Smart Prepaid Energy Meter with Theft Detection

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Abstract: Electromechanical electricity meters are used in India, although they have drawbacks such as power theft, erroneous meter reading, invoicing, and users' unwillingness to pay their electricity bills on time. As a result, such techniques are being phased out in favor of more complex and precise digital and electronic meters. This paper presents a novel approach for implementing a controller. with prepaid energy meter Theft Detection System is primarily used to detect both internal and external energy theft. Internal energy theft takes place after the energy has reached the energy meter, whereas external energy theft takes place before the energy has reached the energy meter. The device prevents theft while simultaneously allowing consumers to utilize the prepaid energy meter. Users may pay in advance and spend the appropriate amount of money energy using this option. When external or internal theft happens in the system, the system notifies the appropriate authority or user through display. The system will also be able to show when the prepaid balance is low or zero. Atmega Microcontroller, current sensors, LCD display, energy meter, and loads make up the system.

Keyword - Smart meter, Safety control, SMS, AMR, PC, Theft Control, etc.

I. INTRODUCTION

Electrical energy has become a necessary for human survival. Its production and correct use are essential for a country's existence, socioeconomic growth, and progress. As a result, its distribution and administration are given top attention in worldwide government programmers. Pilferage of distribution lines and linked equipment such as energy meters, distribution boxes, and other connectors causes significant distribution losses in India. Electric metering is vital in the utility distribution system because it measures consumers' power use and creates bills, which are a source of revenue [1]. Electricity theft is one of the most serious issues plaguing India's power industry; it encompasses any action that involves the use of electricity, in order for electricity users to use electricity without the utility's permission in order to avoid paying for it. Electronic energy measurement is gradually replacing

traditional electromechanical metering equipment across the world. The chore of reading the meters will be made much easier with a cordless digital energy meter. The following are some of the reasons why distribution businesses are losing money: [2] Tampering with electricity meters, nonfunctional meters, meters reading errors, and unpaid bills are all examples of power theft. Delay in generating power bills [6] We created the Prepaid Electricity System to address the issues of overbilling and meters tampering while also ensuring a cost-effective operation. Using technology, the user receives messages on their mobile phones regarding the units they purchased. Before the power was turned off, a warning message was delivered to the user's mobile phone through technology. The primary goal of this research is to develop a cost-effective method for detecting and preventing electricity theft, which has aided many organizational systems in improving efficiency, speeding up processes, reducing errors, and preventing theft by coding and tracking objects, as well as detecting faults at the consumer level. If we can keep track of our daily power usage and turn off appliances that aren't in use, we can drastically minimize our energy consumption. The [3] concept is to limit human intervention in the monthly reading collection procedure while also minimizing technological issues with the charging process. The consumer receives information from the electrical board department about the bill amount, payment, and specifics about the pre-planned power cut off. The user gets notified by display with controller if the client fails to pay the bill on time.

II. EXISTING SYSTEM

For monitoring use in the existing system, either an electronic energy meters or an electro-mechanical meter is installed in the premises. The meters that are now in use can only record in KWH units. Meter readers had to manually record the KWH units consumed back then on a monthly basis. A meter reading business will need to process the recorded data. "To process the meters reading, the company must first link each recorded power usage data to an account holder, and then calculate the amount owed using the current tariff. For Automatic Meter Reading, many systems built on various platforms have been proposed by various research groups around the world. Tele watt meters were installed to send data on a monthly basis. over a dedicated telephone connection and a pair of modems to a remote central office the power consumption of numerous users in a residential area is measured using a microprocessor or DSP-based meter". Using the Power Line Communication technology, a master PC at the control center sent orders to a distant meter, which in turn relayed data back. Several meters in close vicinity connected wirelessly with a Master PC using Bluetooth energy meters, which were devised and deployed in specific places.

III. Hardware Used:

Fig 1 show the block diagram Of setup and components used to design the smart meter.
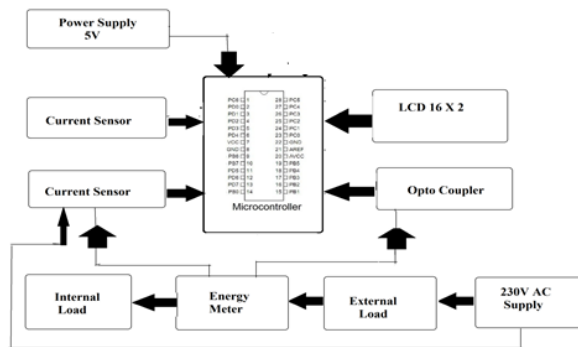

Fig1: Block diagram of proposed System

1. Microcontroller section:

The microcontroller is in charge of power and energy calculations, as well as the LCD display. The microcontroller is also in charge of reading the analogue pins A0 and A1, which correspond to the internal and external current transformers, respectively. It compares these numbers at all times to look for a significant discrepancy that suggests meter bypassing or energy theft. Furthermore, the microcontroller is in charge of decoding the prepayment voucher pins that are provided to the module through SMS. The Arduino Nano, which is based on the ATmega328 microcontroller, was utilized in this project [5].

2. 16X2 LCD:

"On the screen, the 16X2 Liquid Crystal Show is used to display appropriate messages. This is used to print extra information such as the number of units left, a theft detection notice, and so on. It's used to improve the system's usability".

3. Electricity Meter:

"Single phase 220 V electricity meter which is used in homes for metering of electricity is used as the meter in the project. "

4. ACS712 Current Sensor:

"The current flow via the load side of the electricity meter is detected by this sensor, which gives a signal proportionate to the current flow. This sensor is used to detect the individual stealing electricity."

IV. ALGORITHM

"Step 1: Set up balance=1, count=0, and units=0.

Step 2: If (tampering) == yes, proceed to step 3; otherwise, proceed to step 4.

Step 3: Tell the Meter that "tampering has been found." To switch off the load, activate the relay. On the LCD, there will be a following message.

Step 4: Verify if (balance>1) is true. Otherwise, proceed to step 5. 9th step.

Step 5: Turn on the system and notify the subscriber about it.

Step 6: Determine how many units are left and change the balance.

Step 7: If the balance is less than or equal to 5, move to step 8.

Step 8: On the LCD, print the phrase "Low Balance."

Step 9: Check for (stealing), and if so, Go to step 10 if you haven't already.

Step 10: Send a notice to the electrical board saying "Theft is Detected."

Step 11: If a Keypad is received, check it. Go to step 12 if you haven't already, or step 10 if you haven't before.

Step 12: Input from the keypad is read.

Step 13: Determine whether (Keypad ==#). If affirmative, change the balance of the system to balance =balance+10.

Step 14: Inform the user that the recharge was successful and proceed to step 2".

V. Hardware Implementation:

We'll create a system that can identify electric power theft and alert the nearest substation with the meter ID where the theft happened. We've utilized Current to detect the theft in this case. Current detects theft when the energy meter is bypassed and sends a high alarm status signal to the display. As per the flow chart when status signal current=1, theft is detected and when status signal current =0 No theft is occurred. When Atmega328 gives signal to the relay, it will disconnect the load automatically.

Fig 2 EXCITING STEUP

Fig 3: WHEN NO THEFT HAS OCCURRED

Fig4: WHEN THEFT HAS OCCURRED

VI. CONCLUSION

The Prepaid energy meter with theft detection project was successfully executed and has applications in families, particularly in rural regions. This technology can be extensively deployed due to its inexpensive cost and the fact that it prevents income leakage to already overburdened power boards due to electricity theft. This project's key benefit is its low-cost approach for prepayment metering of power use, which also prevents electricity theft at the home level. The tamper

detection feature prevents any user invasions into the electricity metre in order to change or halt the computation of units used.

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