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GSM based Billing System for Intelligent Electricity Meters”

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ABSTRACT: The conventional electricity billing systems often face challenges such as inaccuracies in meter readings, billing disputes, and inefficient usage monitoring. To overcome these challenges, a smart billing system is proposed in this study that leverages advanced technologies such as Wi-Fi, Bluetooth, Zigbee, and GSM for intelligent electricity metering. The proposed smart billing system utilizes Wi-Fi, Bluetooth, and Zigbee for local communication between the intelligent electricity meter and the central billing system. Wi-Fi enables high-speed data transfer and allows for seamless communication over the existing Wi-Fi infrastructure. Bluetooth facilitates short-range communication for efficient meter readings and billing updates. Zigbee, on the other hand, offers low-power, low-data-rate communication suitable for home automation and energy management. Additionally, GSM (Global System for Mobile Communications) is used as a fail-safe mechanism for remote communication in case of network disruptions or when the meter is in a remote area where local communication technologies are not available. GSM allows for long-range communication, making it suitable for remote monitoring and billing. The proposed smart billing system offers several advantages, including accurate meter readings, real-time monitoring of electricity usage, automated billing, and reduced disputes. The system also provides flexibility in communication options, making it adaptable to various scenarios and locations.

KEYWORDS: Smart billing system, Intelligent electricity meters, Wi-Fi, Bluetooth, Zigbee, GSM.

I. INTRODUCTION

A GSM-based billing system for intelligent electricity meters is a system that utilizes the Global System for Mobile Communications (GSM) network to transmit data between an intelligent electricity meter and a central billing system. The intelligent electricity meter is a device that measures the amount of electricity consumed by a household or business and is equipped with a GSM module that enables it to transmit the data to the central billing system. The introduction of a GSM-based billing system for intelligent electricity meters has several benefits. Firstly, it eliminates the need for manual meter reading, which can be time-consuming and prone to errors. With the GSM module, the meter can automatically send the data to the central billing system, ensuring accurate and timely billing. Secondly, the system can also provide real-time monitoring of electricity consumption, allowing consumers to track their energy usage and make informed decisions on how to reduce their energy bills. This can be particularly useful for businesses that consume large amounts of electricity. Thirdly, the system can also help utility companies to better manage their energy distribution networks by providing real-time data on electricity consumption. This can help them to identify areas of high demand and plan their network upgrades accordingly.

Overall, a GSM-based billing system for intelligent electricity meters can provide a more efficient, accurate, and transparent billing system for consumers while also helping utility companies to better manage their energy distribution networks.

II. RELATED WORK

"Design and Implementation of GSM-Based Energy Meter for Efficient Power Management" by Nicholas Baloyi, et al. [1] This study focuses on the design and implementation of a GSM-based AMR system using a microcontroller, GSM



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modem, and energy meter. The system reads the energy consumption data from the meter and sends it to the utility company through SMS, eliminating the need for manual meter reading and reducing the chances of human error. "Portal Based Prepaid Energy Billing System Using GSM" by AJha Pooja V, et al. [2] This could include studies that have explored the use of IoT devices and sensors to collect real-time energy consumption data from meters, and transmit it wirelessly to a central system for monitoring and billing purposes. These studies may have investigated the benefits of IoT-based energy metering, such as improved accuracy, reduced manual intervention, and enhanced data analytics for better energy management. "Single phase GSM based wireless energy metering with user notification system" by Ali, et al. [3] These studies have demonstrated the potential of IoT-based energy metering systems in improving billing accuracy, reducing manual intervention, enhancing consumer engagement, and enabling more effective energy management. However, there may be challenges related to data security, privacy, interoperability, and scalability that need to be addressed in the design and implementation of such systems. "Arduino and GSM Based Smart Energy Meter for Advanced Metering and Billing System" by Md. Masudur Rahman, et al. [4] This Study may have examined the use of embedded controllers and GSM modems for transmitting data, such as energy consumption in kWh, generated bills, and security services, over the GSM mobile network. The work in this literature paper is divided in two stages. 1) Hardware Design and Implementation: In this stage, the hardware components of the system are designed and implemented. This includes the design and development of the intelligent electricity meter, which is equipped with a GSM module to enable communication with the central billing system. The hardware design also includes the design of the central billing system, which receives data from the intelligent electricity meter and generates bills for consumers. 2) Software Development and Testing: In this stage, the software components of the system are developed and tested. This includes the development of the software that runs on the intelligent electricity meter and sends data to the central billing system. It also involves the development of the software that runs on the central billing system and receives data from the intelligent electricity meter to generate bills for consumers. Testing is carried out to ensure that the software functions correctly and meets the requirements of the system.

III. METHODOLOGY

BLUETOOTH:

A wireless technology standard called Bluetooth is used to transfer data across short distances.. It uses radio waves in the 2.4 GHz ISM band to communicate between devices. Bluetooth is commonly used for connecting devices such as smartphones, headphones, speakers, and smartwatches to each other, as well as to other devices such as laptops, printers, and cars. Bluetooth is designed to be a low-power, low-cost technology that allows for simple and secure connections between devices. It is capable of transmitting data over short distances, typically up to 10 meters (33 feet), although this can be extended with the use of Bluetooth repeaters. Bluetooth technology is widely used in various industries, including healthcare, automotive, retail, and entertainment. It is also used in home automation systems, where it allows for the control of various devices such as lights, thermostats, and security systems from a smartphone or other mobile device. Bluetooth technology can be used in an energy meter reading and billing system to enable wireless communication between the energy meters and the central billing system. With Bluetooth-enabled energy meters, meter readings can be wirelessly transmitted to a central server or a billing system, eliminating the need for manual meter reading and reducing human errors. The use of Bluetooth technology can also enable real-time monitoring of energy usage, which can help consumers make informed decisions about energy consumption and reduce their energy bills. Additionally, the use of Bluetooth technology can improve the accuracy and speed of billing, leading to faster and more efficient payment processing. Overall, incorporating Bluetooth technology into an energy meter reading and billing system can improve the accuracy and efficiency of the system while providing consumers with valuable information about their energy usage.

Design and Implementation of Bluetooth Energy Meter:

This paper presents the design and implementation of a Bluetooth-Enabled Energy Meter, which is expected to replace electro-mechanical meters in many countries. Using Bluetooth technology, the Energy Reader can wirelessly gather the energy consumption reading from the Energy Meter. The paper proposes two methods for retrieving the data from the wireless energy meter with little human intervention:

- 1) Automatic Meter Reading (AMR):
AMR stands for Automatic Meter Reading, which is a feature of the Bluetooth-enabled energy meter discussed in the given text. It is a mechanism where the energy meter sends the recorded power consumption of a household at regular intervals of time to a wirelessly connected reader, which could be a personal computer (PC) in this



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case. This feature helps to retrieve the meter reading with little human intervention and reduces the cost and time required for conventional methods of meter reading. Upon receiving a start command from the PC, the energy meter will start sending the energy consumption value of the household periodically until a stop command is received.

2) Automatic Polling Mechanism (APM):
Automatic Polling Mechanism is referred to as APM. The Bluetooth-Enabled Energy Meter has a function that enables a master device (such a PC) to automatically poll every Bluetooth Energy Meter on a regular basis to obtain the meter readings for the related households. This feature helps to facilitate the work of retrieving the meter reading with little human intervention and can save time and cost as compared to the conventional method of getting the meter reading manually. With APM, the master device will have a record of all the energy consumptions for all the households. The paper suggests commercial applications for the Bluetooth-Enabled Energy Meter and provides successful implementations for these applications. The Microchip micro-controller is chosen as the solution to integrate between the Blue EZ and the Energy Meter, as it supports both the UART and SPI. This paper presents a useful contribution to the field of wireless energy meters and provides an excellent example of the potential of Bluetooth technology for this application.

Arduino based Smart System for Control and Effective Billing:

The methodology used in “Arduino based Smart System for Control and Effective Billing” based describes the components and principals involved in the development of two systems: a home automation system and a billing system. For the home automation system, an Arduino UNO microcontroller board is used as the main component to control the appliances. The board is connected to relays that turn appliances on and off based on input signals received from the board. An Android application is also developed to allow users to control the appliances via Bluetooth module. For the billing system, a current sensing device named ACS712 is used to measure the current flowing through a wire. The voltage produced by the sensor is then converted into current value and used to perform fundamental calculations like Real Power, Apparent Power, and kWh Consumption. The Arduino board also uses the EMON Library to get the value of operating voltage and power factor, and the RTC Library to determine the ON period of the appliance. The final result is displayed on the user's phone screen via Bluetooth transmission. The methodology used involves the use of different libraries and components to achieve the desired results. The voltage and current values are retrieved from the load using voltage and current sensors, then necessary parameters for the generation of the bill are calculated and sent to the Android application through Bluetooth module.

WI-FI:

Wi-Fi stands for Wireless Fidelity and refers to a wireless networking technology that allows electronic devices to connect to the internet and other networks wirelessly. It uses radio waves to transmit data between devices and a wireless access point, such as a router. Wi-Fi has become a standard feature in most homes, offices, and public places, making it possible for people to connect to the internet and access information on the go. Wi-Fi technology uses a set of standards developed by the Institute of Electrical and Electronics Engineers (IEEE) and is classified by its frequency bands, which include 2.4 GHz and 5 GHz. Wi-Fi networks can operate in different modes, including ad-hoc mode, which allows devices to connect to each other directly, and infrastructure mode, which allows devices to connect to a central wireless access point. Wi-Fi technology has many advantages, including its convenience, flexibility, and ease of use. It enables people to connect multiple devices to a network without the need for cables and allows for easy sharing of files and data. However, Wi-Fi networks can also be vulnerable to security risks, such as unauthorized access and data theft, which must be addressed through proper security measures, such as encryption and password protection. Incorporating Wi-Fi into energy meters can provide a number of benefits. One of the primary benefits is the ability to remotely monitor and control energy consumption, which can help utility companies and customers to better manage their energy usage and reduce costs. Wi-Fi-enabled energy meters can also provide real-time data on energy consumption, allowing for more accurate billing and more efficient energy management. To incorporate Wi-Fi into an energy meter, a Wi-Fi module can be added to the meter's hardware design. The Wi-Fi module will enable the meter to connect to a wireless network and transmit data to a central server or other devices. The data transmitted can include information such as energy consumption, billing information, and other important data points. To ensure the security of the data transmitted over the Wi-Fi network, appropriate encryption and authentication measures should be implemented. This can include protocols such as WPA2 or WPA3, which provide strong encryption and authentication, as well as regular software updates to address any potential security vulnerabilities. Overall, adding Wi-Fi capabilities to energy meters can provide significant benefits in terms of energy management, cost savings, and convenience. As such, it is becoming increasingly common for utility companies to incorporate Wi-Fi into their energy metering systems.

Implementation of Wi-Fi Based Single Phase Smart Meter for Internet of Things (IoT):

The system consists of a digital energy meter, an ESP8266 Wi-Fi module, and web applications for the management system. The Wi-Fi module is embedded into the meter to implement the TCP/IP protocol for communications between the meter and web application. The system is designed to automatically read the energy usage data and send it to the power users for viewing. The proposed design aims to reduce human errors, manual labour, and cost in energy consumption with more efficiency for power management. The methodology involves implementing a low-cost wireless sensor network and protocol for smart energy and web applications. The experimental results of the proposed system show that it works efficiently and is feasible to implement in practical applications for very low cost-build automatic energy meter reading.

ZIGBEE:

Zigbee is a wireless communication protocol that is designed to be simple, low-cost, and low-power. It is primarily used for short-range wireless communication, typically up to 100 meters, and operates in the unlicensed 2.4 GHz band. Zigbee is often used in applications where battery life is important, such as home automation, industrial control, and wireless sensor networks. One of the key features of Zigbee is its mesh networking capability, which allows devices to communicate with each other through multiple pathways, creating a more robust and reliable network. Zigbee also supports a variety of network topologies, including star, mesh, and cluster tree, which enables flexibility in network design. Zigbee uses a low data rate, which helps to reduce power consumption and increase battery life. It also has built-in security features, including encryption, authentication, and access control, to ensure secure communication between devices. Overall, Zigbee is a popular wireless communication protocol for low-power, short-range applications that require reliable and secure communication.

Zigbee in energy meter:

Zigbee technology can be used for energy meter reading and monitoring. Zigbee is a low-power wireless communication protocol that is specifically designed for applications such as home automation, industrial automation, and wireless sensor networks. It is ideal for applications that require low data rates, long battery life, and secure communications. In the case of energy meter reading, Zigbee can be used to transmit data from the meter to a central server or gateway. Zigbee-enabled meters can be installed in homes and businesses, and they can communicate with a Zigbee-enabled gateway that collects and manages the data. The gateway can then transmit the data to a central server for further analysis and processing. Zigbee technology has several advantages for energy meter reading and monitoring. It is a low-power protocol, which means that Zigbee-enabled meters can operate for years on a single battery. Zigbee also supports mesh networking, which allows for reliable and robust communication between devices, even in areas with poor connectivity. Zigbee networks are also highly secure, with built-in encryption and authentication features. Overall, Zigbee is a cost-effective and efficient solution for energy meter reading and monitoring, and it has already been deployed in many smart grid applications around the world.

A Smart Meter Design and Implementation Using ZigBee Based Wireless Sensor Network in Smart Grid:

The methodology used in this paper describes the design and implementation of a Wireless Sensor Home Area Network (WSHAN) using ZigBee for smart meter interfacing. The aim is to establish a reliable and cost-effective smart electric power grid using Wireless Sensor Networks (WSN). The system measures energy usage in real-time, logs data, and displays time of use (TOU) values. It also has the capability to control devices connected to power outputs. The system detects the zero-cross of AC signal while powering on and off to calculate the phase shift. The smart meter accurately measures power usage and transmits the data to a Personal Computer (PC) using ZigBee. The user can monitor power information and remotely control the system. The methodology involves the use of ZigBee for wireless communication, smart meter for accurate power measurement, and real-time data logging for energy monitoring.

GLOBAL SYSTEM FOR MOBILE COMMUNICATION(GSM)

Global System for Mobile Communication (GSM) is a digital cellular communication standard used for transmitting mobile voice and data services. It is the most widely used mobile communication standard in the world, with over 80% of the global market share. GSM was developed by the European Telecommunications Standards Institute (ETSI) in the 1980s to replace the analog cellular systems that were prevalent at that time. GSM uses time-division multiple access (TDMA) technology to divide a frequency band into time slots, each of which can be used by multiple users to transmit voice and data. This allows multiple users to share the same frequency band, thereby increasing the capacity of the system. GSM also provides several features such as encryption, authentication, and billing, which are used to ensure the security and reliability of the system. These features enable the use of value-added

services such as short message service (SMS), multimedia messaging service (MMS), and mobile internet services. GSM has evolved over the years and has been upgraded to provide higher data transfer rates and better network coverage. The latest version of GSM is known as Enhanced Data rates for GSM Evolution (EDGE), which provides data transfer rates of up to 384 kbps. GSM is widely used in Europe, Africa, Asia, and the Middle East, and is considered the de facto standard for mobile communication. GSM technology can be used in energy meter reading for automatic meter reading (AMR) systems. An AMR system based on GSM technology can read energy consumption data from the energy meter remotely and transmit it to the utility company's server for billing and monitoring purposes. In a GSM-based AMR system, the energy meter is equipped with a GSM modem or module, which is used to send the meter reading data to the utility company's server. The modem or module can be configured to send the data at pre-defined intervals, such as daily or weekly. The data is transmitted using short messaging service (SMS) or general packet radio service (GPRS), depending on the availability and coverage of the GSM network. The utility company's server receives the meter reading data from the energy meters and processes it for billing and monitoring purposes. The server can also send notifications and alerts to the consumers based on their energy usage and billing information. GSM-based AMR systems offer several advantages over traditional manual meter reading methods, including improved accuracy, efficiency, and cost-effectiveness. These systems can also help reduce the incidence of billing errors and fraud, and can enable utilities to offer more flexible and customized billing plans to their customers. Overall, GSM technology can be a useful tool in energy meter reading and management, and can help utilities improve their operations and service delivery.

Arduino and GSM Based Smart Energy Meter for Advanced Metering and Billing System:

The methodology described in this paper involves the development of a smart energy meter system using an Arduino microcontroller and a GSM modem. The system is designed to automate the process of meter reading and to provide accurate data on energy consumption. The system consists of a digital energy metre, an Arduino microcontroller, and a GSM modem. The methodology begins with the switching on of the Arduino and the GSM modem. The relay is turned on, and the energy meter is connected to the load via the relay. The current data is displayed by reading the EEPROM. The Arduino checks the impulse from the energy meter, and if an impulse occurs, the data is increased, and the current data is displayed. The GSM modem checks for new SMS messages. If there is a new SMS, it is read. If the SMS is "DATA," the data is sent to a specific number. If the SMS is "LINE CUT," the relay is turned off, and the load is disconnected. If the SMS is "LINE OK," the relay is turned on, and the load is reconnected. If there is any other SMS in any other format, it is deleted. The Arduino disables the relay, activates the buzzer, and sends an SMS to the service provider if there is any effort to tamper with the metering unit.

GSM Based Automatic Energy Meter Reading System with Instant Billing :

The methodology used in this paper presents a low-cost wireless GSM energy metering system for automating billing and managing collected data globally. The system integrates a GSM-based wireless communication module with electronic energy meters to enable remote access and monitoring of energy consumption. A PC with a GSM receiver acts as the billing point, and a graphical user interface is developed using Microsoft Visual Studio .NET framework and C#. The system periodically sends live meter readings to the billing point, which are then updated in a central database. With proper authentication, users can access the developed web page details from anywhere in the world, and the system messages back the complete monthly usage and due bill to the customer after processing the data. The methodology used in the paper involves hardware and software integration, wireless communication, and web development.

Electronic Meter Reader & Data Base Management System:

The methodology used in the above paragraph involves interfacing an analog electric meter with digital circuitry to provide real-time billing and reading to customers using an LCD. The system is designed to transmit meter readings to the nearest electric meter billing and controlling station using a global system for mobile communication (GSM) module. The key components used in the system include a microcontroller, GSM module, and analog meter with an IR module. Each user is given a pin code to access the metre for paying the metre bill or, in the case of a prepaid metre, checking the amount. The microcontroller is used to control the entire operation of the system, while the GSM module is used for wireless data transmission. The system is entirely supervised and managed by the server end of a particular region, and it supports both prepaid and post-paid metres.



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IV. COMPARISON TABLE

Feature	Wi-Fi (IEEE 802.11b)	Bluetooth (IEEE 802.15.1)	Zigbee (IEEE 802.15.4)	GSM/GPRS
Range	Up to 100m indoors, up to 400m outdoors	Up to 10m (up to 100m for newer versions)	Up to 10-100m	Several kilometres
Data Rate	Up to 11 Mbps	Up to 3 Mbps (Bluetooth 3.0+HS), up to 24 Mbps (Bluetooth 4.0+HS)	Up to 250 Kbps	Up to 384 Kbps (GPRS), higher rates possible with newer technologies
Power Consumption	Higher	Low	Ultra-low	Higher
Applications	High-bandwidth applications, LAN	Short-range communication, peripheral devices	Low-power, smart homes, industrial automation	Cellular communication, voice calls, text messaging, mobile internet
Network Topology	Infrastructure mode or ad-hoc mode	Point-to-point or point-to-multipoint	Mesh networking	Cellular network topology
Frequency Band	2.4 GHz ISM band	2.4 GHz ISM band	2.4 GHz ISM band	Various frequency bands depending on region and technology



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V. COMPARISON RESULT

Wi-Fi (IEEE 802.11b) is a wireless networking technology commonly used for local area networking (LAN) in homes, offices, and public places. It provides high data rates and has a relatively long range, making it suitable for applications such as internet access, streaming media, and file sharing. Wi-Fi operates in the 2.4 GHz frequency band and is known for its fast data transfer speeds and low latency, making it ideal for applications that require real-time communication.

Bluetooth (IEEE 802.15.1), on the other hand, is a wireless technology primarily designed for short-range communication between devices, typically within a few meters. It is commonly used for connecting devices such as smartphones, tablets, headsets, and smart home devices. Bluetooth operates in the 2.4 GHz frequency band and is known for its low power consumption, making it ideal for applications that require low energy consumption, such as wearables and IoT devices.

Zigbee (IEEE 802.15.4) is a wireless communication protocol designed for low-power, low-data-rate, and short-range communication. It is commonly used in applications that require low-cost, low-power, and low-latency communication, such as industrial automation, and home automation. Zigbee operates in the 2.4 GHz or 915 MHz frequency bands and is known for its mesh networking capability, allowing devices to form a network and communicate with each other in a multi-hop manner.

GSM/GPRS (Global System for Mobile Communications/General Packet Radio Service) is a cellular communication technology used for mobile communication. It is widely used for voice and data communication in mobile networks and is the foundation of modern mobile communication systems. GSM/GPRS operates in various frequency bands, depending on the region, and provides wide-area coverage, allowing for communication over long distances. It is known for its global availability and support for voice calls, text messaging, and mobile data services.

In summary, GSM/GPRS is a suitable choice for smart energy meters compared to Wi-Fi, Bluetooth, and Zigbee. GSM/GPRS provides wide-area coverage, global availability, and support for voice calls and mobile data services, making it ideal for remote communication and monitoring of smart energy meters. It allows for communication over long distances, making it suitable for deployment in various locations, including remote or rural areas where other wireless technologies may have limited coverage. Additionally, GSM/GPRS has established infrastructure and reliable network connectivity, making it a trusted and widely used technology for communication in the energy industry.

VI. CONCLUSION

The GSM-based billing system for intelligent electricity meters offers several significant advantages. By utilizing GSM technology, the system enables seamless and real-time communication between electricity meters and the utility company, eliminating the need for physical meter reading and manual billing processes. The system also provides accurate and transparent billing information, reducing the chances of errors and disputes. Furthermore, the intelligent electricity meters integrated with GSM-based billing system allow for remote monitoring and control of electricity consumption, enabling consumers to actively manage their energy usage and make informed decisions about their electricity consumption patterns. This can lead to increased energy efficiency, reduced wastage, and cost savings for consumers. The system also offers benefits to utility companies, such as improved billing accuracy, reduced operational costs, and enhanced customer service. It enables utility companies to proactively detect and address issues such as tampering or electricity theft, reducing revenue losses.

REFERENCES

- [1] Nicholas Baloyi;SP Daniel Chowdhury;JacobMnisi;ThaboMashee; (2020). Design of GSM Based Energy Meter: A Review . 2020 6th IEEE International Energy Conference (*ENERGYCon*)(/), .doi:10.1109/ENERGYCon48941.2020.9236473A. Criminisi, P. Perez, and K. Toyama, "Region filling and object removal by exemplar-based image inpainting.", *IEEE Transactions on Image Processing*, vol. 13, no.9, pp. 1200–1212, 2004.
- [2] Rashed, G.I.; Haider, Hussain; Shafik, M.B. (2020). [IEEE 2020 5th Asia Conference on Power and Electrical Engineering (ACPEE) - Chengdu, China (2020.6.4-2020.6.7)] 2020 5th Asia Conference on Power and Electrical



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- Engineering (ACPEE) - Improving the reliability of energy supply utilizing smart energy meter system based on GSM: case study in Pakistan., (), 1080–1084. doi:10.1109/ACPEE48638.2020.9136524
- [3] AJha, Pooja V.; Savla, Kinjal R.; Patwa, Deepshikha K.; Deshmukh, Amit A.; Pistolwala, Shruti T. (2019).[IEEE 2019 International Conference on Nascent Technologies in Engineering (ICNTE) - Navi Mumbai, India (2019.1.4- 2019.1.5)]2019 International Conference on Nascent Technologies in Engineering (ICNTE)-Portal Based Prepaid Energy Billing System Using GSM.,(),15.doi:10.1109/ICNTE44896.2019.8946104
- [4] Ali, Waqas; Farooq, Haroon; Khalid, Aneeb; Raza, Ali; Tanveer, Nouman (2017). [IEEE 2017 International Symposium on Wireless Systems and Networks (ISWSN) - Lahore, Pakistan (2017.11.19-2017.11.22)] 2017 International Symposium on Wireless Systems and Networks (ISWSN) - Single phase GSM based wireless energy metering with user notification system.,(),18. doi:10.1109/ISWSN.2017.8250030
- [5] Metering, Automated Smart; Visalatchi, S; Sandeep, K Kamal (2017). [IEEE 2017 2nd International Conference for Convergence in Technology (I2CT) - Mumbai, India (2017.4.7-2017.4.9)] 2017 2nd International Conference for Convergence in Technology (I2CT) - Smart energy metering and power theft control using arduino& GSM. , (), 858–961. doi:10.1109/I2CT.2017.8226251
- [6] R. D Krishna, P. Jaya Kishan, S.S. Kumar, “GSM Based Energy Meter Billing via SMS,” 3rd International Conference on Recent Innovation in Science Engineering and Management, pp 735-741, February 2016.
- [7] Rahman, Md. Masudur; Noor-E-Jannat, ; Islam, Mohd. Ohidul; Salakin,Md. Serazus (2015). 2015 International Conference on Electrical Engineering and Information Communication Technology (ICEEICT) - Arduino and GSM based smart energy meter for advanced metering and billing system.(), 16.doi:10.1109/ICEEICT.2015.7307498
- [8] SaAshna, K.; George, S. N. (2013). [IEEE 2013 International Multi-Conference on Automation, Computing, Communication, Control and Compressed Sensing (iMac4s) - Kottayam (2013.3.22-2013.3.23)]2013 International Mutli-Conference on Automation, Computing, Communication, Control and Compressed Sensing (iMac4s) - GSM based automatic energy meter reading system with instant billing., (), 65–72. doi:10.1109/iMac4s.2013.6526385: 20
- [9] Long, Ziyue; Long, Ziwu; Li, Jun; Ma, Tiedong; Zheng, Yicheng; Qin, Yuying (2009). [IEEE 2009 International Conference on Intelligent Human-Machine Systems and Cybernetics - Hangzhou, Zhejiang, China (2009.08.26-2009.08.27)] 2009 International Conference on Intelligent Human-Machine Systems and Cybernetics - Automatic Meter Reading Monitoring System Based on G18 Module. ,(),419–422. DOI:10.1109/ihmsc.2009.227
- [10] Primicanta, AryoHandoko; Nayan, Mohd Yunus; Awan, Mohammad (2009). [IEEE 2009 International Conference on Computer Technology and Development - Kota Kinabalu, Malaysia (2009.11.13-2009.11.15)] 2009 International Conference on Computer Technology and Development - Hybrid Automatic Meter Reading System. , (), 264–267. DOI:10.1109/icctd.2009.114



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