IOT based smart electricity meter control and surveillance for prediction future meter consumption using machine learning

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Abstract

Electricity is the heart of today's world. And now the world is going to be digital so electricity is a very much important aspect. Generation and supply of electricity is the fundamental task of the electricity board but it is also valuable to compute the energy used by the customer that is seizing readings and produce the bills. In the current scenario taking reading and generating bills is manual work. It is very time-consuming. Energy stealing is one of the largest problems in India. Sometimes the user is not paid the bills on time so the electricity board worker cut the power supply manually. In this case, sometimes corruption is done by the user or that worker which leads to the loss of electricity board. In some regions cameras also utilized to take a reading but it is a very complex system and not so user friendly. To prevent all these troubles, we presented a wireless technique for smart and intelligent electricity meter and billing system utilizing IoT (Internet of Things). We also tried the relays to cut down the energy supply of overdue unpaid user which would be regulated wirelessly utilizing the IoT theory. Reading will be taken automatically and users get the notification through the message using GSM.

Keywords— IoT, cloud computing, relay, Arduino,

I. INTRODUCTION

The Internet of Things (IoT) idea allows us to link everyday gadgets to one another over the internet. The IoT idea allows items to be controlled and examined remotely. The Internet of Things (IoT) idea establishes the necessary infrastructure and opportunity for establishing a link between the real world and computer-based systems. With the passage of time, the notion has grown in relevance. There are a growing number of wireless gadgets. At the market place, it establishes a link between the physical devices and other people over the internet. The Wi-Fi module ESP 8266 was utilized in this project. The technology allows you to connect to the internet from anywhere in the system. Electricity demand is expanding at a steady rate among the people, and it is being used for a variety of applications such as agriculture, industry, domestic uses, hospitals, and so on. As a result, managing electrical maintenance and demand is getting increasingly difficult. As a result, there is an instant need to conserve as much energy as possible. As the need for power from younger generations grows, so does the necessity for technological advancement. Using IoT technology, the suggested solution adds a technological twist to traditional energy meters. There are also additional challenges to handle, such as electricity theft and meter manipulation, both of which result in economic losses for the country. The primary objectives that lay ahead for a better system are monitoring, optimized power utilization, and reduced power waste. For billing, the current system is heavily reliant on human intervention. Billing necessitates a human being visiting each and every customer's energy meter and generating a bill based on the meter's unit readings. It takes a long time to do this task. We needed a solution based on IoT technology to overcome all of the aforementioned restrictions.

II. LITERATURE SURVEY

According to this study in [1], power companies in many nations, particularly in developing nations, are losing a lot of money owing to electricity theft. To combat power theft, this article offers a prepaid energy

metering system. [2] study presented a low-cost smart meter that is meant to not only assess a customer's power consumption and generation, but also to allow and support new distribution network operation and control capabilities. It is built on open-source hardware (Arduino and Arduino Ethernet Board) and has USB, Ethernet, ZigBee, and Bluetooth connection options. [3] research offered a high-potential energy-saving approach based on changing people's behaviour habits in their homes. To tackle this problem, customers will need a comprehensive feedback system that allows them to better understand and compare how their actions affect their energy usage, allowing them to optimize their usage of power. [4] study describes the creation of a completely automated energy meter with characteristics such as remote monitoring and control. It eliminates a significant amount of human labour. [5] system's main goal is to identify power theft, which raises consumers' costs and can have major safety implications. Identify the theft by sending an alarm SMS to the owner. Every month, provide the owner the meter reading and rate. [6] system has an extra IOT setup that shows the user the global connection environment and allows them to see the status of meter readings from anywhere at any time. Theft of energy has a significant financial and safety impact on consumers. [7] proposes a novel way for avoiding excessive construction and maintenance costs in the current system in this study. The system is set up in a way that if the customer is unable to pay the bill, the power connection to the distant server may be severed automatically. A CPU core board and a peripheral board make up the ARM 7-based hardware system. Human power is now used to record the energy meter readings for each residence and put them into the regional office's system. This technology is overly complicated, and it will need more human effort to read each house's energy meter. Humans cannot know the reading till the bill payment day with this method. A person cannot detect overload or power theft while taking a readout.

III. PROPOSED SYSTEM

In this proposed system with high efficiency and robustness. the user needs to registered first, then the data of user will be stored at cloud. the access to internet is via android which have unique MAC id so exchange of meter can't be possible. billing will be automatic through sever based unit. For defaulter customer electricity connection can be cut through relay on electric meter. Thus, manual work gets avoided. The proposed system works in the following way

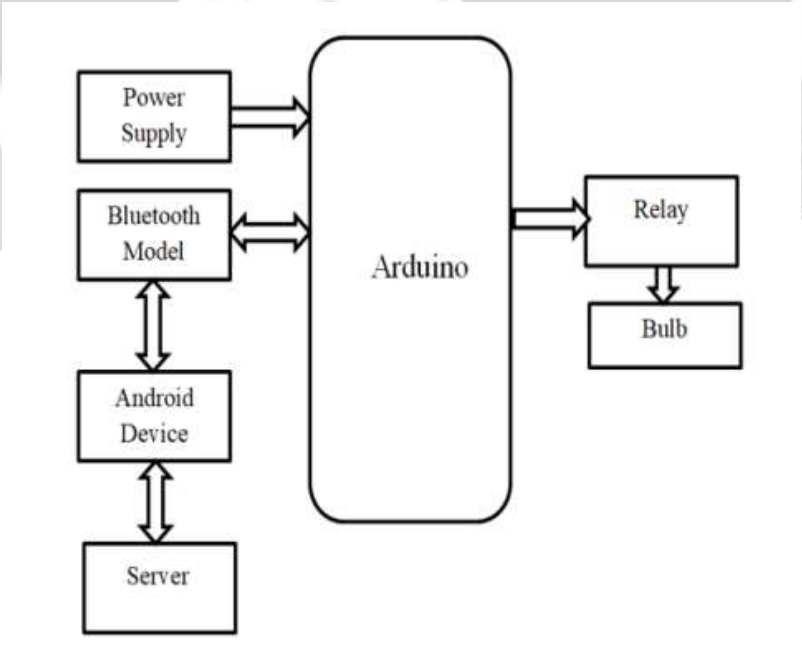

Fig 1. Proposed System

The proposed system makes use of following components for obtaining the desired outcome:

*A. **Arduino ATmega 328***

The key benefit of adopting the ATmega 328 is its high capability combined with its ease of use and familiarity. The ATmega 328 bridges the gap between sensors and the Internet of Things (Internet of Thing). For its function, the ATmega 328 requires a 5-volt dc supply.

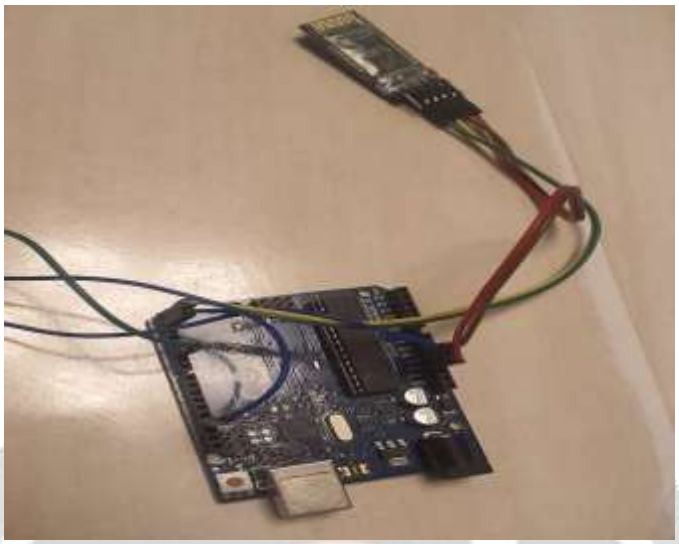

Fig 2. Arduino

*B. **Energy meter***

An energy meter is an electrical device that measures how much electricity is utilized by customers. Utilities is one of the electrical departments that installs these devices in various locations such as houses, businesses, organizations, and commercial buildings to charge for the power consumed by loads such as lights, fans, refrigerators, and other household equipment.

*C. **Single Channel Relay***

The proposed architecture makes use of single channel relay which is being controlled by the server obtained due date values after checking the due date passing confirmation and accordingly keeping server on or off.

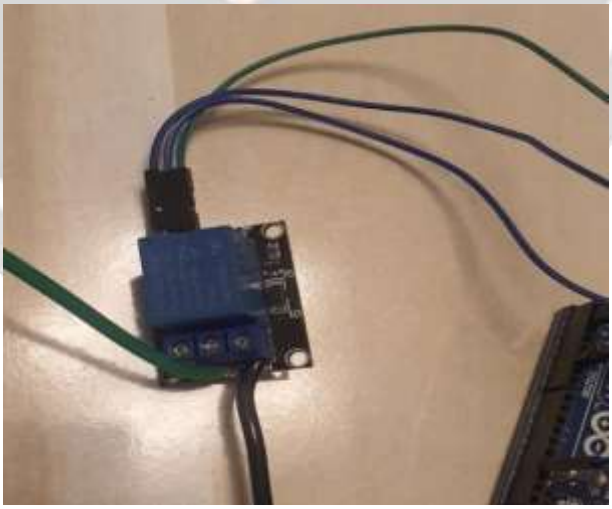

Fig 3. Single Channel Relay

*D.**HC-05 BLUETOOTH***

HC-05 module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). The Bluetooth module HC-05 is a MASTER/SLAVE module. By default, the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices.

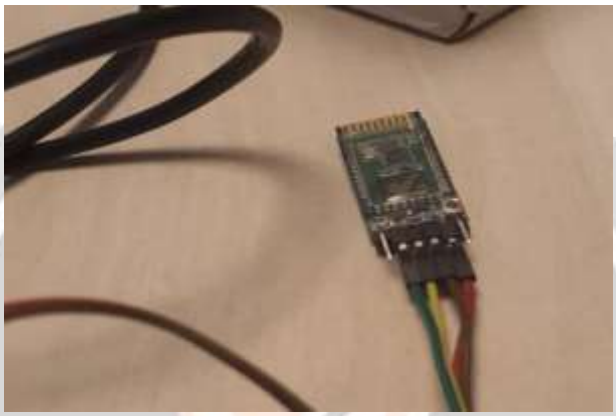

Fig 4. HC-05 BLUETOOTH

The proposed system comprises of 4 major entities:

1. Android Smart Meter Device Controller
2. Hardware Meter
3. Server
4. Android User Application

The proposed system works in the following way:

1. The user is registered on server via authorized server admin.
2. Once the user is registered, the user is allocated a unique meter id and the username password.
3. The username password and meter id need to be entered in smart meter android device in order to specify whose meter is connected to server.
4. As the user logs in and meter is started, the SMS from android device GSM is sent to users registered mobile where, the inbuilt android GSM card is used for sending SMS by calling SMS Manager Class in android device
5. As the Meter is started, the timer and the meter unit reading increases and as the timer increases every minute the unit also increases, and this increases unit value is immediately sent to server along with the cost of those consumed units to the server.
6. The user when starts the meter, the due date is automatically set to 1 month after the registration date and the meter bulb can be turned off only when the due date is crossed and the bill status is unpaid.

An android device (processor) is connected to the digital electricity meter to fetch the number of units consumed and send it to the database on server. Server, whenever required will fetch the data from cloud where the electricity bill will be generated for user and will be sent via SMS to registered mobile number.

IV. EXPERIMENTS AND RESULTS

The proposed system implementation includes an android device attached to the smart electricity meter for controlling the units of the meter and updating it in Realtime to the server in order to get the bill computation in real-time. The experimental results show that the android device which is connected to the digital meter i.e., hardware computer the timer for calculating the units consumed (it is assumed that 1 minute usage will consume 1unit). As the timer updated its number of minutes, the number of units also increase and so the values of units consumed and bill amount is also computed for the same and sent to server. The hardware gets the command via Bluetooth from the android device connected to the kit. The major advantage here is if the command from the android device has arrived for turning off the meter or relay, it cannot be turned on manually, unless the actual command is received from the connected device.

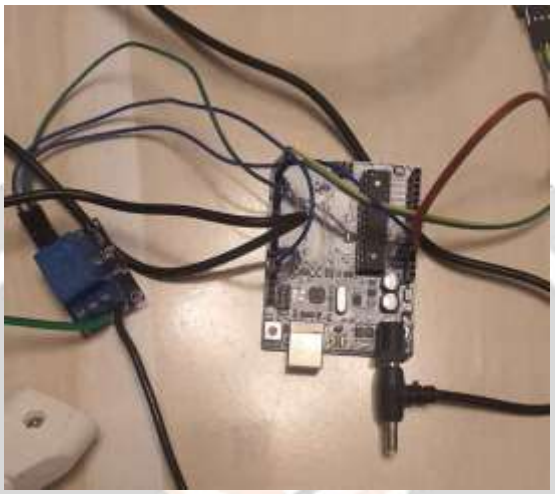

Fig 5. Entire Setup

Fig 6. Smart meter result Meter Activate

Fig 7. Electric Device which operates on smart meter

V. CONCLUSION

In this system with the help of presented proposed system it is possible to avoid meter reader visit and revisit for recording the meter reading to each house. Also, if consumer gets faulty bill, he has to go to Electricity Board office to correct it and be in long queue. This is avoided here by taking reading by android processor unit counter located besides meter and sending these readings to server wirelessly, keeping the database updated which is hard to maintain now a days manually. This is real time system and take reading of meter in a very less time. Also, as customer is getting message of bill printing can be avoided to reduce paper wastage.

VI. REFERENCES

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