

# Security in Smart Meter using Iot

Somalina Chowdhury, Santanu Kumar Sen

**Abstract:** Today digitalization is key of our lifestyle not only in cities but also in rural areas. Nowadays, Internet of Things (IoT) is adding feathers to this globalization. In this research paper we will discuss about the safety and security of one of the most popular applications in IoT, i.e. Smart Meter in Smart Grid. Especially about Smart Meter in Smart Grid, which is fundamental part of it. Smart Meter unlike traditional metering system bidirectional in nature. Thus they have two streams one for power flow and second is data collection, analysis and procesāng i.e. communication, this is done by communication channel. Assured, strong, high-end security must be designed to the communication network so that data cannot be tampered, manipulated or interrupted by outer world. Here we will apply a unique technique of cryptography by which a secure communication channel method using Genetic Algorithm can be designed. By implementing this technique we can ensure a safe communication between customer and utility company. Thus, provide security to the data flow.

**Keywords:** Smart Grid, Smart Meter, IoT, Cryptography, Genetic Algorithm

## I. INTRODUCTION

Power grid is use to distribute generated electricity or power from utility company to the customer through Smart Meter as per demand. It includes generators, high voltage transmission lines, and data concentrator for carrying electricity and distribution lines that connects end customers. But these power grids has limitations like low reliability, low security, high rate electricity failure, high greenhouse gas effect and high carbon emission. These loopholes are overcome by Smart Meter in Smart Grid [1]. Smart Meter has unique ID and it helps in bidirectional communication between the utility companies and its customers. AMI in regular metering help to automate it to certain extent but Smart Meter along with IoT enhance the process. SG collects data from Smart Meter. Then analyse the data and compose it as per power supply and customers or utility wants. In SMART METER data are stored in cloud server IoT based Smart Meter uses sensors, RFID, cloud, transmission lines etc., all of these must ensure safety and security. Any communications network that can be public, private, wired, and unwired all can have threats. Cyber security must be guaranteed availability, integrity, confidentiality and control system required to manage, operate and protect Smart Meter in Smart Grid infrastructure [2]. Delay of data arrival and packet loss degrades system performance.

## II. RELATED WORK

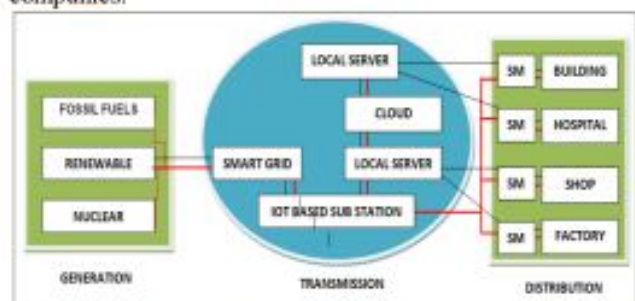
IoT interact with living and non-living things. Thus it works in all three dimensions i.e. Physical, real and virtual world. It can collect data from Smart Meter and analyse is the data of the customer.

These data can be personal data of them like how much electricity consume by them, when the power is having high usage or low etc. Thus can even predict when users are at home or not [3] or can theft electricity consumed data and manipulated it. Smart Meter must implement high encrypted security device or sensor. There can be many cyber or security attacks like Man in the Middle, Replay, Denial of service, Spoofy, tamper, fake user etc. These are overcome by many cryptographic techniques introduced like Rabin encryption for secure data [4] or RSA etc. Data is collected through Smart Meter and send through transmission line with the help of ZigBee, WiFi, 3G etc. Cyber security in SG that can occur in Smart meter deployment, is one of vital problem. We categorized the Smart meter security issues into three divisions which are attacks on network, attacks on physical hardware and attacks on data. Each division, a number of security issues and attacks that have been identified[5]. Cyber-attack in Smart Meter can cause false billing, customers personal data like at what time of the day how much power consumed or their billing accounts details etc. and analyse them in adverse way. Secured communication must be our goal.

In this paper we will apply encryption decryption algorithm with genetic algorithm proposed in one of my papers. So that we can strengthen our security process [6]. It is an asymmetric key cryptographic algorithm where two kinds of key is used public and private. Public key for encryption and private for decryption. Data receive herein digital format. We will take out our algorithm on per 64 bit each time we encode. Here genetic algorithm is implemented so that the method get stronger.

## III. METHODOLOGY

The algorithm given is capable of giving security to data communicate through a very strong process of data security. After securing the data during communication it must be storage in local database. Like these various Smart Meter stores their data. After interval of time, these data send to cloud. We can also designed web page that linked with smart meter to give information to customer and utility companies.



**Fig: Block Diagram Of Smart Meter In Relation To Smart GRID (Here red line for power distribution and black for data distribution)**

Revised Manuscript Received on April 27, 2020.

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# Smart Meter using Big Data in IoT

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**ABSTRACT:** Nowadays Green energy or energy efficiency has become one of the key concerns of the people. In this era Smart Grid with Internet of Things has took a vital role. Here distributed system with Smart Grid principle is being discussed. Unlike traditional Grid, Smart Grid are bidirectional in nature. One of the important component of Smart Grid is Smart Meter. In this paper we will focus on the vast data handled by Smart Meter using Big Data. The paper will focus on efficient energy management and how tactical decision making is done by Big Data to improve the overall Smart Grid performance. Data is collected through sensors especially wireless sensors are used. A vast amount of data is collected, analyzed, and processed to retrieve information. This will increase the business prospects and will be cost effective in future. Issues like instability, blackouts, etc will be under controlled. In traditional process of meter reading collecting usage and generating bill is the vital issue done by manually visiting the individual location which is now automated. Smart Meter works with real time data. It will be shown how Big Data will improve customer relation as well as improves social welfare. Thus proper techniques of data mining is used to retrieve data but with high data security. Mesmerising of various current technology is done here to get ultimate information about energy consumption and also to maintain a balance among customers and utilities.

**KEYWORDS:** Smart Grid, Smart Meter, Internet of Things (IoT), Big Data, Green Energy, Energy consumption, Wireless Sensor Network (WSN), Wireless Sensor, Business Intelligence

## I. INTRODUCTION

In traditional system every house in each apartment are having meter which can be digital or analogue, connected with individual appliances. An electricity board official, physically visit individual houses to check the meter reading each month and generates a manual bill for each month. But Smart meter smarten the entire system. IoT is one of the new technologies that make a Smart Meter as well as Smart grid smarter. IoT is a connection between internet and actual things. Here IoT connected to Smart grid infrastructure thus collecting a huge volume of data from simple home appliances of individual houses in a locality or city or may be across the border. As large data needed to handle, so Big data is introduced [1]. Big data has seven v's namely Volume, Velocity, Variety, Variability, Veracity, Visualization, and Value. As a large real time data is collected each time from customer using Smart meter, are need to process efficiently. Unless proper processing done, exact informations cannot be extracted from them. The demands of electricity supply energy balanced using Smart grid and renewable energy. Renewable energy are like energy produced from wind, solar, biomass, water can also called green energy, meaning they're naturally replenished.

A massive positive change is thus observed. A large centralised electricity generator is distributed to various small generators which are self-independent. These small generators can be made of renewables energies. Here the concept of distributed system is actually refer to the various utilities and power generation stations used to distribute power. This is a complex process done Big Data. And distributed generations refers to different power manufacturing source. The motive behind is to create enough power storage in the grid to make it more efficient. In traditional Grid electricity flow in one track from utility to customer. But in smart Grid energy flows in two ways or bidirectional track. Generally data are collected from Smart Meter with the help of sensors which are in general nowadays wireless in nature. Only collection of data is not enough, also data analysis is a vital part which is done by Big Data. Proper classification of Big Data is discussed here. Data analytics normally finds some meaningful informations from raw data. Big Data helps in structuring the vast amount of raw data in the system. Thus most of the utility inclined to the big data analytics as it improving their business and also provides security. Customers also shown interested in this new Smarter module of Smart meter with Big Data and IoT support, as their bill get reduced and can track their consumption at regular intervals in a secured manner. It has been seen instability and blackout gets reduce by this process.

## II. RELATED WORK

Today consumption of energy is one of the basic concern and it gets complimented with IoT and Big Data. This is being designed, implemented and tested using an embedded system with Arduino and it takes renewable energy as source. Day by day increase in energy demands also increases energy cost and energy management becomes very important. A smart meter can serve this purposes with the help of Internet of Things (IoT) and Big Data in the commercial, industrial and as well as residential sector. Business intelligence is also can be blended with Smart Meter and utility company applications [2]. Smart Grid has many Big Data applications in different fields like Smart building, electric vehicles, data hub of utilities, etc., among which we will discuss about Smart Meter in this paper. Micro grid is also used to increase productivity and electricity consumption for enhancement of the overall efficiency. Smart Grids are one of the most prominent future technologies. Its Advanced Metering Infrastructure (AMI) creates a hub for Smart Grid components, and contains smart meters and sensors, among which most of them are Wireless Sensors, to collect data. These data are collected and analysed through Big Data.

Revised Manuscript Received on October 20, 2020.

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# Cloud Computing in IoT based Smart Meter

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**ABSTRACT:** Modern trends forces a massive change in power industry and utility value chain. Therefore demands of resources and storage is also increases which can be supported by cloud computing. Consumer role becomes one of the vital role here. These are all implemented by Smart Grid. So we need to develop advanced power distribution grids with modern infrastructure. In this paper we will discuss about one of the most important component of smart grid that is smart meter that will IoT based and use cloud platform for data processing and storing. Cloud infrastructure will help in building a large number of application on it and also helps in storing large volume of data. Cloud technology enhances the storage on demand using virtual memory concept. Thus provides an economic, portable, scalable infrastructure.

**KEYWORDS:** Smart grid, Cloud infrastructure, smart metering infrastructure, IoT, GSM, Wi-Fi, webpage

## I. INTRODUCTION

Smart Grid becomes smarter when IoT is introduced to it. Smart meter in smart grid also uses this technology. Sensors are part of smart meter consists IoT technology use to collect Raw data after every fixed interval of time may be 15 min then transforms it in big data[1] and stores it. In some countries they have implemented this infrastructure. In this paper, we mainly focus on processing of huge amount of data in proper and efficient way with the help of cloud. Cloud provides resource on demand that is visualization of data is supported by it. Thus it saves energy, increase portability, and makes it cost effective and reliable. Electric transmission and distribution system modernization is very much needed to improve energy efficiency. The Smart grid with IoT delivers efficient, stable and safe bidirectional system. Renewable energy or alternative energy also used here for power generation [2]. Cloud computing becomes an integral part of Smart meter as it excellently managing the huge data with least effort and high utilization of physical memory. There are various cloud infrastructure available viz- Azure, Microsoft Azure, Amazon Web Services (AWS), Alibaba Cloud, IBM Cloud, SAP etc. One of the vital part of cloud computing is routing and congestion control algorithm [3]. Cloud computing systems and smart grid are connected through data centres. We will mainly focus on the cloud database to store smart meter data.

## II. RELATED WORK

Today consumption of energy is one of the basic concern and it gets complimented if it Cloud computing is vast recourse that can store large volume of data as per requirement of the data store in big data. But implementation of this concept must be done with proper security [4][5]. The cloud infrastructure has scalability, interoperability and flexibility.

Revised Manuscript Received on October 20, 2020.

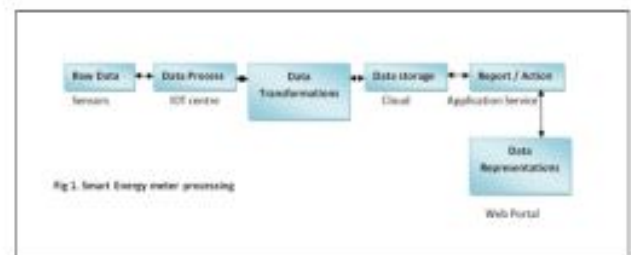
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It also helps in integrating distribution of power system and transform it to automated one. Here not only power distribution, but control and management of entire system with reconfiguration and other cloud services is also initiated here [6]. In old metering system, a person monthly visits every house in a locality to check the electricity meter for collecting the electricity consumption. Sometimes this bill was not properly calculated. Overbilled problem was quite a common feature here. To overcome this problem there need a single bidirectional secure communication is needed. IoT with Arduino helps to build this system as efficient in energy consumption as they consume less power and work faster. The GSM system can be implemented to give proper information and website is also created to provide reports in graphical format [7]. Cloud computing can also combine with Big Data to manage the entire energy consumption system in smart grid effectively. Data analysis and processing both can be done more effectively with these two technologies [8].

## III. METHODOLOGY

In this paper our primary goal is to see vast amount of data used in smart meter must be properly collected and then analyse and process them in cloud atmosphere. The main goal is create a pyramid structure of cloud infrastructure to provide different types of computer services and information. But the most important feature is the security concern in the communicational network.



### A. Smart Grid and Smart meter

Smart Grid is adopted by many countries like Canada, Italy, and Portugal etc. Smart Grid can becomes smarter by implementing IoT in them and other components among which the most important one is smart meter. Smart grids are bidirectional in nature. So they can through back excess energy in the grid when not needed or customer as well as the utility both can communicated between them. Smart meter is a mainly designed meter with IoT devises, wireless sensors, arduino. Quick customer response is one of the vibrant features of this system.

### B. Big data in smart grid

Smart meter produce vast data is difficult to handle by normal data structure and data base system. This is stored inform of big data. Big data has its own V structure.