

Prepaid Energy Meter with Automatic Billing and Theft Detection

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ABSTRACT- Electricity is very necessary in our day to day life. The introduction of the Prepaid Electricity System in order to address the issues of overbilling, meter tempering, fault finding and to ensure a cost-effective operation. This paper discusses the IOT-based smart prepaid energy meter as a measure to make electricity available to every consumer. On their mobile phones, the user gets messages about the devices they bought using IOT technology. In the society we live in, electricity powers almost everything. Their non-renewable energy sources account for 67% of the energy they use to generate power. "Electricity" is the word that currently rules the world, and power is the soul of the world, which is linked to electricity. Therefore effective use of these tools is crucial to us. From the electricity board section, the consumer receives the information about the bill amount, prepayment information and details of the pre-planned power shutdown. This system's benefit is that a user can understand the power consumed by the electrical appliances every 10 days and takes further actions to control them, aiding in energy conservation. The user receives a message if the customer doesn't pay the payment on time. If the customer continues to not pay the bill, then one alert message will be sent as per the specified consideration, and then the power connection to the remote server will be cut off automatically. The energy consumed by the appliances starting on the energy meter installation date is shown in the already installed smart energy meter, along with the equivalent rupees. The suggested energy meter provides daily energy consumption, its associated rupees, daily meter fault finding, billing information, and IOT payment options.

KEYWORD: Internet of Things (IOT), Electricity, Non-renewable energy, Prepayment and Power consume, Alert message.

I. INTRODUCTION

The distribution and management of electrical energy are given top priority in global government policies because it is now a vital component of human existence and that of the nation's survival, socioeconomic development, and progress. One of the biggest issues harming India's power sector is electricity theft, which includes any action taken to allow electricity consume to use electricity without the proper permission of the utility in order to avoid paying for the energy. Electricity meter plays a crucial role in this because it measures the globe by electronics energy measurement technology. The job of reading the energy meter will undoubtedly be more convenient with a wireless digital energy meter. Electricity meter are typically placed on consumers' properties, and meter readers record the information during their fortnightly or monthly visits to the property. The following factors, which are leading causes of losses for distribution businesses, energy theft committed by tampering with the energy meter, malfunctioning meters, meter reading errors, and unpaid bills. Delayed Generation of Energy Bills. We have implemented the Prepaid Electricity System to address the issues of overbilling, meter tempering, and to guarantee a cost-effective operation. Using GSM technology, the customer gets messages about the products they bought on their mobile phones. Before the power was cut off, a warning message was sent to the user's mobile device via GSM technology. The development of a low-cost Internet-of-Things (IOT) based energy theft detection and prevention system is the study's main goal. The networked interconnection of everyday objects is what the Internet of Things (IOT) is described as. The Internet of Things (IOT) has assisted many organizational systems in increasing process speed, reducing error, preventing theft, and improving efficiency by coding and tracking items as well as detecting consumer-level faults. If we can keep an eye on how much energy we use each day and turn off any appliances that aren't absolutely essential, we can greatly reduce our power consumption. The idea is being proposed to reduce the human interference to collect the monthly reading and to minimize the technical problems regarding the billing process. From the electricity board section, the information to use electricity without the proper permission of the utility in order to avoid paying for the energy. Electricity meter plays a crucial role in this because it measures the globe by electronics energy measurement technology. The job of reading the energy meter will undoubtedly be more convenient with a wireless digital energy meter. Electricity meter are typically placed on consumers' properties, and meter readers record the information during their fortnightly or monthly visits to the property. The following factors, which are leading causes of losses for distribution businesses, energy theft committed by tampering with the energy meter, malfunctioning meters, meter reading errors, and unpaid bills. Delayed Generation of Energy Bills. We have

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I.I.OBJECTIVES:

1. Calculate energy usage precisely.
2. Account amount is shown accurately.
3. Utilize the cloud to communicate with the user.
4. Inform the user if the account balance is insufficient.
5. Turn off the electricity when the account has no credit.
6. Minimize instance of power theft.
7. It can easily sense smoke and fire.

II.EXISTING SYSTEM

Prepaid energy meter with smart card one is the smart card, and the other is the smart card reader, which make up the two major parts of this kind of prepaid energy meter. A smart card is essentially an integrated device that is embedded on a plastic credit card. It contains various components, including CPU, ROM, EEPROM, etc. To manage the data on a smart card, a complete smart card operating system must be used. With this type of scheme, the customer can load as many units as he wishes on his card. The card is then put into a card scanner that has an energy meter built right in as a complete unit. Once the card reader has finished working and has stored the units from the smart card. Following the completion of the card reader's task and the storage of the smart card's available units, the energy meter deducts units in proportion to the amount of power used. When the unit hits zero, it cuts off the electricity until it can be recharged.

- *Prepaid energy meter with GSM technology*

In this type of scheme, consumers send a message to smart meters via the GSM network after topping off their cell phone accounts. As much money is sent to the energy meter, it purchases a certain number of units, which it then stores. As the consumer uses electricity, the energy meter reduces the number of purchased units, and when the purchased units are exhausted, electricity is turned off.

III.METHODOLOGY

RFID based smart meter

A RFID tag is attached to or merged into a thing, animal, or person with the true objective of recognizable proof and following using radio waves. Radio-frequency identification (RFID) is a programmed recognizable proof strategy, depending on storing and remotely recovering information utilizing devices called RFID tags or also known as transponders. In order to implement this plan, the users make use of the RFID cards provided by the power companies. By using the code on the new RFID cards to recharge them, the energy could be bought. When the customer needs to use the electricity, he must present the card to the reader. When this happens, the reader recognizes the unique code inside the card and starts deducting the RFID card amount in accordance with the quantized unit fee. After using up the entire quantity, the consumer must recharge the RFID card once more.

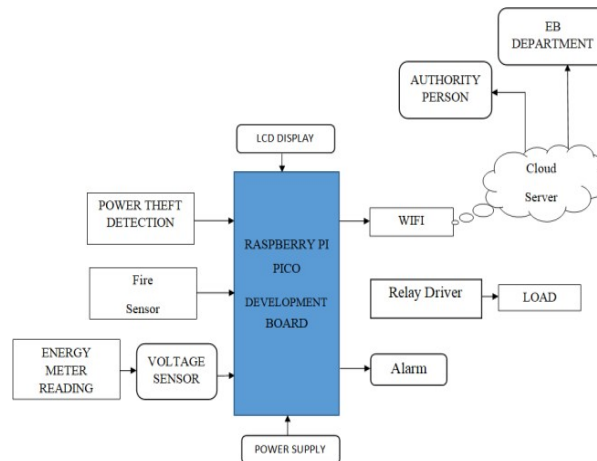
PROPOSED SYSTEM:

The current model requires a lot of work and takes a long period. The suggested method eliminates the need for User and is both a time and money saver. The proposed system provides information about daily energy consumption, billing and payment via IOT, pre-intimation of shutdown details, alert systems when energy consumption exceeds beyond the critical limit, and power disconnection via message when residential are out of station to prevent energy waste.

The project's operation is shown in the above image. The Node MCU first creates a network for communication with the user after initialization. The load is switched on if the balance is above optimal balance after initialization by the controller. The manager will send an SMS requesting that the energy account be recharged if the balance falls below a certain amount.

IV.HARDWARE REQUIREMENTS:RASPBERRY PI PICO

The first microcontroller board built on the RP2040 is the Raspberry Pi Pico. With the MCU in the middle, a micro-USB connector on one end, and an array of contacts along each side, it resembles other microcontroller boards quite a bit. The board has a 3-pin debug connection on the opposite end. The precise dimensions of the Raspberry Pi Pico are 51 by 21 mm, making it slightly larger than an Arduino UNO or Micro and identical in size to an ESP32 Pico Kit. The Pico has 25 of the RP2040's 30 GPIO ports exposed on extension connectors, and it has 2 MB of QSPI Flash memory. The board is ideal for use with a breadboard and fits their precisely.

**VOLTAGE SENSOR:**

Fundamentally, they are a sort of device that can detect, recognize, and respond to specific electrical or optical signals. As an outstanding alternative to traditional current and voltage measurement techniques, voltage sensor and current sensor implementation has become very popular.

FLAME SENSOR:

One type of detector that is primarily made for both sensing and responding to the occurrence of a fire or flame is a flame-sensor. Its fitting may affect the flame sensing reaction. It has a fire suppression system, a propane line, a natural gas line, and an alert system. In commercial furnaces, this sensor is utilized. This has the primary purpose of providing verification of the boiler's correct operation. Because of its mechanism for sensing the flame, these sensors respond more quickly and accurately than a heat or smoke detector.

ENERGY METER:

The disc on the energy meter, whose rotation determines the load's power usage, is there. Between the air space of the series and shunt electromagnet is the disc. The pressure coil is located in the shunt magnet, and the current coil is located in the series magnet. Due to the source voltage in the pressure coil and the current in the current coil, the magnetic field is generated. Eddy current is created in the disc as a result of the voltage coil's field trailing by 90 degrees on the current coil's magnetic field. The torque produced by the eddy current and magnetic field's interplay pulls on the disc. The disc thus begins to rotate.

NODE MCU:

A UART serial connection can be used to add Wi-Fi capability to an existing microcontroller project using the impressive and affordable ESP8266 Wi-Fi module. With the addition of electricity, the module can even be reprogrammed to function as a standalone Wi-Fi-connected device.

RELAY:

One of the most significant electromechanical devices, particularly in automation uses, is the relay. A relay is used to switch electrical circuits running at high AC voltage on or off using a low DC control voltage. This is known as electronic to electrical interfacing. A relay typically consists of two components: a mechanically movable switch and a coil that works at the rated DC voltage. The electrical isolation between the electronic and electrical circuitry and their magnetic connection prevent any fault on one side from affecting the other.

V. SOFTWARE REQUIREMENTS

MICRO PYTHON:

Micro Python is a complete Python 3 implementation that can be used with embedded devices like the Raspberry Pi Pico. You receive a built-in file system, an interactive prompt (the REPL), and the ability to run instructions instantly over USB Serial.

THONNY IDE:

Coding tools called Integrated Development Environments (IDEs) make creating, debugging, and testing code simpler. Numerous offer beneficial features, including code completion, grammar highlighting, debugging tools, variable explorers, visualization tools, and many others.

UPYCRAFT IDE:

An integrated development environment called uPyCraft IDE is used to program development devices in the Micro Python programming language. It streamlines the processes for developing firmware, debugging code.

ADVANTAGES OF PROPOSED SYSTEM:

- No more estimates, just accurate invoices.
- Able to carefully monitor the utilization and spending.
- Pay Oriented.
- It can lessen energy waste caused by theft detection.
- It stops fire-related damages from happenings.

VI. APPLICATIONS:

- Home Appliances.
- Electricity Board.
- Industries and Factories.
- Commercial uses.

VII. RESULT AND ANALYSIS:

Only when the system balance is higher than or equal to one rupee does the power supply turn on. The system calculates the power used by the connected load and subtracts that quantity from the remaining balance. The system notifies the user via notifications.

1. To prompt the user to recharge, the system amount is Rs. 1.
2. When the balance reaches 0, indicating the electricity has been turned off.
3. The person recharges the system.

The system can be refilled by the user by sending a simple SMS to the system. Through the GSM module, the system gets the message. After the message is received, the Arduino decodes it based on the code, recharges the system, alerts the user that a recharge of Rs. 10 has been made and turns the power back on by activating the relay. By providing a straightforward mechanism that switches OFF the power supply by activating the relay whenever the

electricity meter protective casing is lifted or someone attempts to force it Open, the system is made impenetrable to tampering. This has been done in order to check the practice of users manipulating meter readings in order to use energy for free or at a significantly reduced cost. By using a current sensor that detects the electricity owing through the load end of the meter even after the power supply is turned OFF after the balance has become zero, the system notifies the electricity board whenever a user attempts to use electricity even after the balance in his or her account falls to zero.

VIII. CONCLUSION

The Prepaid Electricity Meter with Theft Detection Project has been successfully implemented, and it has uses in homes, particularly in rural areas. Due to its low cost and ability to stop income leakage to the already overworked electricity boards brought on by electricity theft, this system can be widely adopted. The primary benefit of this initiative is its low-cost approach to prepaid metering of electricity consumption, which also prevents household-level electricity theft. The tamper detection feature prevents any user tampering with the energy meter to change or halt the calculation of consumption units. Wireless meter reading system in the current work is designed to continuously monitor the meter reading and it avoids human intervention, provides accurate meter reading, avoids billing error, and reduces maintenance cost. To reduce issues like unpaid bills, billing irregularities, inaccurate meter readings, and illicit payment from customers because of bribed service man, this system can be a powerful tool for having efficient use of electricity.

UTURE SCOPE

The 21st century does not allow for mistakes or flaws in any technical system or in everyday uses. The idea of prepaid energy meter is advantageous for the future. It makes the payment of electricity expenses easier. Electricity Shops in the area will sell coupons. Prepaid translates to "pay before." use" one of this idea's advantageous features An energy prepayment meter is employed to prepaid the current energy supply to homes, businesses, and other places.

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