Watch meter readings allowing service providers to disconnect power when consumers fail to pay their monthly bills thereby reducing human involvement and enhancing the Precision of meter readings while preventing billing errors.

Index Term: IoT (Internet Of Things), Application (Bylnk), Smart Meter, Wifi Module ESP8266

I. INTRODUCTION

Currently electricity is a vital Supply for human existence globally. every house power pot and diligence relies along electric connections for their trading operations. The rapid growth of the human population and increasing dependence on electrical energy have very importantly heightened the demand for electricity leading to shortages during peak usage times. to work these Send challenges it is desperate to develop the electric base. The Use of Internet of elements (IoT) Tech can Improve energy consumption and distribution across various scenarios [1]. with the current advancements inch iot and digital technologies the construct of forward cities is evolving to go further Smart than inch old age. as an result it is essential to adopt Creative and Improved alternatives such as smart grids smart metering and zero-energy Constructings which will help reduce reliance on conventional energy sources by decreasing consumption and optimizing the use of renewable energy. this passage leave finally raise the Productivity of force and Send direction systems [2]. Accurate metering theft Findion and the Applyation of effective tariff and billing systems are decisive for managing electrical energy consumption. collection time readings clay i of the about hard aspects of charge. Traditionally utility providers send personnel to consumer locations periodically to record meter readings. this wise has many drawbacks including existence time-consuming labor-intensive prostrate to man mistake and vulnerable to depravity

The procedure may be halted due to adverse weather conditions. in addition if the consumer is inaccessible charge leave rest unfinished necessitating amp take call away amp man hustler. India is currently experiencing an energy deficit during peak hours with low voltage identified as a significant power quality concern. charge sloughing is amp current force direction scheme engaged away substitute providers [3]. In light of the rising demand for electrical energy energy conservation holds considerable importance in this context.

The current energy billing system is susceptible to errors, is time-intensive, and requires considerable manual effort. Mistakes can occur at various stages of the billing process, including inaccuracies from electro-mechanical meters and human errors during the recording of meter readings. These issues can be addressed through the implementation of a smart energy meter. The primary aim of this project is to create a smart energy meter. The Arduino receives pulses from the energy meter, calculates the energy consumption, and displays the results on an LCD screen. The readings are stored in the built-in EEPROM, ensuring that computations continue even during power outages [4]. Additionally, the energy meter readings are transmitted to the user's mobile phone via a message through a Wi-Fi modem. The prototype system is powered by an external power supply that converts AC power into DC power, which is then supplied to the Arduino and Wi-Fi module.

The Internet of elements (IoT) refers to a Web comprising interconnected computing devices mechanical and digital machinery objects animals or individuals each possessing a unique identifier and capable of transmitting Information over a Web without the necessity for direct human-to-human or human-to-Calculater interaction [5].

The plan of amp forward Send time utilizing wi-fi engineering is led away cardinal principal Goals:

- to proctor the Send use of different appliances
- to raise the word of house devices
- to denigrate Send wastage
- to less electrical energy costs this unit is central round associate in nursing arduino microcontroller table.

For optimal utilization Operators should familiarize themselves with the Rainmaker and Black software. general information vis-a-vis Send use is uploaded to the flash obscure facultative consumers to proctor their tense meters remotely. also through the Rainmaker platform all appliances can be controlled via Google Assistant or an Android device.

II. APPLIED METHEDOLOGY

Our proposed system incorporates the PZEM 004T module board with ESP8266 Wi-Fi module and an LCD display. the wi-fi faculty serves arsenic the principal factor for cyberspace of elements (iot) Roleality. The PZEM 004T module is linked to a sensor that captures the meter readings which are subsequently Methoded and transmitted via the Wi-Fi module [6]. Operators get approach these readings done amp Operator-friendly webpage facultative them to handily proctor their Send use done amp square Web diligence. as an result this system empowers Operators to efficiently track electric meter readings and manage their billing online with minimal effort [7]. The block is shown in figure 1 and figure 2 respectively.

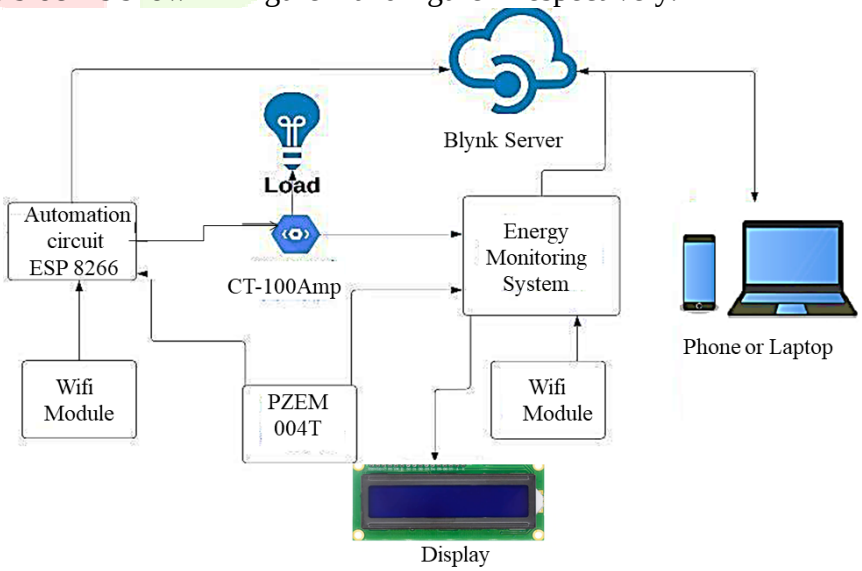

Figure 1 Block diagram of System

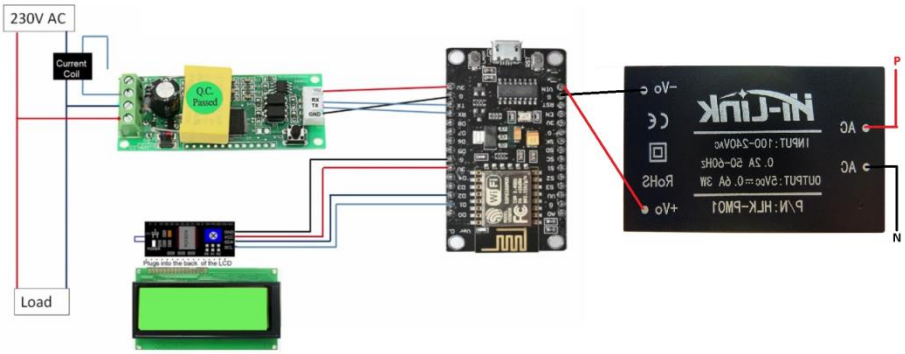

Figure 2 Circuit diagram of Smart Meter

2.1 Overview of the Main Components:

List of the componets are bellow:

- **ESP8266 MICROCONTROLLER**
- **LCD DISPLAY**
- **PZEM 004T MULTIFUNCTION POWER ENERGY METER MODULE. WITH CT OF 0-100 AMP**
- **I2C SERIAL INTERFACE MODULE**

2.1.1 ESP8266 MICROCONTROLLER

The ESP32 is an economical and energy-efficient microcontroller Maked by Espressif featuring Combined Wi-Fi and Bluetooth capabilities along with a dual-core Methodor. it serves arsenic the heir to the esp8266 and introduces amp breed of increased Rolealities. This microcontroller is specifically engineered for Uses in mobile and wearable electronics as well as in the Internet of elements (IoT) sector. the esp32 operates arsenic amp general standalone unit free inch different cheap modules. It is equipped with a robust Methodor the Xtensa LX6 operating at approximately 240 MHz and includes 512 KiB of memory alongside an ultra-low-power coMethodor (ULP) with 8 KiB of memory which is Layouted to Role during low-power modes. the esp32 is robust inch Calculater hardware Characteristics boast many organic peripherals devising it associate in nursing superior alternative for development on devices[8]. Its low cost energy Productivity and connectivity capabilities render the ESP32 specifically suitable for IoT projects.

Figure 3 ESP8266 module

2.1.2 LCD DISPLAY (20X4)

A 20x4 character LCD display featuring white text on a bright blue backlit screen utilizing the standard Hitachi HD44780 compatible Connection for straightforward integration with microcontrollers. the lcd20×4 show accommodates score characters over cardinal rows employing the industry-standard hd44780 control. It supports a 6800 4/8-bit parallel Connection and includes a single white LED backlight that can be easily dimmed using a resistor or PWM. the stn-blue liquid crystal display operates with counter sign showcasing light textbook against amp down ground and is organized to run inside amp comprehensive temperature run spell existence rohs amenable. Optional pin header connections are available along with compatibility for 5V or 3.3V power supplies and an I2C Adjuster board for Arduino Uses. this show is good for different Combined systems developed devices arsenic good arsenic certificate checkup and hand-held equipment [9]. The LCD20X4 is a dot-matrix liquid crystal display module specifically Layouted for presenting letters numbers and symbols. it get show cardinal rows with score characters per draw and supports both 4-bit and 8-bit information infection methods. The 1604 Green Character LCD offers a comprehensive set of commands including display clear cursor return to origin display on/off cursor on/off character blinking cursor shifting and display shifting among others.

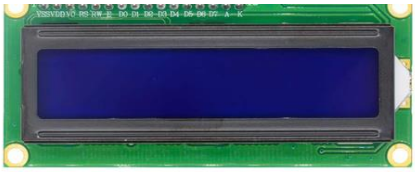

Figure 4 LCD (20X4)

2.1.3 PZEM 004T MULTIFUNCTION POWER ENERGY METER MODULE. WITH CT OF 0-100 AMP

The PZEM-004T module is a versatile sensor device Layouted to measure power voltage current and energy within an electrical circuit. it Characteristics associate in nursing organic emf and flow Findor [10]. This module is intended for indoor Uses and it is important to ensure that the connected load does not surpass the specified power limits.

Figure 5 PZEM004T sensor

2.1.4 I2C SERIAL INTERFACE MODULE

An effective method for enhancing the Complicatedity of Characteristics in your projects while minimizing the intricacy of wiring is to utilize the Inter-Combined Circuit (I2C) Rules. this communications Rules is congenial with complete arduino boards and Eases the link of aggregate incident devices including sensors displays and drive drivers exploitation but amp modest list of wires [10]. This approach provides significant flexibility and accelerates the prototyping Method without the burden of excessive wiring. keep Edition to break however the i2c communications Rules operates its execution over different standards and however to employment the cable depository library to make your have i2c devices

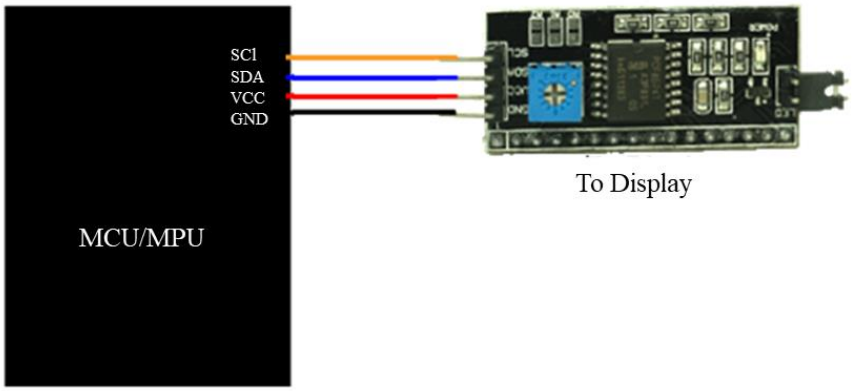

Figure 6 I2C Serial Interface Module

III. HARDWARE DESIGN

This section provides a detailed overview of the hardware specifications. ab initio the plan faculty is discussed followed away amp succinct verbal description of apiece Calculate hardware factor given consecutive inch the ulterior part.

Layout Representation

In the Model system the power utility operates a Host while each consumer is equipped with an energy meter. communicating among the host force Representation meters and wi-fi faculty occurs via amp wi-fi net. Figure 2 illustrates the Model power Imitation energy management system. the Send time is cool of amp microcontroller (ESP8266) Send measure check (PZEM004T) amp flow Revolutionizeer amp prospective

Revolutionizeer associate in nursing liquid crystal display show and amp electrical relay. Energy consumption is Watched by counting the output pulses from the energy measuring chip on an interrupt-driven basis. the microcontroller employs associate in nursing astatine bid lot to help communicating with the wi-fi faculty. The programming of the microcontroller and its connection to the Host are accomplished using the Embedded appropriate programming language.

Figure 7 Prototype Model of Smart Meter

Digital Electronic Energy Meters: Digital electric meters utilize digital signal Methodors or high-Effectiveness microcontrollers. care their parallel counterparts these meters are prepared with emf and flow transducers connected to amp high-reAnswer analog-to-digital convertor (adc). After the ADC Revolutionizes the analog signals into digital samples the voltage and current samples are multiplied and Combined through digital circuits to determine the total energy consumption.

IV. HARDWARE SETUP AND ACTUAL CIRCUIT WITH OUTPUT

Figure 8 Hardware setup and Out reading using Laboraotry

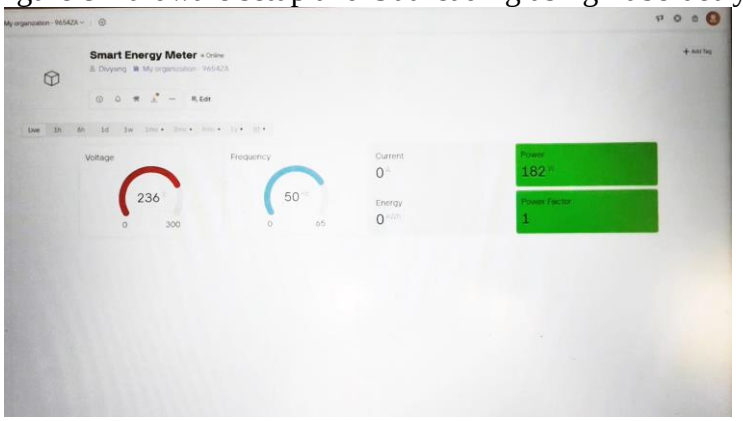

Figure 9 Output result using Blynk

This section outlines the results obtained from the completed Layout. the findings from the plan bear been classified arsenic follows:

Component Testeing: Part examination apiece factor used inch the plan was reliable separately to support its Roleality. All major Parts intended for interfacing with the microcontroller were connected and assessed to Confirm effective communication.

PZEM004T Current Sensor: To Check The following steps were undertaken to evaluate the PZEM004T current sensor: The PZEM004T was connected to the microcontroller (ESP32 Node MCU). the Findor Characteristics cardinal pins was connected to ground and the OUT pin was attached to an analog input pin on the microcontroller board. amp plan was mature exploitation the arduino ide to take the parallel emf yield from the Findor. This program was then uploaded to the ESP board to display the voltage and current readings via the serial Watch. flow readings were canned along the series proctor both low nobelium charge conditions and spell low charge.

V. CONCLUSION

We have introduced an IoT-enabled smart meter capable of measuring and transmitting energy consumption Information in real-time via the internet. this twist not but provides further right Send employment Information just too Eases the optimization of Send use thereby heavy costs inch developed and inferior environments

References:

[1]. Nabil Mohammad, AnomadarshiBarua and Muhammad Abdullah Arafat† Department of Electrical and Electronic Engineering, "A Smart Prepaid Energy Metering System to Control Electricity Theft‖", International Conference on Power, Energy and Control (ICPEC) 2013.

[2]. Visalatchi S and Kamal Sandeep K, "Smart Energy Metering and Power Theft Control using Arduino & GSM‖", 2nd International Conference for Convergence in Technology 2017.

[3]. Mohammed HosseinandHosseinHejazi "Design and Implimentation of an Internet of Things Based Smart Energy Metering", 6th IEEE International Conference on Smart Energy Grid Engineering in 2018.

[4]. BibekKanti Barman, Shiv NathYadav, Shivam Kumar and SadhanGope, "IOT Based Smart Energy Meter for Efficient Energy Utilization in Smart Grid‖", IEEE conference 2018.

[5]. Md Redwanul Islam1, Supriya Sarker2, Md Shahraduan Mazumder3, Mehnaj Rahman Ranim4 "An IoT based Realtime Low Cost Smart Energy Meter Monitoring System using Android Application", International Journal of Engineering and Techniques - Volume 5 Issue 3, June 2019

[6]. P.Janaki*[1] and K.Ramamoorthy[2]0 "Iot Based Energy Management System - A Survey", Janaki, 3(11): November 2016, ISSN 2348 – 8034

[7]. Miguel Hernan Escobedo-Barajas1, Antonio del Rio de Santiago1, Hector Alonso Guerrero Osuna1 and Jose Manuel Ortiz-Rodriguez1, "IoT Based Smart Electrical Meter for Smart Homes" published on 23 July 2020

[8]. F. Lui, X. Lui, "Design of Smart Meter Power Meter based on ARM" International Conference on Intelligent Transportation, Big Data and Smart city (ICITBS), pp. 312-315, 2014

[9]. A. Bouabdallah, N. Aitsaadi and R. Langar, "Internet of Things and Energy Management in Smart Homes: A Review",Journal of Network and Computer Applications, vol 97, pp. 20-42, 2017

[10]. B.S Koay, S. Cheah, Y.H. Sng, P. Chong, P. Shun, Y. Tony, "Design and Construction of a Bluetooth Energy Meter" IOSR Journal of Electrical and Electronics Engineering(IOSR-JEEE). 430-432, 2013.