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KWh Meter Monitoring System for Boarding House Payments using The BLYNK and ESP32 Applications

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Abstract

The growth of electrical energy continues to increase from time to time in line with increasing economic activities and community welfare. The increasing growth of electrical energy will deplete existing non-renewable energy sources if their utilization is not effective and efficient. In the utilization of electrical energy it is not known how much energy has been used so that it tends to waste electrical energy. It is necessary to measure the use of electrical energy which aims to manage electrical energy which is very important so that the process of saving and efficiency can be obtained easily. This device is designed to replace the manual electrical energy measurement system because the data obtained cannot be done all the time and the results take too long to come out. This device consists of 4 (four) parts, namely sensors, microcontroller, display and network. The sensor used is the PZEM-004T sensor which is used to measure AC voltage and current, the microcontroller is used NodeMCU which will process the sensor results, the display uses a Liquid Crystal Display (LCD).) type to display real time output data. The last part is the network as a place for permanent storage and further data processing.

Keywords: Electricity, Microcontroller PZEM-004T

INTRODUCTION

The growth of electrical energy continues to increase from time to time in line with increasing economic activities and community welfare. The increase in the growth of electrical energy will certainly consume current non-renewable energy sources if their utilization is not effective and efficient. In the utilization of electrical energy, sometimes it is not known how much energy has been used so that there tends to be a waste of electrical energy. Therefore, to find out the amount of electrical energy that is being used, it is necessary to measure the use of electrical energy. Measurement of the use of electrical energy is a very important electrical energy management process so that the process of saving and efficiency can be obtained easily. This Design and Build Monitoring of Electrical Energy Usage Based on an Android Smartphone Via Wifi is designed to obtain information related to the measurement of electrical energy in real time that can be accessed from an Android Smartphone at any time.

Measurements are usually carried out using simple measuring instruments and the recording is still manual so that the data obtained cannot be done all the time and the results take too long to obtain. This system consists of hardware and software that are interconnected so that the information presented can be accessed immediately. Hardware cannot work effectively if software is not designed properly. This device is designed to replace the manual electrical energy measurement system. This device consists of 4 (four) parts, namely sensors, microcontroller, display and network. The sensor section consists of the PZEM-004T sensor which is used to measure AC voltage and current, the microcontroller is used NodeMCU which will process the sensor results, the display uses a Liquid Crystal Display (LCD) type to display real time output data. The last part is the network as a place for permanent storage and further data processing.

RESEARCH METHODS

This chapter will explain the components used in the design of the "KWh Meter Monitoring System for boarding house payments using the BLYNK and ESP32 Applications". This system consists of hardware and software that are interconnected so that the information presented can be accessed immediately. Hardware cannot work effectively if software is not designed properly. This device is designed to replace the manual electrical energy measurement system. This device consists of 4 (four) parts, namely sensors, microcontroller, display and network. The sensor section consists of the PZEM-004T sensor which is used to measure AC voltage and current, the microcontroller is used NodeMCU which will process the sensor results, the display uses a Liquid Crystal Display (LCD) type to display real time output data.

A. KWH Meter

Kilo Watt Hour (KWH) meter is a tool to measure active energy using a calculator and using the principle of induction. The KWH meter is a tool to calculate the amount of electrical work (Watt hours) in a certain time. So the KWH meter is equipped with an aluminum disc and a calculator that can be called a mechanical counter. This measuring instrument consists of a current coil connected in series with the load and a voltage coil connected in parallel with the load. The amount of electrical work on a load for a certain time can be determined using the following equation: In the KWH meter measuring instrument the amount of electrical work is converted into mechanical energy, namely to rotate the wheels the number of revolutions of the wheels will be equal to the number of turns. electrical work used load. In addition to the KWH meter measuring instrument that uses rotating number wheels, there is another type of KWH meter measuring instrument, namely the number designation using a needle. The measuring instrument is based on the principle of induction and calculation tools, where the rotating wheels are replaced with a pointer. This KWH meter measuring instrument with a pointer has a clock plate consisting of 10 digits, ranging from 0 to 9. To be able to show a number, several groups of numbers are also needed, thus several clock plates and several rotating wheels are needed to move the pointer. The group of numbers also consists of groups of units, tens, hundreds, thousands and so on.

B. Microcontroller

Microcontroller is a functional computer system on a chip. It contains a processor core, memory (a small amount of RAM, program memory, or both), and input output equipment. In other words, a microcontroller is a digital electronic device that has input and output as well as control with programs that can be written and erased in a special way, how the microcontroller actually reads and writes data. Just as an example, imagine yourself when you start learning to read and write, when you can do that you can read any writing, either books, short stories, articles and so on, and you can also write the other way around. Likewise, if you are proficient at reading and writing data, then you can write a program to create an automatic control system using a microcontroller according to your wishes.

C. PZEM-004T Sensor

A sensor is a sophisticated device that is often used to detect and respond to electrical or optical signals. A sensor will convert physical parameters (eg temperature, blood pressure, humidity, speed, etc.) into electrically measurable signals. For example: mercury in a glass thermometer and liquid thread can convert the temperature so that it can fluctuate according to the temperature sensor. There are several criteria for selecting a sensor. There are certain features that must be considered when we choose a sensor. These criteria are Accuracy, Environmental Conditions, Range or Limits

of Measurement, Calibration, Resolution, Cost and Repeatability. And sensors have various classifications, namely primary input quantity (measurement), Transduction principle, material technology, property and application. The principle of transduction is the basic criterion followed by an efficient approach. Usually the criteria for materials and technology are selected in the engineering development group. PZEM-004T is an electronic module that functions to measure voltage, current, power, frequency, energy and power factor. With this complete function, the PZEM-004T module is ideal for use as a power meter project or experiment in an electrical network such as a house or building. The PZEM-004T module is produced by a company called Peacefair, there are 10 ampere and 100 ampere models. The PZEM-004T sensor is a sensor that can measure current, voltage, power and energy from AC current. This sensor outputs by serial communication. If it is connected to Arduino, the communication used is serial communication. The PZEM-004T sensor is quite easy to use because its output can be read directly, whether in the form of current, voltage, power or energy. For the lack of this sensor itself is not able to read AC current with milli Ampere accuracy. The PZEM-004T module is a multifunctional sensor module that functions to measure the power, voltage, current and energy contained in an electric current. This module is equipped with an integrated voltage sensor and current sensor (CT). In its use, this tool is specifically for indoor use and the installed load is not allowed to exceed the specified power. PZEM-004T is a hardware function to measure parameters of voltage, current, active power and power consumption (wh). The wiring of this module has 2 parts, namely from the input terminal wiring for voltage and current, as well as serial communication wiring. Based on requirements, this module has a TTL pin board to support serial data communication between hardware. If the user wants to communicate this PZEM-004T with a device that has a USB or RS-232 port (such as a computer), a converter cable is required (TTL to USB, TTL to RS232).

D. ESP32

ESP32 is basically an extension of the ESP 8266 with e-Lua based firmware. The ESP32 is equipped with a micro usb port that functions for programming and power supply. In addition, the ESP32 is equipped with a push button, namely the reset and flash buttons. ESP32 uses the Lua programming language which is a package of esp8266. Lua has the same logic and programming structure as c, only the syntax is different. If you use Lua, you can use the Lua loader and Lua uploader tools. In addition to the Lua language, ESP32 also supports Arduino IDE software by making a few changes to the board manager on the Arduino IDE. Before using this board, it must be flashed first so that it supports the tools that will be used. If using the Arduino IDE, use a suitable firmware, namely the firmware output from the Ai-Thinker which supports AT Command. For the use of the Firmware loader tool, the ESP32 firmware is used.

E. BLYNK App

Blynk is an application for iOS and Android OS to control Arduino,NodeMCU,Raspberry Pi and the like via the Internet. This application can be used to control hardware devices, display sensor data, store data, visualize, and others. The Blynk application has 3 main components. namely Application, Server, and Libraries. Blynk server serves to handle all communication between the smartphone and hardware. Widgets available on Blynk include Button, Value Display, History Graph, Twitter, and Email. Blynk is not tied to some type of microcontroller but must be supported by the selected hardware. NodeMCU controlled with Internet via WiFi, ESP8266 chip, Blynk will be made online and ready for Internet of Things.

F. WI-FI

“Wireless Fidelity” or abbreviated as WiFi is a technology that uses radio waves to connect

devices (PCs, laptops, smartphones) to a computer network. Or the definition of WiFi is a technology that uses radio waves so that computers can access the internet.

For a WiFi connection, a wireless adapter (without cables) is needed to build a hotspot, so that with a certain scope the user can access the internet. In connectivity, WiFi uses wireless to connect to the user's device, which generally uses a frequency of 2.4GHz to 5GHz. Initially, WiFi was only used as a wireless device on a LAN (Local Area Network) network, but along with the development of technology and user needs, now it can also be used to access the internet network.

G. Mobile Communication

Mobile can be defined as an electronic device used for two-way radio telecommunications through the cellular network of BTS known as cell sites. Cell phones differ from cordless phones, which only offer telephone service within a limited range through a single base station attached to a fixed land line, for example in a home or office.

In addition to being a telephone, modern cell phones also support many additional services, and accessories, such as SMS (or text) messaging, e-mail, Internet access, games, Bluetooth and infrared short-range wireless communications, cameras, MMS messaging, radio players, MP3 and GPS. Low-end phones are often referred to as feature phones, while high-end phones that offer more advanced computing capabilities are referred to as smartphones.

RESULTS AND DISCUSSION

The materials used for the kWh Meter Monitoring System for boarding house payments using the BLYNK and ESP32 applications are as follows:

1. USB data cable and rainbow cable
2. PZEM sensor
3. ESP32
4. 16x2 . LCD
5. Wi-Fi Network
6. Smartphones
7. Battery
8. Glue
9. Solder
10. Tin
11. PCB Board
12. Some bolts and nuts

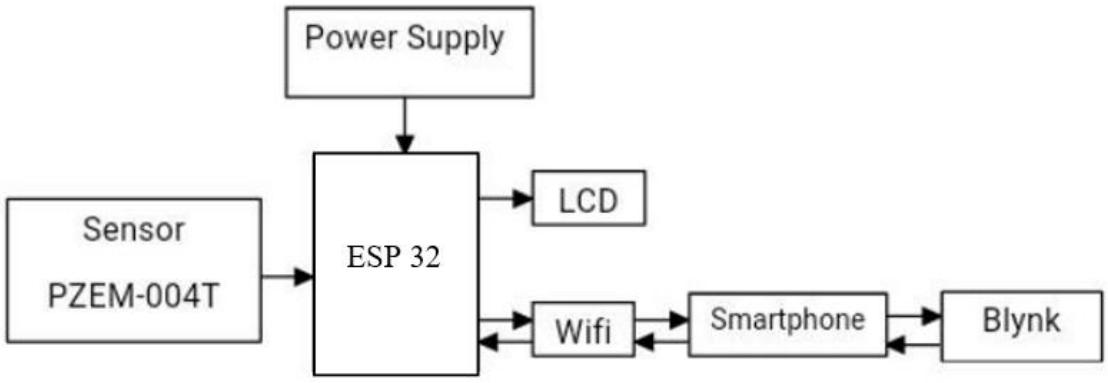
Tool making is done manually. The PCB manufacturing process is as follows:

1. Make a Schematic PCB using eagle software. The finished schematic is then created to Board.
2. In the create to Board process, the ready Schematic will be redesigned in such a way by drawing a path according to the Schematic circuit following the PCB size.
3. PCB layout printed using glossy paper or glossy paper.
4. Screen printing of glossy paper layout on a plain PCB using an iron, until the ink sticks to the PCB.
5. The printed PCB is then dissolved using a solution of ferrite chloride (FeCl) so that the unused copper layer is lost.
6. PCB line check.
7. After the PCB path is neat, punch holes in the PCB according to the screen-printed pattern using a drill.

8. Clean the PCB from screen printing ink.
9. After the PCB is clean, install the required PCB components in the designated places.
10. Install all components according to the design of the tool to be made.

A. Result Picture

The block diagram of the designed system, as shown in the figure below :

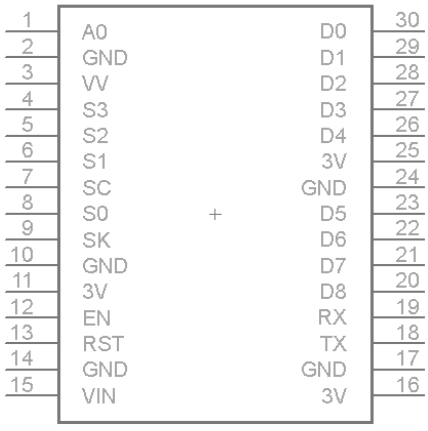


B. Function of Each Block

1) ESP block, as the brain and controller in the electronic system of the device.
2) Sensor Block PZEM-004T, as sensor input for reading voltage, current, and electric power
3) LCD block, as output display value reading voltage, current, and electric power.
4) Supply Block, as a provider of electric current sources to the tool system.
5) WI-FI network, serves as a communication medium between Android and the device's electronic system.
6) Android, serves as an output display of voltage, current, and electric power readings.
7) Blynk, an application used to display voltage, current, and electric power readings on Android smartphones.

a. NodeMCU Circuit ESP8266

The NodeMCU ESP8266 series serves as the control center of the entire existing system.

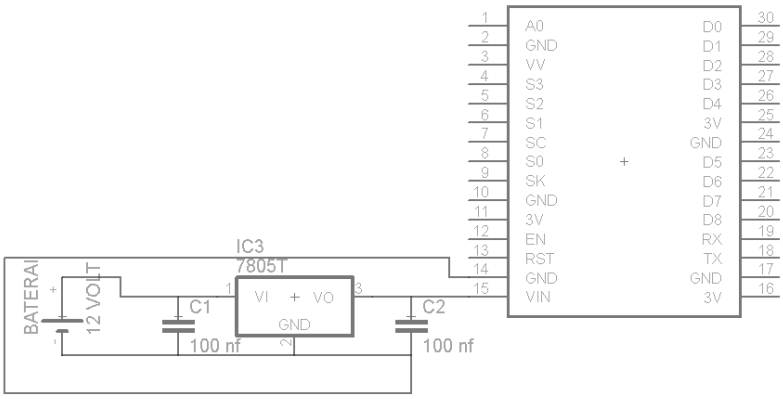


NodeMCU is basically an extension of the ESP 8266 with e-Lua based firmware. The NodeMcu is equipped with a micro usb port that functions for programming and power supply. In addition, the NodeMCU is equipped with a push button, namely the reset and flash buttons. NodeMCU uses the Lua programming language which is a package of esp8266. Lua has the same

logic and programming structure as c, only the syntax is different. If you use Lua, you can use the Lua loader and Lua uploader tools. In addition to the Lua language, NodeMCU also supports Arduino IDE software by making a few changes to the Arduino IDE board manager. Before using this board, it must be flashed first so that it supports the tools that will be used. If using the Arduino IDE, use a suitable firmware, namely the firmware output from AiThinker which supports AT Command. For the use of the Firmware loader tool, the NodeMCU firmware is used.

b. Voltage Stabilizer Circuit (Regulator)

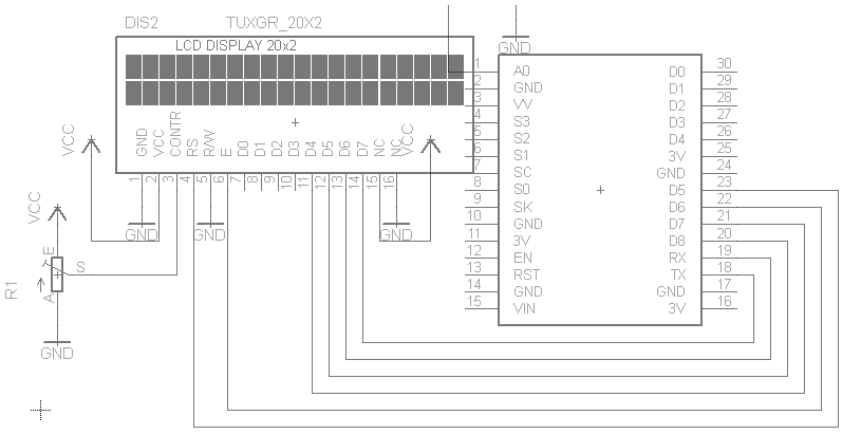
This circuit serves to provide a voltage supply from the battery to the entire existing circuit. The output of this regulator circuit is 5 volts.



In the above circuit a 12 volt battery is connected to a 100 nf capacitor, then connected to the input voltage regulator ic 7805 to get a 5 volt dc output, this 5 volt dc output will serve to supply the NodeMCU ESP8266 system.

c. LCD Circuit Designer (Liquid Crystal Display)

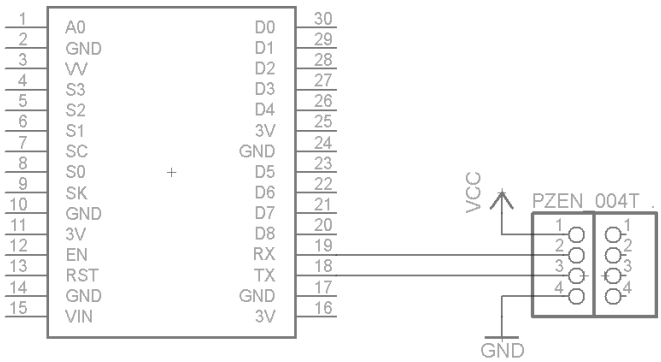
In this tool, the display used is an LCD (Liquid Crystal Display) 16 x 2. For this block there are no additional components because the microcontroller can provide data directly to the LCD, on the Hitachi - M1632 LCD there is already a driver to convert the ASCII data output of the microcontroller into a display. character. Installing a potentiometer of 5 KΩ to adjust the contrast of the characters that appear. The following is an image of the LCD circuit connected to the microcontroller.



From the picture above, this circuit is connected to PD.0... PD7, which is a bidirectional I/O pin and a special function pin, which is Analog and Digital Converter. The value that will appear on the LCD display will be controlled by the NodeMCU ESP8266 Microcontroller.

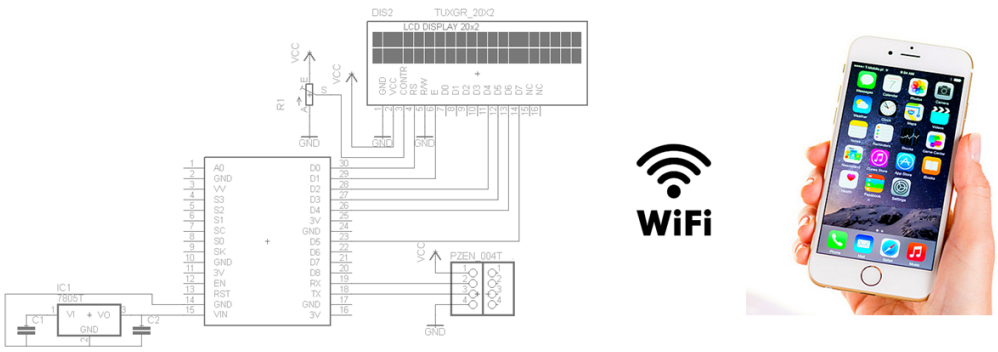
d. PZEM-004T Sensor Circuit

This circuit serves as an input reading the value of voltage, current and power generated by the measured electronic devices.



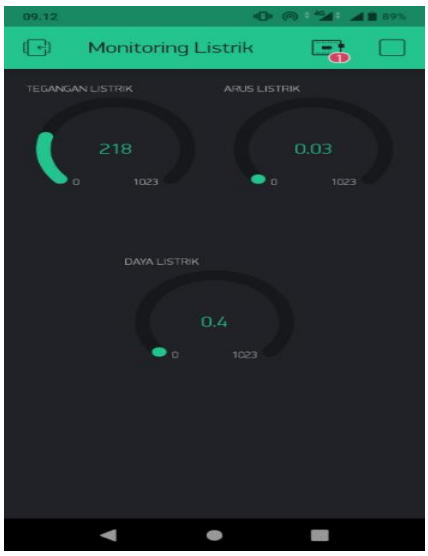
e. The Whole Tool System Circuit

This circuit is composed of the components needed to design the tool so that the data tool works as desired.



f. BLYNK Application Display On Smartphones.

The display of sensor readings results using the BLYNK application which can be downloaded via Google Playstore or Appstore.



CONCLUSION

Based on the results of the analysis of the research that has been done above, the conclusions that can be drawn are as follows:1)With this kwh meter monitoring system, it is hoped that it can help and make it easier for users to measure their electricity usage without having to do manual calculations. 2) With the kwh meter monitoring system, it is hoped that the measurement time will be efficient which is usually carried out in a longer time because it can be done from a smartphone at any time. With the kwh meter monitoring system, it is expected to save electricity use because its use is effective and efficient.

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