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Unattained Tamper Proof Digital Energy Meter Based on IOT

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Abstract: *The Unachievable Energy metre is designed to prevent tampering with readings. The concept is to employ a wireless monitoring gadget connected to a smartphone to display the amount of energy consumed. The IoT-based communication system may be linked to a digital energy meter using an MCU processor. The digital energy metre, which is made up of digital components, must be installed above the electric pole, out of reach of the energy consumer. Energy consumption data may be tracked using a smartphone, removing the need for an energy meter to be installed on the energy user's campus and the risk of metre manipulation. Energy customers may view their energy use data using IOT technology on their mobile phone instead of the main unit of the energy meter being located above the electric pole itself, avoiding meter manipulation because the main unit is not accessible to them. We only required one electronic energy metre to demonstrate the idea in action. This energy meter, which is mounted on the pole, must be updated in order for data on energy usage to be transmitted via Wi-Fi module. The metre generates and transmits proportionate pulses based on energy consumption. To improve energy meter accuracy, it is designed to generate 1600 pulses per unit consumption, with the length between the two pulses varying depending on the load. The energy meter's main unit may be installed directly on the electric pole, eliminating metre tampering because the main unit is not accessible to energy consumers; instead, data from the meter's pulse output is processed and transmitted by the Arduino MCU.*

Keywords: MCU processor, Wi-Fi module, IOT technology, Arduino

I. INTRODUCTION

The idea presented in this project will be put to the test with the help of an electronic energy metre, which is designed to generate pulses in response to the load applied to it. The pulse output from the energy metre is converted to digital and sent into the Arduino Uno. A 3 digit 7 segment display device that is interfaced with Arduino may be used to show the amount of energy consumed. The 7-segment display is meant to be visible from a distance, allowing the meter reader to modify the power bill accordingly, as this system is supposed to be mounted on an electric pole.

The project work specifications presented in this article are focused on new innovations in smart energy metering technology, which intends to eliminate the installation of an energy meter in an energy user compound, hence reducing energy theft through metre manipulation. Although smart energy meters have many advantages, the focus of this research is on using IOT technologies to show metre readings on a consumer's smartphone.

In the project work, the electronic energy metre (EEM) was used, and it has a lot of features. Its distinguishing feature is that it creates pulses dependent on the quantity of energy utilised. Based on this data, the used energy is converted to digital and shown on a 7-segment display. Because the EEM has so many useful characteristics, it can be customized to do a wide range of jobs, transforming it into a smart energy meter. The vast range of possibilities provided by smart energy metres is causing them to gain popularity. The concept is unique in that it makes use of IoT technology to broadcast energy usage data to the cell phone in question. Because this metre is designed to generate 1600 pulses per unit, it has excellent accuracy and can accurately measure very small loads.

The Arduino Uno module uses the ATmega328 microcontroller chip. It's a single-chip Atmel microcontroller from the mega AVR family. It has a Harvard architecture-based 8-bit RISC processor core. RSIC (Reduced Instruction Set Computer) is a CPU design strategy based on the premise that a reduced instruction set produces greater performance when paired with a microprocessor architecture that can execute the instructions with a restricted number of

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microprocessor cycles per instruction. RISC is used in portable devices because of its power efficiency. The RISC architecture is a microprocessor architecture.

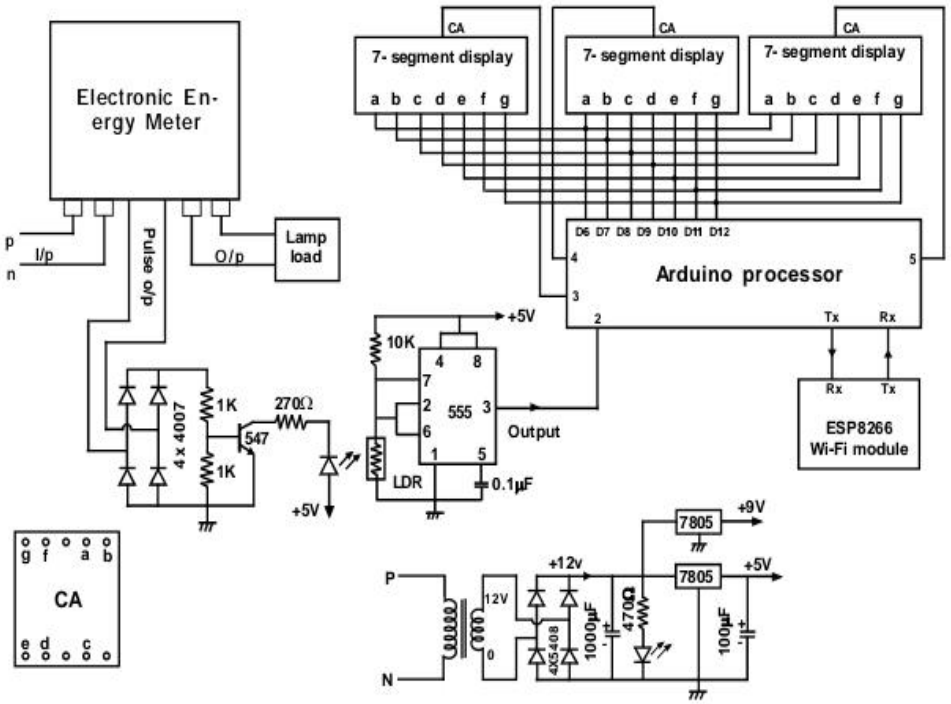
The ATmega-328 can handle data up to 8 bits and has 32KB of internal memory. It also has a 1Kb EEPROM (Electrically Erasable Programmable Read Only Memory), which ensures that the particular data saved in the EEPROM is not overwritten in the event of a power outage. PWM, Built-in-with-ADC, and other ideas

It features 11 GPIO pins as well as an analogue input. These gadgets use the 2.4GHz band to communicate at a distance of up to 150 feet. The next chapters offer a full explanation of this gadget.

II. CIRCUIT DESCRIPTION

We have a circuit built for the given project. Initially the lamp/bulb, which is connected for power generation will glow and the output of this is fed to the electronic energy meter through a connection wire. The Output of the energy meter circuit is connected to the pulse shaping circuit. The calibration of this circuit is 1600 pulses per unit energy consumption. The electric pulses then converts to light pulses. The light pulses are connected to clock pulses using LDR. These Clock pulses are created using 555 timer IC. The output of energy metering circuit is fed to the bridge rectifier to convert the ac current to dc current .Low power transistors are used in the switching circuit to provide dc voltage to the light source .Then the generated pulses are sent to the Arduino uno board pins accordingly to the circuit like connected to the 2nd pin of Arduino.

All the software necessary to operate the project is done by Arduino mainly, the programming is carried out there. From here the output pins 3,4,5 are connected to the 7 segment display to display the energy consumed in watts. And also TX ,RX pins of Arduino are connected to the ESP8266 Wifi Module .This Wifi Module helps in connecting with the mobile with the help of an application .ESP8266 gives access to the wifi network thus sending the data across the IOT platform within seconds. In this way ,the circuit arrangement is done.



IOT based unattained tamper proof digital energy meter

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III. HARDWARE DETAILS

3.1 Digital Electric Meter

The meter which contains an led/ lcd display which displays the readings of the electricity/ power consumption is simply called a digital electronic meter. The digital readings of the electronic appliances which are connected to the meter are displayed accordingly. There are two types of digital meters i.e., analog multimeter and digital multimeter, however both differ from each other in various parameters. Digital meters are the best choice for a signal which varies slightly over a large distance and we can obtain accurate readings from these meters. It has an electronic/ digital display which shows 5 digits then a decimal point, followed by some numbers.

Fig. Digital Electric Meter

3.2 Arduino Uno Board

Arduino is an open source microcontroller based on Atmega 328P.It has a set of digital input/ output pins that are interfaced with Arduino. This Board can be programmed with Arduino software. It has a USB connection that can be used for power supply as well it acts as a serial connector b/w computer and Arduino board. It has a capability of handling constant voltage upto 5V.It has a specific importance in the implementation of electronic projects.

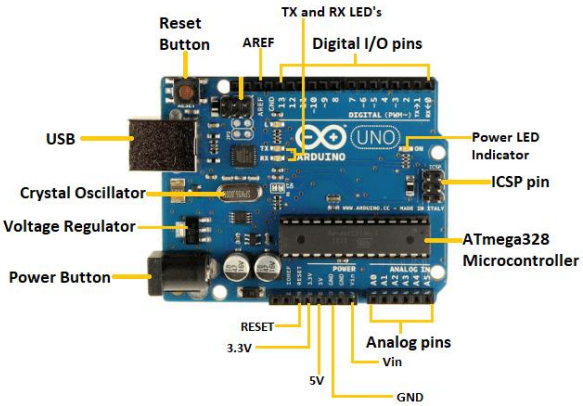

Fig. Arduino Uno Board

3.3 7-Segment Display

It is an electronic device that displays the readings in the form of digits. It can also display information in the form of images, text etc. It has applications in digital clocks, calculators, digital meters, and other electronic appliances where the information is displayed in the form of decimal digits.

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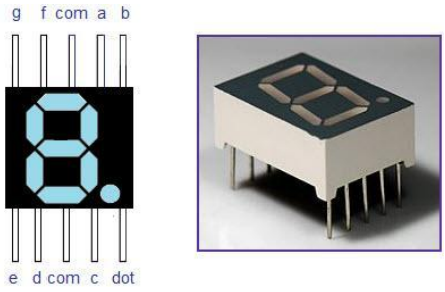

Fig.7- Segment Display

3.4 ESP- 8266 WIFI Module

It is an electronic module that can be connected to the microcontroller board for gaining access to the wifi network. It can be stand alone or can be connected to Arduino etc boards. This is a low cost, high performance , low power consumption, easy to programmable device. For connection with the mobile we need to connect it with this module for accessing the data over platforms like IOT.

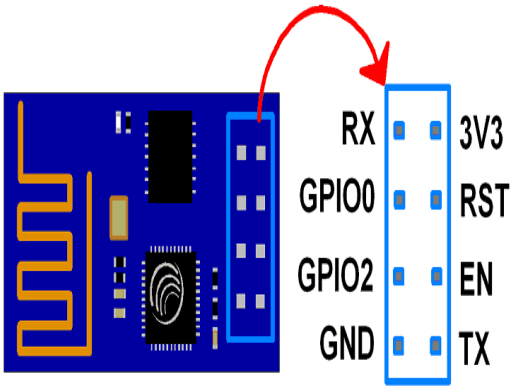

Fig. Esp- 8266 Wifi Module

3.5 Transformer

It is an electronic device that transfers electric energy from one electric circuit to another or to multiple circuits. It works based on the principle of electromagnetic induction. The magnetic force in the primary coil varies due to the current that is received by the transformer and then it in turn induces an electromagnetic force in the secondary coil. Transformers can be step-up or step-down to increase/ decrease the voltage levels respectively.

Fig. Transformer

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3.6 555 –IC Timer:

The 555 timer IC is an integrated circuit (chip) used in a variety of timer, delay, pulse generation, and oscillator applications. Derivatives provide two (556) or four (558) timing circuits in one package.The working principle of the 555 timer is by considering the block diagram of the 555 timer IC. The first comparator has threshold input to pin 6 and control inputs for pin 5.

IV. COMPONENT CONNECTIONS

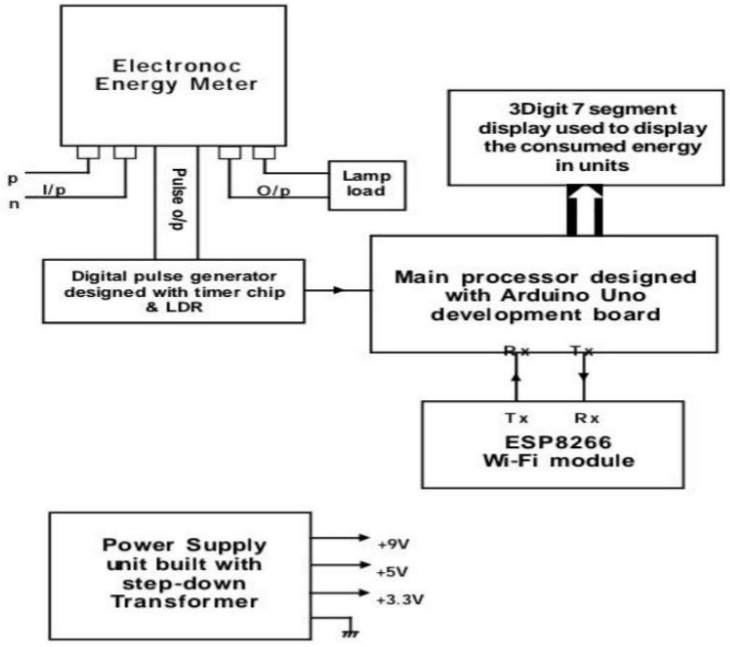

Fig. Sample Diagram

V. RESULTS

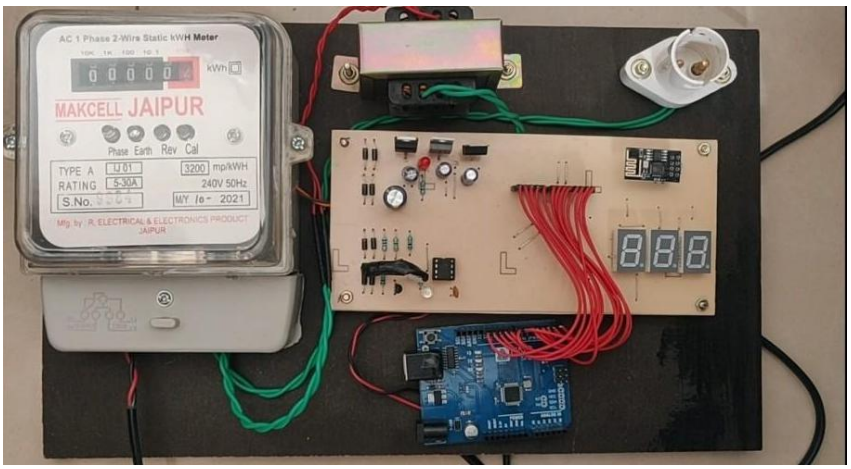

Fig (a) : Here are the connections of all the hardware material at one point.

So By giving the load with the help of a bulb the process begins.

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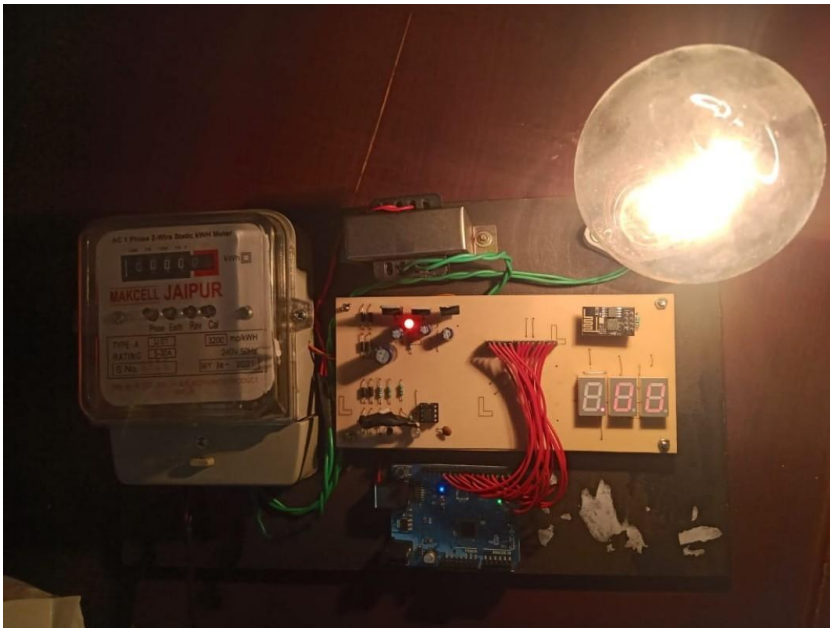

Fig (b) : So by the bulb it transfers the energy to the voltage meter and then it travels to 7-Segment Display through the Arduino Uno.

VI. ADVANTAGES

1. The meter is designed to generate pulses based on the amount of energy spent, allowing data to be saved and displayed in digital systems, or data to be communicated if necessary.
2. The meter's resolution is quite high, allowing it to correctly measure low levels as well.
3. The system is set up in such a way that energy theft is effectively avoided (totally tamper proof).
4. Human mistakes can be removed thanks to the digitized display.
5. Finally, electronic meters offer a variety of innovative capabilities, such as prepaid metering and remote metering, that can help the utility become more efficient.

VII. DISADVANTAGES

The main downside of the method is that it requires a small amount of extra electric energy due to the additional electrical hardware needed.

VIII. CONCLUSION

The project work on the "IOT based unattained tamper resistant energy meter" was finished successfully, and a prototype module was built for demonstration purposes, With good results, which is extremely near to the original operating system. The concept of a smart energy meter is a new trend in technology, and a wide range of smart systems with various features are being developed. However, the system designed with IOT technology offers unique features, such as the ability to install the energy meter directly on the electric pole, where it cannot be tampered with in any way because it is not accessible to the energy user.

Many more functionalities, such as identifying tampered energy meters, monitoring line voltage and load current, and so on, may be monitored remotely using the same network because the system uses IOT technology. If necessary, the user can turn off the power to the house from the same phone, and many other capabilities can be added to the system. Power theft may be completely eliminated by installing these types of smart energy meters throughout the home and industrial sectors for the benefit of energy users, saving the electricity department a significant amount of money.

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