

Internet of Things Role Based Smart Energy Meter

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ABSTRACT: Smart grid is one of the features of smart city model. It is energy consumption monitoring and management system. Smart grids are based on communication between the provider and consumer. One of the main issues with today's outdated grid deal with efficiency. The grid become overloaded during peak times or seasons. It is also possible to hack the system, and basically, take free electricity. By using smart grid consumer and owner get daily electricity consumption reading and owner can cut electricity supply remotely through internet if bill is not paid. One more thing, the data collected from the smart meters should not be accessed by any unauthorised entities. Can see a person standing in front of our house from electricity board, whose duty is to read the energy meter and handover the bills to the owner of that house every month. This is nothing but meter reading. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills. Many times errors like extra bill amount, or notification from electric board even though the bills are paid are common errors. To overcome this drawback we have come up with an idea which will eliminate the third party between the consumer and service provider, even the errors will be overcome.

I. INTRODUCTION

Internet of Things (IOT) is a concept and a paradigm that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new applications/services and reach common goals. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. Internet of Things is a new revolution of the Internet. Objects make themselves recognizable and they obtain intelligence by making or enabling context related decisions thanks to the fact that they can communicate information about themselves. They can access information that has been aggregated by other things, or they can be components of complex services. Smart cities are complex environments where several areas of innovation meet in order to substantially improve socioeconomic development and quality of life.

Energy meters in India have overwhelmingly been electromechanical in nature yet are progressively their status of working capability being supplanted by more modern and precise advanced and electronic meters [1]. A high amount of power at destinations is lost because of theft. With few changes made with present existing architecture of energy meters we can overcome the theft. As indicated by an investigation agency distributed by Northeast Group, India is hoping to shrewd lattice framework to help handle a power robbery issue and enhance unwavering quality. Robbery costs the Indian power \$16.2bn per year[2]. In this paper the idea of smart energy meter using IoT and Arduino have been introduced.

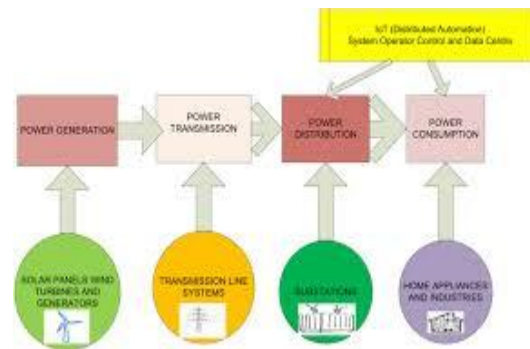
In this method we are using Arduino because it is energy efficient i.e. it consume less power, it is fastest and has two UARTS. In this paper, energy meters which is already installed at our houses are not replaced, but a small modification on the already installed meters can change the existing meters into smart meters. The use of GSM module provides a feature of notification through SMS. One can easily access the meter working through web page that we designed. Current reading with cost can be seen on web page. Automatic ON & OFF of meter is possible. Threshold value setting and sending of notification is the additional task that we are performing)

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Fig. 3: State of controlling null appliances

In the present billing system the distribution companies are unable to keep track of the changing maximum demand of consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on timely basis, which will help to assure accurate billing, track maximum demand and to detect threshold value. These are all the features to be taken into account for designing an efficient energy billing system.



The present project “IoT Based Smart Energy Meter” addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems i.e. combination of hardware and software in order to implement desired functionality. The paper discusses comparison of Arduino and other controllers, and the application of GSM and Wi-Fi modems to introduce ‘Smart’ concept. With the use of GSM modem the consumer as well as service provider will get the used energy reading with the respective amount, Consumers will even get notification in the form text through GSM when they are about to reach their threshold value, that they have set. Also with the help of Wi-Fi modem the consumer can monitor his consumed reading and can set the threshold value through webpage

This system enables the electricity department to read the meter readings monthly without a person visiting each house. This can be achieved by the use of Arduino unit that continuously monitor and records the energy meter reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer on request. This system also can be used to disconnect the power supply of the house when needed.

II. BACKGROUND WORK

One year after the past edition of the Cluster book 2012 it can be clearly stated that the Internet of Things (IOT) has reached many different players and gained further recognition. Out of the potential Internet of Things application areas, Smart Cities (and regions), Smart Car and mobility, Smart Home and assisted living, Smart Industries, Public safety, Energy environmental protection, Agriculture and Tourism as part of a future IoT Ecosystem have acquired high attention. In line with this development, the majority of the governments in Europe, in Asia, and in the Americas consider now the Internet of Things as an area of innovation and growth. Although larger players in some application

areas still do not recognise the potential, many of them pay high attention or even accelerate the pace by coining new terms for the IoT and adding additional components to it. Moreover, end-users in the private and business domain have nowadays acquired a significant competence in dealing with smart devices and networked applications. As the Internet of Things continues to develop, further potential is estimated by a combination with related technology approaches and concepts such as Cloud computing, Future Internet, Big Data, robotics and Semantic technologies. The idea is of course not new as such but becomes now evident as those related concepts have started to reveal synergies by combining them.

In recent years many reforms have brought numerous changes to enhance power services benefits across the country. Still there are a few issues in the framework, which influence the nature of administrations and in this manner the level of fulfilment of end clients or open. Among numerous uncertain issues, one of the issue is knowing the consumption by consumer's zone wise/region wise. Indeed, even after establishment of more precise electronic or advanced meters, the issue is proceeded in numerous areas across the country. In present framework the system received by the greater part of intensity supply organizations/offices for getting perusing for power utilization is the manual meter perusing or a portion of its variations like photograph realistic perusing, perusing SMS etc [7].

Some of identified drawbacks of such methodology are Time expending, requires more human resources, efforts and Possibility of incorrect or purposeful manipulated controlling the power consumption etc.

The proposed model evaluates previously mentioned methodology drawbacks and the present techniques with a computerized framework to remotely gather /control energy meter readings getting a capacity to continuous observing the power utilization. The model recommends establishment of Wi-Fi/GPRS empowered energy meters at consumer end. Such meters have capacity to get associated with the system (through remote or GPRS framework). Such system associated meters can be connected remotely to the server, status of perusing information and also other required information put away in the meters memory can be gathered whenever [8].

These planned techniques will perform operations like consequently associating with the particular meters through their IP Address. Getting current information from the device. Refreshing reading tables at servers. Preparing list of consumer meters with any connection error or any invalid data. Thereby Initiating error reporting and removal routines according to the errors observed. The information gathered through remote meters in each calendar, at that point might be used from the database by the billing programs, the greater part of which are as of now in utilized by the power supply offices. As the framework does not require much changes in existing billing information/programs, it very well may be advantageously added to the present providers. The model through its planned automated activities, may carry higher execution with condition of control in power supply units.

Automation is a technique for controlling apparatuses naturally for the comfort of clients. Controlling of electrical gadgets in the home that can be modified utilizing a principle controller or even by means of mobile phone (GSM) from anyplace in the world [8]. It likewise includes turning on and off electrical apparatuses like airconditioners or refrigerators when a desired temperature has been reached. It additionally is utilized to secure a house from thieves by sending caution messages to the closest police station.

III. METHODS

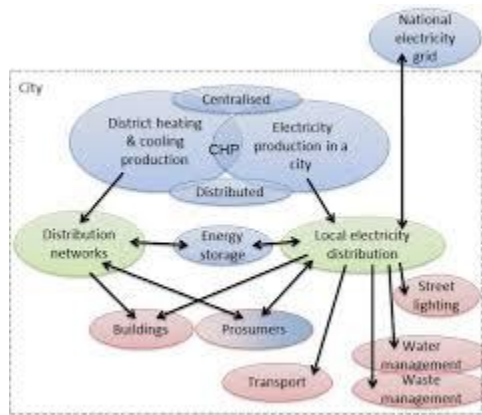
IOT IN THE GENERATION LEVEL

The management of generation resources used to be controlled using local controlling devices. The system operator has low controllability for remote control and many actions must be carried out by sending commands or instructions to be performed by a local operator. In addition, power system generation asset management is becoming more sophisticated than ever before due to some reasons. First, the penetration of renewable energy resources, as a huge source of uncertainty, is mounting in power systems. In near future, the pervasiveness of electric vehicles will be in widespread use that impacts on power system generation scheduling. Third, the participation of loads as demand response resources is increasing which is highly corresponded with the uncertain hourly electricity prices. The electricity price is also correlated with many items such as power market structure, and instantaneous fuel price. In addition, demand side medium-scale or small-scale distributed generation (DG) will have extensive prevalence in the near future which is referred to as virtual power plants (VPPs) or microsources in microgrids. The operator must deal with such a high level of uncertainty and volatility in addition to prevailing constraints of the grid which can be led to the imposition of load shedding or curtailment in some cases. In order to prevent such measures and to retain the security, stability, reliability, and environmental sustainability of the power system, IoT technology can facilitate tackling the problems and challenges.

In IoT-aided smart grids, all fluctuations and generations in both demand and supply sides can be automatically and accurately be monitored and the operator will be able to have more elaborated supervisory on the grid. The IoT technologies in generation level deal with the integration of a couple of energy resources such as coal, oil, gas, nuclear,

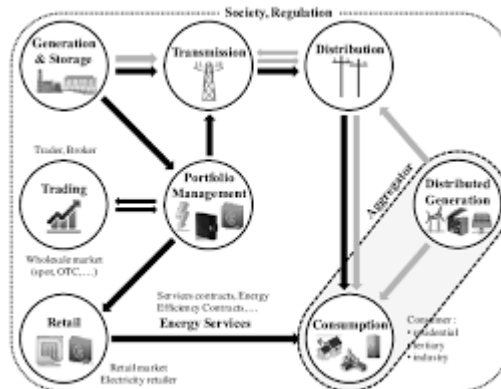
hydro as well as renewable energy sources such as wind, solar, geothermal, and marine-based energies in order to improve the performance of the generation sector and maintain the dynamic and static security of power system. In addition, energy storage utilities can be utilized to redress imbalances caused by various sources of uncertainty which can be influenced by IoT infrastructures. IoT is an ecosystem of connected physical objects that are accessible through the internet. To transfer information wirelessly for power consumption monitoring and controlling NodeMCU Wi-Fi module is used. The NodeMCU development board is a powerful solution to program microcontrollers and be part of the Internet of Things (IoT).

Here for monitoring power the IoT ESP8266 modules take the calibration pulse from meter and perform necessary operations afterward it sends the required information like no. of units or power is on limit or not etc. in blynk server from there it continuously notified to the authorized person about the detail of consumption of power.



RFID Reader

EM-18 reader modules are those RFID reader modules that can read 125 KHz tags. It provides security as this is only accessible by the authorized person of electricity board section as the predefined value of the meter is only set by the electricity board so that they can control the power consumption of the whole area. If consumer required more power so as per their requirement the predefined values is change using these EM-18 RFID readers. On showing the ID cards of authorized person along that entering confidential passkey, RFID reader allows them to make changes on the predefined values if the ID cards of unauthorized person is shown at that time the system doesn't allow them to make changes in the predefined value.



USB to TTL convertor

CP2102 chip from SilicionLabs (siLabs) is a single chip USB to UART bridge IC. It requires minimal external of PC interfaced projects. This module helps to interface the system with LabVIEW. With the help of designed model power consumption of a customer is monitored. When the user exceeds his limit of power consumption the supply of power will cut off automatically. The usage of every consumer in the region or sector is sent to the blynk server. Supplier will be notified about the power consumption of the entire region or sector. The supplier can monitor and control the power usage of the user as well as the entire region. The power consumption data sheet of the entire region is generated and analyzed using LabVIEW. If the generated data is provided to the customers, they can compare their usage with the data sheet. So this will help to identify the fraudulent user who is stealing the user's power by direct hooking method. As the Indian Government has also proposed formation of Smart Cities which will have an effective energy management, transportation, waste disposal and resource conservation strategy using primarily Internet of Things. This

wireless IoT based technique is much useful to detect the stealing of the electricity worldwide. So in this work variable voltage and variable power will set according to electricity board section as well as it provide safety as the limit of meter will change by the authorized person.

IV. CONCLUSION

A revolution in energy domain is underway, namely the Smart Grid. Smart Grid is owner as well as user friendly technology. User can check daily consumption from any location using internet. Owner can control customer meter from control unit. Smart grid represents one of the most promising and prominent internet of things applications. More efficient transmission of electricity. Quicker restoration of electricity after power disturbances. Reduced operations and management costs for utilities, and ultimately lower power costs for consumers. Time saving technology. Control on Meter tempering.

REFERENCES

- [1] Dr. Ovidiu Vermesan and Dr. Peter Friess, "Internet of Things Strategic Research and Innovation Agenda" in Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, Denmark, 2013, pp. 9-30.
- [2] Rajiv .K. Bhatia and Varsha Bodade, "Smart Grid Security and Privacy: Challenges, Literature Survey and Issues", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 1, January 2014.
- [3] Stamatis Karnouskos, "The cooperative Internet of Things enabled Smart Grid", SAP Research, Vincenz-Priessnitz Strasse 1, D-76131, Karlsruhe, Germany, 2013.
- [4] David Chaves, Alexandre Pellitero and Daniel Garcia, "Providing IoT Services in Smart Cities through Dynamic Augmented Reality Markers", sensors, ISSN1424- 8220, Published: 3 July 2015
- [5] V. Dehalwar, R. K. Baghel, M. Kolhe. Multi-Agent based Public Key Infrastructure for Smart Grid, The 7th International Conference on Computer Science & Education (ICCSE 2012) July, 2012. Melbourne, Australia.
- [6] E. Yaacoub and A. Abu-Dayya, "Automatic Meter Reading in the Smart Grid using Contention Based Random Access over the Free Cellular Spectrum," Computer Networks, vol. 59, pp. 171–183, 2014.
- [7] M. Yigit, V. C. Gungor, and S. Baktir, "Cloud Computing for Smart Grid Applications," Computer Networks, vol. 70, pp. 312–329, 2014.
- [8] H. Sun, A. Nallanathan, B. Tan, J. S. Thompson, J. Jiang, and H. V. Poor, "Relaying Technologies for Smart Grid Communications," IEEE Wireless Communications, vol. 19, no. 6, pp. 52–59, 2012.
- [9] S. Bush, "Network Theory and Smart Grid Distribution Automation," IEEE Journal on Selected Areas in Communications, vol. 32, no. 7, pp. 1451–1459, 2014.
- [10] C. Wang, X. Li, Y. Liu, and H. Wang, "The Research on Development Direction and Points in IoT in China Power Grid," in International Conference on Information Science, Electronics and Electrical Engineering (ISEEE), vol. 1, 2014, pp. 245–248.
- [11] X. Chen, L. Sun, H. Zhu, Y. Zhen, and H. Chen, "Application of Internet of Things in Power-Line Monitoring," in International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery (CyberC), 2012, pp. 423–426.
- [12] W. Meng, R. Ma, and H.-H. Chen, "Smart Grid Neighborhood Area Networks: A Survey," IEEE Network, vol. 28, no. 1, pp. 24–32, 2014.
- [13] Smart Grid News, "Smart Grid 101: The Internet of Things and the Smart Grid (Part 1)," 12 November 2013, accessed: January 2016. [Online]. Available: <http://www.smartgridnews.com/story/smart-grid-101-internet-things-and-smart-grid-part-1/2013-11-12>
- [14] EAI International Conference on Smart Grid and Internet of Things (SGIoT). [Online]. Available: <http://sgiot.org>
- [15] Z. M. Fadlullah, A.-S. K. Pathan, and K. Singh, "Smart Grid Internet of Things," Mobile Networks and Applications, pp. 1–2, 2017.
- [16] F. Al-Turjman and M. Abujubbeh, "IoT-enabled Smart Grid via SM: An Overview," Future Generation Computer Systems, In Press, 2019.
- [17] A. Gupta, A. Anpalagan, G. H. Carvalho, L. Guan, and I. Woungang, "Prevailing and Emerging Cyber Threats and Security Practices in IoT-enabled Smart Grids: A Survey," Journal of Network and Computer Applications, vol. 132, p. 1, 2019.