IOT BASED UNATTAINED TAMPER PROOF DIGITAL ENERGY METER

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***Abstract**:* This Unachievable Energy meter is designed to prevent readings from being tampered with. The idea given here is to use a wireless monitoring device linked to a smart phone to display the amount of energy spent. The communication system is built with IoT and may be connected to a digital energy meter via an MCU processor. The digital energy meter, which is made up of digital components, must be mounted above the electric pole itself, out of reach of the energy user. Consumed energy data can be tracked using a smart phone, avoiding the installation of an energy meter on the energy user's campus and eliminating the possibility of meter tampering.

The main unit of the energy meter can be mounted over the electric pole itself, preventing meter manipulation because the main unit is not accessible to energy users; instead, they can check their energy usage statistics using IOT technology on their mobile phone. To show the theory in practice, we simply needed one electronic energy meter. This energy meter, which is mounted on the pole, must be updated so that the data on energy usage may be transmitted via Wi-Fi module.The meter generates and transmits proportionate pulses based on the energy usage.To improve energy meter accuracy, it is designed to create 1600 pulses per unit consumption, with the length between the two pulses varying depending on the load The pulse rate will increase if the burden is too heavy. The data from the meter's pulse output is now processed by the Arduino MCU and delivered. Because the IOT is linked to a smartphone, the received energy consumption data will be shown on the smartphone. The utilized energy data is shown on a 7-segment display that is interfaced with a pole unit so that it may be read from ground level by energy users or bill collectors.

1. INTRODUCTION

The concept provided in this project work will be tested in practice using an electronic energy meter, which is designed to create pulses in response to the load supplied to it. The energy meter's pulse output is converted to digital and supplied to the Arduino Uno board. Consumed energy information can be presented using a 3 digit 7 segment display unit that is interfaced with Arduino. Because this system is intended to be put on an electric pole, the 7-segment display is designed to be viewed from a distance, which in turn allows the meter to adjust itself.

The project work specifics provided in this paper are centered on new developments in smart energy metering technology, which aims to avoid the installation of an energy meter in an energy user compound, therefore preserving energy from being theft by tampering the meter. Although smart energy meters offer a wide range of benefits, this project effort is focused on displaying meter readings via an energy consumer's smart phone utilizing IOT technology.

The electronic energy meter (EEM) was employed in the project work, and it has a lot of characteristics. The key characteristic is that it generates pulses based on the amount of power consumed. The consumed energy is translated to digital and shown on a 7-segment display based on this data. Because the EEM has so many beneficial features, it can be adapted to do a variety of tasks, making it a smart energy meter. Smart energy meters are gaining popularity as a result of the wide range of features they provide.

The concept is novel in that it uses IoT technology to broadcast energy consumption information to the concerned cell phone. The main goal of this project is to create an unachievable smart energy meter that can be mounted on an electric pole. The meter's pulse will be analogue, but the microcontroller-based Arduino processor used here to do the computing process will not take analogue pulses, so the analogue pulse is transformed to a digital pulse using a pulse converter.

Though this kind of system does not present in our country, the benefits and applications of this system are numerous, as discussed in the next chapter. When it comes to smart energy meters, the potential for smart meters to provide consumers with improved information and control over their energy use, resulting in both financial savings and energy consumption control, has been debated for years. All state electricity agencies are encouraged to seek new technology to expand their benefits and find cost-efficient solutions. As an engineering student, I hope to serve my country and provide an appropriate solution to the current problem.

This innovative concept is intended to raise our state's power department's attention to it. The 4RTH chapter contains a full circuit description of the project's work. Before going into the details, it's important to know the importance of IoT technology. The Internet of Things (IoT) is a communication network in which physical things are linked to one another or to bigger systems. This network captures billions of data points from a variety of gadgets that we use on a daily basis and converts them into meaningful information. There are around 20 billion gadgets that interact with each other in the globe now, with estimates of 75 billion devices by 2025. This demonstrates that we will be living in cities with IoT in the coming year. It will evolve into smart cities that can keep up with today's fast-paced and planned lifestyles. This transformation will provide us with numerous opportunity to simplify our lives.

IoT technology allows for information sharing amongst various smart devices from anywhere in the world. In this climate, this technology has the potential to accelerate smart energy meter research.

2. DESCRIPTION

The MCP3909 chip is a popular device that is commonly used in single phase energy meters. It is a 24 pin chip that is designed to be surface mounted. This chip's internal structure allows it to meet the requirements of international metering standards. Even though the chip has a lot of features, only a few of them are used to construct a simple electronic energy meter. The analogue input data collected from voltage and current samples circuits will be transformed to digital for further processing because this chip has a 16-bit ADC internal. A constant frequency of 3.579 MHz will be generated with the help of a crystal attached externally to pins 17&18 to execute internal functions properly.

2.1 Pulse rate

The IC starts generating pulses through pins 23 and 24 based on the voltage and current samples given to pins 8 and 6, respectively, and with the help of a predetermined frequency. Because this chip can create impulses, a two-phase stepper motor can be used to drive the mechanical counter, allowing the meter reading to be displayed. Because the purpose is to display the pulse rate in digital format, the impulse is translated to digital using a timer device set to monostable operation. The pulse rate is just a measurement from a meter that displays consumption in units.

Pulses are generated through pulse output pins depending on the load supplied to the meter; as the load increases, short duration pulses are generated, implying that more pulses are generated in less time. Longer duration pulses will be created if the load is lower.

According to watt hour meter regulations, when a constant load of 1000W is supplied to the meter output terminals for one hour, the meter should reflect one unit of power consumption. This meter reading standard has been followed for the past five decades, whether it is an electromechanical meter or the most recent Smart digital energy meter, because it is an international standard.

2.2. Current Sensor

This is a well-known fact in the field of electrical instrumentation. In most circumstances, current transformers (CTs) are employed, but one Tin metal strip/plate is used as a current sensor in this project. Very little voltage will be dropped across this conductor, depending on the current running through it, and it will be measured. Because this strip must be linked in series with the load, it should be attached between the energy meter's input and output power terminals.

Depending on the current flowing, only a small amount of voltage is dropped across the Tin conductor, which is slightly greater than copper conductor. The thickness of the conductor has an effect on the voltage drop across it. According to the data available on the internet, a conductor with a thickness of one mm, a width of five millimeters, and a length of thirty millimeters is utilized. At one amp load, it is projected that about 0.1 volt will drop across the wire based on these dimensions and the description accessible on websites. 220 watts are equal to one amp load.

2.3. Digital energy meter with a digital display :

The notion of digitally displaying consumed energy provided here cannot be verified without the use of an energy meter. As a result, the energy meter plays a significant role in this project, and defining its operation is critical. The energy metering IC chosen here has a very high accuracy, allowing it to precisely measure and show the consumed energy. Power output can be utilized to drive heavy loads such as a water heater or an iron box, depending on the thickness of the current sensor linked in series with the load terminals. The energy meter's overall circuit is designed to create pulses in response to the load supplied to it.

2.4. Digital pulse converter

The semiconductor generates an analogue pulse, which is transformed to a pure digital pulse. The digital pulse generator circuit is made up of an LDR, a light source, and a 555 timer IC. The IC is set to operate in monostable mode, triggering at 1/3 and 2/3 of the operating voltage levels. The process starts with a pulse from the energy meter; whenever the meter generates a pulse, the lamp (LED) briefly glows, and the light intensity falls on the LDR (Light Dependent Resistor), causing the voltage level to drop by less than 1/3 Vcc, triggering the IC and generating a perfect square pulse. Instead of a bulb, a high-glow LED can be used in this situation.

The Arduino unit's major functions are listed below, and it is programmed appropriately.

1. To obtain data on energy use from the energy metering IC.

2. To use a seven-segment display to show the amount of energy utilized in units.

3. Using IoT, relay data to the concerned cell phone.

4. The functions listed above are the most critical functions of the Arduino unit, and the program is set up to perform them correctly. Three common anode seven segment screens are used in the display portion, with a maximum power consumption of 9.99 units. A decimal point is included, and two digits are presented following the decimal point. As previously stated, the energy meter generates 100 pulses per unit, resulting in one unit being calibrated into 100 equal parts and counting in increment mode based on energy usage.

Energy Metering IC function

1) Digital Pulse Generator

2) Microcontroller

3) Display section

4) Latch cum display driver

3. ENERGY METERING IC FUNCTION

3.1. Digital pulse generator

This pulse generator block's primary job is to transform the impulse generated by the energy metering chip into a digital pulse. The IC's pulse is nothing more than a peak impulse, which is then transformed into a square pulse. A high-glow LED is positioned parallel to the LDR (Light dependent resistor) in this block, which flashes brightly whenever the chip receives a pulse. With the help of an LDR and an IC 555 timer configured in Bi-stable Multi-vibrator mode, this light energy is transformed into discrete electrical pulses. With the help of a Microcontroller, these pulses are handled as clock pulses for subsequent stages for counting/display purposes and monitoring energy use.

3.2. Latch

The program data stored in RAM is to be displayed on a 7-segment display system, and data latches are utilized to hold this data. The display system is connected to the microcontroller through the 74LS573; the display system is driven by one microcontroller port. The unit usage is displayed on four 7-segment monitors in this case. Before a new address is placed on the bus, the processor's signal ALE becomes high, and it goes low before it is withdrawn. The address is locked into a 74LS573 8-bit transparent latch by the action of ALE going low. While the data is carried via the CPU Bus, the 74LS573 provides its latched address output to the memory.

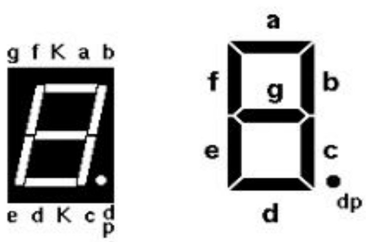
3.3. Display drive circuit

The NPN switching transistor in each display drive circuit is arranged in emitter following mode of operation with the goal of driving the display. When number 8 is displayed, all of the segments remain in glow mode, consuming about 35-40 milliamps. The controller's current output is just enough to run a low-power transistor, therefore the bc547 transistor is utilized, which has a very low base current. This transistor's output is utilized to power the display, and it can drive up to 100ma loads.

The numeric numbers are usually displayed solely on seven segment displays. It has seven LED bars that may be switched on by connecting the correct signals to the correct pins. We must light the correct portions of the LED in order to get a specified number. To display the number 3, for example, we must light segments a, b, c, d, and g. This means that a binary number may be constructed from the pattern of lighted and unlit segments.

3.4 Segment display

A visible numeric display is a requirement for many different digital devices. Of course, individual LEDs can show the binary states of a group of latches or flip-flops. We're more accustomed to thinking about and dealing with decimal numbers. To that end, we'd like some kind of display that can clearly depict decimal numbers without the need to convert binary to decimal or any other format.

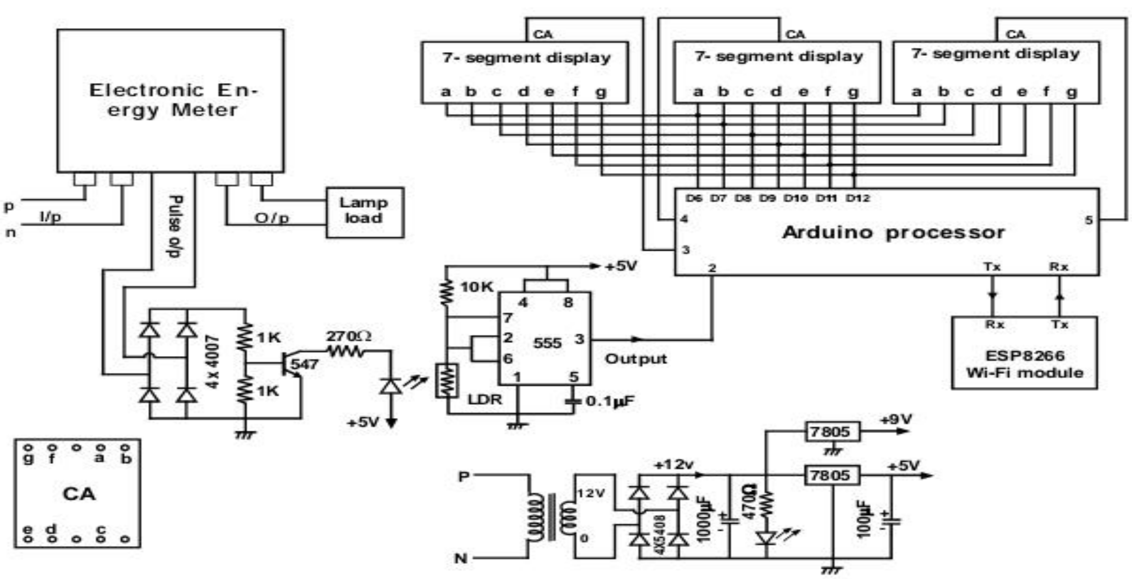


Seven-segment Display Design

A matrix of 28 LEDs in a 744 array is one option. Then, for whichever character we desire, we can light up selected LEDs in the pattern required. An enlarged version of this is utilized for fancy displays in a variety of ways. However, if all we want to show are numbers, this gets a little pricey. A much better method is to arrange the smallest number of LEDs feasible in such a way that they only indicate numbers in a straightforward manner. This just necessitates the use of seven LEDs. A common method is to utilize and moulded piece of translucent plastic to act as a customized optical fiber, distributing the light from the LED evenly across a fixed bar shape.

4. CIRCUIT DESCRIPTION

The output of the energy metering circuit is sent to the pulse shaping circuit, which is calibrated at 1600 pulses per unit of electric energy consumption (therefore the display of 1600 pulses is equal to one unit of energy consumption). Steps: a) converting pulses into light pulses; b) using an LDR, the light intensity falling on it is transformed into clock pulses; and c) creating the clock pulses using a 555 timer IC. The following are the specifics: The output of the energy metering circuits (F1 and F2) is sent to a full wave bridge rectifier, which converts the frequency input into proportional dc voltage.



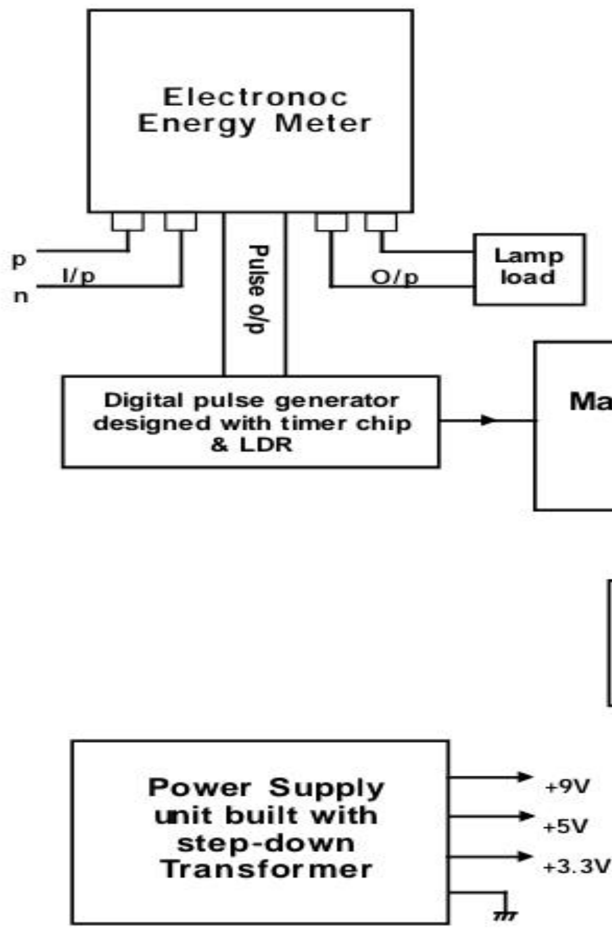
IOT based unattained tamper proof digital energy meter

The high glow LED generates a dc voltage, which is fed to the light source. The input signal given by the Metering circuit determines how bright the LED glows. Low-power transistors are used in the switching circuit to provide dc voltage to the light source. Either the positive peak or negative peak produced by the energy meter will be transformed into a positive DC source using a full wave bridge rectifier with four diodes. Through a switching transistor, this source is used to energize the LED. The light intensity of this device will fall over the surface of LDR whenever the LED is turned on. Both the LDR and the LED are positioned parallel to each other The LDR is now connected to a timer chip, which is set to operate in mono-stable mode. The energization and de-energization of the light source are translated into clock pulses. Pins No. 2 (Trigger Pin) and No. 6 (Thresh Hold Pin) of the 555 timer IC are set to 1/3 and 2/3 VCC, respectively. As a result, anytime the voltage at Pins 2 / 6 is less than 1/3 VCC or greater than 2/3 VCC, state transitions occur. The resistance fluctuations of the light dependent resistor cause this voltage variation. Because of the light landing on it, this LDR variation occurs. As a result, the timer's output generates clock pulses in response to variations in light/resistance. As a result, the pulse-shaping circuit generates clock pulses, which are required by the controller for counting and reporting energy consumption.

Pin Description

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

5. COMPONENTS



5.1. HARDWARE COMPONENTS

This chapter's goal is to collect data sheets for key components used in the project. Important information from the data sheet provided by the specific component manufacturer is acquired from websites and used in this chapter. The data sheets are displayed as individual folders.

Important electrical components such as ICs, transistors, sensors, and other components must be interconnected over a well-fabricated PCB for a stable and high-quality output. The quality of components determines the performance of any well-designed electrical circuit. The following are the major components that were used in this project.

1 – Arduino

2 - Voltage Regulator

3 – 555 Timer IC

4 – Wi-Fi module

5 – LDR

6 – IC74543

5.1.1 Arduino

Arduino is a simple software board, microcontrollers and microcontroller kits for making digital devices and interactive things with physical and digital sensing and control.

Anyone can distribute it. Commercially available Arduino boards are either preassembled or sold as DIY kits.

A wide range of microprocessors and controllers are used in Arduino board designs. The boards provide digital and analogue input/output (I/O) pins that can be used to connect to expansion boards, breadboards (shields), and other circuits. Microcontrollers are often programmed using a dialect of C and C++ programming features. The Arduino project includes an integrated development environment (IDE) based on the Processing language project, in addition to standard compiler tool chains.

Arduino is made up of a hardware programmable circuit board (also known as a microcontroller) and software, known as an IDE (Integrated Development Environment .

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Inpu Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

5.1.2. WI-FI MODULE

It's surprising to learn that many individuals are unaware that Wi-Fi stands for wireless fidelity. Even those who do aren't always aware of the meaning of Wi-Fi. There are other theories regarding what the phrase signifies, but Wireless Fidelity is the most widely acknowledged meaning in the tech sector.

Wireless technology has been quite popular in recent years, and we may connect nearly anywhere: at home, at work, at libraries, schools, airports, hotels, and even some restaurants. Because it encompasses IEEE 802.11 technology, wireless networking is referred to as Wi-Fi or 802.11 networking. Wi-Fi's main benefit is that it works with nearly any operating system, game device, and modern printer.

5.1.3. MICROCONTROLLER

Microcontrollers are single-chip computers that have a central processing unit (CPU), data and program memory, serial and parallel I/O (input/output), timers, and external and internal interrupts. Microcontrollers are smart electrical devices that are used to operate and monitor real-world devices. Microcontrollers are now found in nearly every piece of commercial and industrial machinery. Office automation, such as PCs, laser printers, fax machines, and other devices, account for about 40% of microcontroller applications. Consumer electronics products contain about a third of all microcontrollers. Products like

This includes CD players, hi-fi equipment, video games, washing machines, and cookers. The other application areas include the communications market, the automobile market, and the military.

Microcontrollers are electronic devices that can be programmed. A program is a set of instructions that the microcontroller follows to do a certain task. Microcontrollers have typically been programmed in the target processor's low-level assembly language. This is a set of mnemonics that contain a succession of instructions. The most significant disadvantage of assembly language is that different manufacturers' microcontrollers utilise different assembly languages, requiring the user to learn a new language each time a new processor is selected.

5.2. DESCRIPTION OF ARDUINO UNO PROCESSOR

Arduino boards are utilized in a variety of electronic and telecommunication applications. Arduino is a single-board microcontroller that may be used to customize applications, interactive controls, and surroundings. A board based on an 8-bit microcontroller or a 32-bit ARM is used as the hardware. A USB port, analogue inputs, and GPIO pins are all included in current models, allowing the user to connect additional boards. The acronym GPIO stands for General Purpose, Input, and Output. All of the CPUs we use have a few, and the Raspberry Pi and Arduino both have a bunch of General Purpose Input Output that we can use to create our circuits.

All Arduino boards are open-source, allowing users to create them on their own and customize them to meet their own needs. The software is also open-source, and it is evolving thanks to contributions from users all over the world.

5.3 DISCRIPTION OF WIFI MODULE

Because of the convergence of different technologies, real-time analytics, machine learning, sensors, and embedded systems, the definition of the Internet of Things has expanded. IoT technology is most closely associated with items that enable the concept of the "smart home" in the consumer market, which includes devices and appliances that support one or more common ecosystems.

5.3.1. History

The current vision of the IoT is based on Mark Weiser's 1991 paper "The Computer of the Twenty-First Century," as well as academic forums such as Ubi=Comp and Pe-Com. Between 1993 and the present, Several firms, such as Microsoft's at Work and Novell's NEST, suggested solutions in 1997. When Bill Joy proposed device-to-device communication as part of his "Six Webs" paradigm at the World Economic Forum in Davos in 1999, the field gained traction.

Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Center, is thought to have invented the term "Internet of things" in 1999, though he prefers the phrase "Internet for things." He saw radio-frequency identification (RFID) as critical to the Internet of Devices at the time, as it would allow computers to manage all of the individual things. Cisco Systems estimated that the Internet of Things was "born" between 2008 and 2012.

5.3.2. APPLICATIONS

1. Smart home
2. Medical and healthcare
3. Building and home automation
4. Industrial applications
5. Manufacturing
6. Agriculture
7. Energy management
8. Internet of military things
9. Internet of Battlefield Things

5.3.3. ARCHITECTURE

In its most basic form, IOT system architecture comprises of three tiers: Tier 1: Devices, Tier 2: Edge Gateway, and Tier 3: Cloud. Devices are networked devices like sensors and actuators found in IoT equipment, especially those that link to an Edge Gateway using protocols like Modbus, Bluetooth, Zigbee, or custom protocols. Edge Gateways are sensor data aggregation systems that provide capabilities such as pre-processing data, securing connectivity to the cloud, and even edge analytics or fog computing in certain circumstances, employing technologies such as Web-Sockets, the event hub, and, in some cases, edge analytics or fog computing. The Edge Gateway layer is also needed to provide a common picture of the devices to the upper levels, making management easier. The cloud application designed for IoT using the microservices architecture, which are typically polyglot and inherently secure using HTTPS/OAuth, is the ultimate tier. It encompasses a variety of sensor data database systems, such as time series databases and asset stores that use backend data storage systems (e.g. Cassandra, PostgreSQL). In most cloud-based IoT systems, the cloud tier includes an event queuing and messaging system that manages communication across all tiers. The three levels of the IoT system are characterized by some experts as edge, platform, and enterprise, and are connected through proximity network, access network, and service network, respectively.

5.4. Timer chip description

The 555 is an integrated circuit that can be used to implement a number of timer and multi-vibrator functions. The 555 timer is one of the most widely used and adaptable integrated circuits. On a silicon chip, it has 23 transistors, 2 diodes, and 16 resistors fitted in an 8-pin small dual-in-line package (DIP-8).

The 555 has three modes of operation:

• Monostable mode: the 555 acts as a "one-shot" in this mode. Timers, missing pulse detection, bounce free switches, touch switches, Frequency Divider, Capacitance Measurement, Pulse Width Modulation (PWM), and other applications are examples.

• Astable - Free Running Mode: The 555 can be used as an oscillator in this mode. LED and lamp flashers, pulse production, logic clocks, tone generation, security alarms, pulse position modulation, and other applications are all possible.

• Bistable mode or Schmitt trigger: if the DIS pin is not connected and no capacitor is utilized, the 555 can function as a flip-flop. Bounce-free latching switches, for example, are one application.

5.5. An overview of electronic energy meters

Electrical metering device technology has advanced significantly since its inception more than a century ago. Many advances have resulted in size and weight reductions, as well as improvements in features and specifications, since the initial huge meters with hefty magnets and coils.

The benefits of electronic energy meters are as follows:

1. Accuracy: While electromechanical meters often have a Class 2 accuracy, electronic meters with a Class 1 accuracy are quite popular.

2. Low Current Performance: After a few years, most electromechanical meters slow down and stop recording under low loads, often less than 40% of their basic current. This is because their bearings are causing more friction.

3. Low Voltage Performance: Mechanical meters lose accuracy at voltages below 75% of rated voltage, but electronic meters record accurately at 50% of rated voltage. This is a significant benefit in areas where low voltage issues are widespread.

4. Installation: The mechanical meter is quite sensitive to its installation location. It will run slowly if it is not installed vertically, resulting in revenue loss. Electronic meters aren't affected by where they're mounted.

5. Tamper: Mechanical meters may be tampered with extremely easily, even without disrupting the wiring, by introducing a thin film into the meter to touch the rotating disc, or by using an external magnet. In addition to these ways, there are more than 20 external wiring circumstances that can cause a single-phase meter to record less data. External wiring on a three-phase meter can be altered in four ways to slow it down. Electronic meters cannot be tampered with using any of these methods. They also use LEDs to show the existence of tampering.

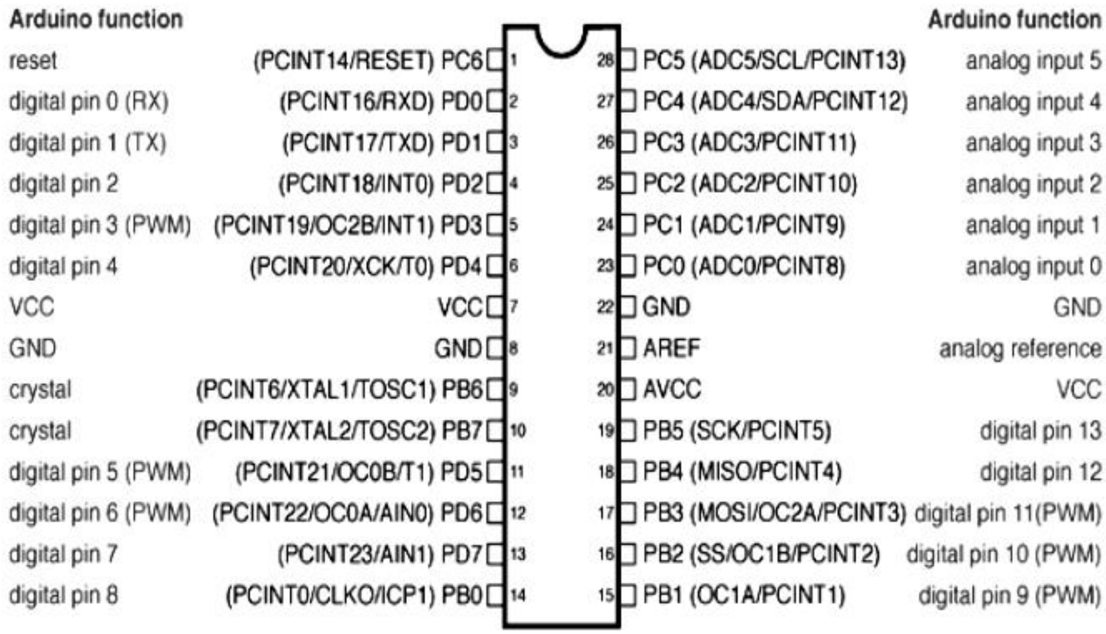
6. New Functions: Many new capabilities, including as prepayment metering and remote metering, are available with electronic meters, which can help the utility become more efficient.

6. WHY ARDUINO?

• Low-cost - When compared to other microcontroller platforms, Arduino boards are a bargain. The Arduino module's cheapest version can be assembled by hand, and even pre-made Arduino modules cost less than $50.

• Cross-platform - The Arduino Software (IDE) is compatible with Windows, Macintosh OSX, and Linux. The majority of microcontroller systems are only compatible with Windows.

People who want to learn more about the language can use C++ libraries, and those who want to learn more about the technical specifics can switch from Arduino to the AVR C programming language. Similarly, if you want to, you can include AVR-C code directly in your Arduino applications.



Digital Pins 11,12 & 13 are used by the ICSP header for MOSI, MISO, SCK connections (Atmega168 pins 17,18 & 19). Avoid low-impedance loads on these pins when using the ICSP header.

7. ADVANTAGES

a) 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.

b) The meter's resolution is quite high, allowing it to correctly measure low levels as well.

c) The system is set up in such a way that energy theft is effectively avoided (totally tamper proof).

d) Because of the digitalized display, human error can be eliminated.

e) Finally, electronic meters offer a variety of innovative capabilities, such as prepaid metering and remote metering, that can help the utility become more efficient.

8. 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.

Solution: The bulky hardware can be transformed into a small-integrated chip when the system is converted into an engineering module. The system consumes less power when the hardware is decreased.

9. APPLICATIONS

A smart energy meter equipped with a microcontroller for safe data storage and processing capacity can be utilized for multiple purposes at the same time, making it a very versatile technology. Access control, data transmission, data storage, finance, and data carrier are common functional categories for smart energy meter applications. The system's principal application is AMR (Automatic Meter Reading System). State electrical bureaus would benefit greatly from such systems.

10. 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, which is extremely close to the genuine operating system, with satisfactory results. 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.

11. REFERENCES

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(2) – Getting started with Arduino – Mossimo Banzi