

## IOT Based Grid Cutoff System for Unpaid Bill of Consumers: A Review

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**Abstract-***The electricity consumption in household is increasing rapidly through a time due to many issues. Automated and intelligent electricity meters are being introduced around the world to monitor and assess electricity use in every home and workplace. This is the application of smart electric meters is very important to track and record the real-time electricity Consumption of a household. The system helps the electricity provider to reduce the operation cost as the system could cut off electricity automatically when the usage limit is exceeds. Utility can cut off and reconnect the customer connection by short message service (SMS). In some areas consumers can't pay bills when MSEB officials visit to the particular site for disconnecting the supply of electricity some consumers try to bypass the connections of the meter and also some consumers Try to settle down the matter by giving bribes ultimately it regards to electricity power theft. Furthermore, the customer can check the Status of electricity (load) from anywhere.*

**Key words-** Internet of things (IOT), GSM Module, Short Messaging System (SMS), Energy Monitoring System.

### INTRODUCTION

In recent decades, the global energy crisis has increased very rapidly. As a result, many new technologies are being Introduced to meet the needs of our users. In addition to power generation, demand can also be met by automating energy Distribution to improve people's living standards. The traditional method of electricity billing system is complicated. There are many problems with this method, and the system needs to be further

developed and automated [1].It causes shortage of power supply to residential as well as commercial premises. The aim of the project is to design and control a system which will automatically cut-off the electricity connection directly from the electricity pole for those consumers who fail to pay electricity bill on time. When M.S.E.B officials arrive at that site to cut-off the supply, some consumers argue with the officials and try to settle the matter by giving bribes. Even if after disconnecting the supply, some consumers may bypass the system and connect the home appliances from the service mains. So, to overcome all these issues a prototype is proposed which includes WemosESP8266, relays through which it will automatically cut-off the electric supply as per given instruction by microcontroller from the pole itself for that particular consumer who does not pay electricity bill within a specific given period. Also, power theft will be taken care by this proposed Smart energy controlling system [2]. A current sensor which Senses a current between the transmission line and energy meter and provides advanced theft monitoring in this System. Hence this system is very useful as it can detect / monitor and overcome all the issues of power theft. The cost of this system is economical without compromising the functionality and accuracy of the system. The Paper proposes automated billing of energy meter. It is just like postpaid mobile connection. In the proposed Work, the front end is user friendly and one can work on this software with minimum knowledge of computers and can read the meter by sitting in the office. This is useful for billing purpose in electricity board authority. A GSM modem is connected to the energy meter. Each modem will be having its own SIM (usual mobile phone SIM).

## 1. SMART METER

Smart meters can track and control energy consumption, saving energy and money.

Smart metering technology allows remote contact with a metered contact point, which can also present cybersecurity risks.

If smart meters are installed by a local utility or government for utility management, property owners do not have much say in whether the technology is used. This article is for business owners unfamiliar with smart meter technology who are interested in reducing their energy consumption.

In this project the smart meter is runs on IOT system.

## 2. IOT (Internet of Things)

Internet of Things (IoT) term represents a general concept for the ability of network devices to sense and collect data from around the world, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The IoT is comprised of smart machines interacting and communicating with other machines, objects, environments, and infrastructures. Now a day's all persons relate to each other using lots of communication way. Where most popular communication way is internet so in another word, we can say internet which connect people.

The essential idea of the Internet of Things (IoT) has been

around for nearly two decades, and has attracted many researchers and industries because of its great estimated impact in improving our daily lives and society. When things like household appliances are connected to a network, they can work together in cooperation to provide the ideal service, not as a collection of independently working devices. This is useful for many of the real-world applications and services, and one would for example apply it to build a smart residence; windows can be closed automatically when the air conditioner is

turned on, or can be opened for oxygen when the gas oven is turned on. The idea of IoT is especially valuable or persons with disabilities, as IoT technologies can support human activities at larger scale like building or society, as the devices can mutually cooperate to act as a total system.

## 3. GSM MODULE

A GSM module or a GPRS module is a chip or circuit that use to establish communication between a mobile device or a computing machine and a GSM or GPRS system. These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computers.

A GSM modem can be a dedicated modem device with a serial, USB, or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

Its functions include:

- Read, write, and delete SMS messages.
- Send SMS messages.
- Monitor the signal strength.
- Monitor the charging status and charge level of the battery.
- Read, write, and search phone book entries.

## 4. ESP8266

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-

effective board with a huge, and ever growing.

### PROBLEM STATEMENT

Smart electricity meter issues, problems and challenges are discussed by various researchers. Despite their benefits, issues with smart meters can range from their mismanaged rollout to the installation in your home. Here are some of the problems we have discussed related with our project. It avoids the human intervention in the process of billing so the possibility of hacking and theft of electricity is avoided [3]. It reduces the human effort majorly happens nowadays the workers goes to the customers home individually to collect the data of their meter to generate a bill. Due to smart meters the workers can make customers billing from office itself and any customer who are yet to pay bill on time they can cut their power from office. Due to smart meter reading billing process the customers can see their overall power consumption from their mobile itself and can manage or reduce the wastage of electricity which were happened before [4]. In many areas where electricity meters are read manually, people are often bribed to make false readings in order to keep their electricity bills cheaper than the electricity used also in some regions, consumers are unbilled, who intentionally do not pay their bills, and some consumers turn off their meters when MSEB officials visit the site to disrupt service. The Internet of Things will enable remote sensing and control of objects through existing network infrastructures, creating opportunities for more direct integration of the physical world and computer-based systems, resulting in efficiency, accuracy, and economic benefit [5]. The electric power is being wasted with an estimated range of 7–10%. During peak demand hours the energy wasted reaches up to 20 or 30%, but with smart metering we can manage the energy consumption remotely. And there is no wastage of electricity happened [6]. This system will run on two energy sources either on solar panel or on battery if the battery is not

producing enough power to generate electricity, then the system will automatically shift towards solar panel which is the source of renewable energy [7]. A lot of current meters were designed not to be replaced or removed. That makes replacing them sometimes difficult as they were installed in either hard to reach places or without much thought to future technology innovations. A smart meter sends your meter readings to your energy supplier automatically, so in principle your bills should be more accurate than when they rely on you submitting manual readings. Within a seconds MSEB official can send you the information regarding your billing process by sending SMS only [8].

### LITERATURE SURVEY

1. Rishabh Jain, Sharvi Gupta & Ashish Chauhan, **"IOT based Smart Energy Meter Monitoring and Controlling System,"** INTERNATIONAL JOURNAL OF RESEARCH IN ELECTRONICS AND COMPUTER ENGINEERING, IJRECE VOL. 7 ISSUE 2 APR.-JUNE 2019 ISSN: 2393- 9028 (PRINT) | ISSN: 2348-2281. In this research paper the author statement that "In recent time e-meter (electronic meter) place a Major role for the power consumption & cost-efficient System. In advanced future it has high reliable and Productive programmed meter perusing framework (AMRS)." This paper aims to plan a straightforward ease. IOT based energy meter reading system which includes Fault indication. Unit usage after (i.e., for 15 days once). Mode selection (automatic & manual) and SMS alert to user [9].
2. Ruhi Uzma & Amber Qureshi, **"Iot Based Automatic Electricity Cut- Off,"** International Conference on Innovation & Research in Engineering, Science & Technology (ICIREST-19), ISSN (e): 2250-3021, ISSN (p): 2278-8719 PP 10-15. In this research paper the author gives statement that "Nowadays everyone talks about the problem faced by government regarding electricity. Based on this situation, it becomes an extrinsic motivation to

develop an Automated system for residential electricity device.” The system consists of an embedded device to control power Supply main switch and update the data into data center. Cut-off warning message is sent to users via GSM and Short message services. The system helps the electricity provider to reduce the operation cost as the system Could cut off electricity automatically when the usage limit is exceeded [10].

3. Dennis A. Martillano, **“Android-Based Smart Power Outlet Switching Device Using ESP8266 Enabled Wi-Fi Module,”** Journal of Advances in Computer Networks, Vol. 6, No. 1, June 2018, doi: 10.18178/jacn.2018.6.1.255. In this research paper the author gives statement that “Having the advantage of merging allows changes to be adopted with respect to organization, manipulation and even control of almost anything via networked technology. This leads to the idea of Internet of Things (IoT), which can be defined as the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure.” This study aims to engage in research, modeling and implementation of an integrated technology that will blend WIFI development board modules built on ESP8266 based modules, microcontrollers and elements of Internet of Things to form an intelligent environment[11].

4. Dr. V. S. Gulhane & Tushar V. Dave, **“IOT BASED THRESHOLD POWER CUTOFF – SMART ENERGY METER,”** International Research Journal of Modernization in Engineering Technology and Science, Volume:03/Issue:06/June2021. In this research paper the author gives statement that “The electricity board uses a manual process to get the information of each house by visiting and clicking the photos of meters. This Process has lots of drawbacks, and thus the concept of Smart Energy Meter (SEM) came across.” The smart meter can help stop working manually and it will count energy consumption by

using sensors, Sensors will help us to count the intensity utilization charges and help to manage the use of electricity [12].

5. Md Abdullah Al Rakib &Md. Moklesur Rahman, **“IoT based Controlling of Power Grid,”** European Journal of Engineering and Technology Research, Vol 6 | Issue 6 | September 2021, DOI: <http://dx.doi.org/10.24018/ejers.2021.6.6.2579>. In this research paper the Author gives statement that “An electric network, electric grid, or electricity network is an integrated electricity supply network for producers to consumers. The main objective of this study Is to monitor the electricity grid system process, disclose this system at a dangerous level, monitor The current line, and reduce conventional systems expenses. From anywhere on the Internet, we can Monitor. " It uses an electrical microcontroller to monitor a single-phase electrical device using Arduino to read sensor voltage and current and then communicate measured data via a new Android application for wireless monitoring. It enables the monitoring of several basic power quality parameters of basic voltage. The technology also determines the line frequency and power factor [13].

6. B.Rajalakshmi, S.Surya, **“Voltage and Other Parameters Monitoring System Using Android Mobile Application,”** International Journal of Scientific Research & Engineering Trends Volume 7, Issue 4, July-Aug-2021, ISSN (Online): 2395-566X. In this research paper the author gives statement that “When Testing and troubleshooting the electrical works/PCB, the person face issues while placing probes on 2 points on the electrical Lines and simultaneously noting the value in multi-meter”. To overcome the issue, have Proposed to integrate voltage display through the user application for a virtual voltage display while trouble shooting/testing the system. An Arduino is used in the circuit for processing and displaying output. The Arduino Nano V3.0 controller and Bluetooth HC-05 are a cheap microcontroller and wireless device,



respectively. The new Android smartphone application that Monitors the voltage and current measurements uses the open source MIT App Inventor 2 software [14].

7. Saurabh Padalkar & Akshay Rathod, **“Smart Energy Meter,”** International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 2, March 2022, DOI: 10.48175/IJARSCT-2888. In this research paper the author gives statement that “India uses electromechanical electricity meters, but considers the drawbacks of electricity theft, Meter reading errors, billing, and consumers hesitating to pay utility bills on time. Therefore, such systems Are being replaced by more sophisticated and accurate digital and electronic gauges.” This paper proposes a new methodology for implementing a control-based global system for mobile communication networks (GSMs) to integrate prepaid metering system setup and remote load control. This provides a secure smart card solution for new types of prepaid power systems. It aims to reduce the number of utility bill obstacles using smart card technology. The LCD display is used to show the amount of energy consumed [15].

8. Angshuman Goswami & Abhijay Hazarika, **“GSM Based Automatic Energy Meter Reading,”** International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 12, December 2015, DOI:10.15680/IJIRSET.2015.0412138. In this research paper the author gives statement that “The major constraint is the use of as the termination character of the SMS and the display of one SMS at A time.” The limitations can be removed using higher end microcontrollers and extended RAM. The meter Readings regularly without the person visiting each house. A GSM based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the uses of electricity. Live meter reading from The GSM enabled energy meter is sent back

to this billing point periodically and these details are updated in a central Database [16].

9. Serhii Tsyruynyka, **“Energy Monitoring System based on IoT,”** ITTAP’2021: 1<sup>st</sup> International Workshop on Information Technologies: Theoretical and Applied Problems, November 16–18, 2021. In this research paper the author gives statement that “The paper proposes a system designed for remote monitoring of electricity consumption from Anywhere in the world and sends e-mail notifications when energy consumption reaches the Threshold value.” This technique uses a WeMo’s wireless control module with an ESP8266 Microcontroller using a Wi-Fi channel, which is built into the Internet of Things and allows You to measure the current consumption of the load connected to the 220V mains and transmit The measured value via Wi-Fi [17].

10. Chakib Bekara, **“Security Issues and Challenges for the IoT-based Smart Grid,”** International Workshop on Communicating Objects and Machine to Machine for Mission-Critical Applications (COMMCA-2104). In this research paper the author gives statement that “ The Smart Grid (SG), which is considered as one of the most critical Infrastructures, is defined as the classical power grid augmented with a large-scale ICT and renewable energy integration, can be seen as one of the largest IoT network. The SG will involve billions of smart objects/things: smart meters, smart appliances, sensors, actuators-cars, etc. in addition to several communication infrastructures whether public (most often) or private. However, security is seen as one of the major factors hampering the rapid and large-scale adoption and deployment of both the IoT vision and the Smart Grid.” In this paper, we investigate the security issues and challenges of the IoT-based SG. In section 2 we briefly describe IoT, SG and the link between them. In section 3 we investigate security issues and challenges in the IoT based SG. In section 4 we consider the

security services for the SG, and we conclude our work in section 5[18].

11. Harsha Khandel, Suchitra Pandey and D. Reynolds, **"IoT BASED POWER CONSUMPTION MONITORING AND CONTROLLING SYSTEM,"**

International Research Journal of Engineering and Technology (IRJET) Volume:5 Issue 07| July 2018. In this research paper the author gives statement that "Despite many efforts, Energy crisis is the present-day problem and it is getting worse day by day. To overcome this situation people are finding various energy efficient resources. Among them, power is the main concern which needs to be monitored and controlled. With the rise in power consumption in every part of the world there is a subsequent rise in power theft and over usage of power. This is a serious problem which is being faced by the power utilities." In this paper, a model is designed which aims to control and monitor power consumption of a particular area or sector. The designed model monitors the power consumption of the end users and cut off the power supply when it exceeds the set limit. The device sends the power consumption data to the supplier's blink server using Internet of Things (IoT) technology [19].

12. K. Lova Raju, K. Yaswanth Pavankalyan(&), Sk. Md. Khasim, and A. Naveen, **"Node MCU Based Power Monitoring and Smart Billing System Using IoT,"** In this research paper the author gives statement that "Electricity is the heart of today's world and now due to digitalization it became key aspect to be taken care, which will enhance the way of living of people and economic development of our country. For the past decades, there is a lack of technological advancement for the basic structure of power grid which involves lack of knowledge in power usage and tedious billing system through a dedicated worker need to take out the bill from meter and gives to the consumer area by area, in addition to mistakes like extra billing amount notifications from the electricity production board even bills are paid by the

consumer, are quite common. In some areas cameras also used to take the reading but it is not so user friendly." All the above-mentioned problems can be solved by using Internet of Things based power management system which keeps track of consumer loads in order to accurate billing, awareness about the power consumption and a way to save the wastage of power by using some threshold values which will turn off the required load through relay as per the requirement. This paper mainly focuses on power management system which utilizes Internet of Things (IoT) in order to improve the power management levels and smart billing system with the help of smart meters and smart grids [20].

13. Semra Gündüç, Saif Ali Gaeed, **"An Iot-Based Method for Managing Power Grids in Smart Way,"** International Journal of INTELLIGENT SYSTEM AND APPLICATION IN ENGINEERING SSN:2147-6799. In this research paper the author gives statement that "System designers find it difficult to reduce power consumption. High power consumption leads to higher temperatures, affecting performance and reliability. Increasing energy prices and concerns regarding the impact of electronic systems on the environment highlight the importance of low power consumption. Smart grids are emerging as a new side of the power industry. They incorporate advanced technologies and solve many problems, but continue to face readiness challenges." A new technology called the Internet of Things (IoT) is making it possible to monitor and manage electricity consumption, wherever a variety of different technologies are utilized, including IoT cloud platforms. In this research, smart grid and IoT technologies are used to build a power management system. It is also discussed how the system functions and is automated. Through the design of a system that detects voltage, current, and weather conditions and gathers data to warn consumers in advance of power usage problems, A system is proposed to monitor power consumption by consumers and control power usage by electrical devices [21].

14. Anas Bin Rokan and Yasser Kotb, **“Towards a Real IoT-Based Smart Meter System,”** First International Conference on Sustainable Technologies for Computational Intelligence, Advances in Intelligent Systems and Computing 1045. In this research paper the author gives statement that “Smart grid grants a more reliable and cost-effective electricity system for transporting electricity from power stations to homes, business, and industry. It has effectively and efficiently evolved into a smarter system of grid connecting peers and devices in an intelligent manner.” In this paper, we give an overview about the smart grid and smart meter technologies, what are the functionalities of those systems, and then propose and implement a new prototype of such smart grid system in order to show their benefits in different domains. The proposed prototype system is a device with relative similarity to the smart meter contains two different sensor modules that are constructed to measure electricity voltage, current, and power. The data obtained from these sensors transmit to a Microcontroller Unit to process it [22].

15. Keshri Kulmate, Himanshu Thepe & Siddhant Patne, **“AUTOMATIC ELECTRICITY CUT-OFF BASED ON IOT,”** International Research Journal of Modernization in Engineering Technology and Science Volume:05/Issue:01/January-2023. In this research paper the author gives statement that “Transmission lines play an important role in carrying electricity from generators to consumers. In a conventional power grid, energy is generated at a central power station and two-way communication is not possible. A smart grid system is an evolution of the convective power grid. A system that monitors and manages energy consumption. A smart grid is based on communication between providers and consumers. One of the main issues with today's legacy networks is efficiency. The network is congested during peak times and seasons. It is also possible to hack the

system and get electricity basically for free.” Smart grids allow consumers and owners to see their daily electricity consumption, and if their bills go unpaid, owners can remotely cut off power over the internet. Additionally, data collected by smart meters should not be accessed by unauthorized persons. If the meter is out of alignment, the owner and consumer will receive a message and the owner will take appropriate action. Once data is collected, it can be updated in a cloud service, making it accessible to consumers and providers over the Internet [23].

## CONCLUSION

The project model reduces the manual manipulation work. use of ESP8266 in our system provide the numerous advantage of wireless network systems. In this paper we proposed a system to provide early warning to the users electric power which provided by government. In the present situation all consumers are using manual manipulation. To reduce the manual effort and human errors, we need to have some kind of automated system monitoring all the parameters and functioning of connections between the customers and electricity board. Also, by implementing this system we can control the usage of electricity on consumer side to avoid wastage of power. Since there is need to utilize energy in better and efficient way which is beneficial in power sector.

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