A Research Paper on Automated Meter System

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ABSTRACT: The present system of energy metering as well as billing in India uses electromechanical and somewhere digital energy meter. It consume more time and Labour. One of the prime reasons is the tradition billing system which is incorrect. Many times slow, costly and lack in flexibility as well as reliability. Today accuracy in electrical billing is highly recommended. The smart energy meter gives real time consumption as well as accurate billing. A possible solution is a Wireless Energy Meter which is able to send its data via wireless communication to PC or a remote device where monitoring and analysis of the data will be easily made. In smart metering there is a different technique in communication system like Amazon Machine Image (AMI), Worldwide Interoperability for Microwave Access (WIMAX), and Zig-bee etc. This paper presents a brief literature review of the work carried out by the various researchers in this field by using AMI techniques. And also the various communication system used in smart metering technology.

KEYWORDS: AMI, Global System for Mobile Communications (GSM), Zig-bee, WIMAX.

INTRODUCTION

Energy meters in India have overwhelmingly been electromechanical in nature yet are slowly being supplanted by progressively complex and exact computerized and electronic meters. A high level of power income is lost to control robbery, wrong meter perusing and charging, and hesitance of buyers towards taking care of power tabs on schedule. Extensive measure of income misfortunes can be decreased by utilizing prepaid energy meters.

The smart meters realized today are essentially robotized understanding units, or ARU, equipped for figuring the force utilization and cost for the utilization in agreement to the time, and day of the week. On other hand, the progressed metering system, or AMI, is an arrangement of utility meters that measure the utilization and give the data to the service organizations, just as the shoppers keen on keeping the use costs low, or needing to gracefully the power back to the network. Concerning the energy proficiency issues of smart metering gadgets, since most keen metering gadgets embraced remote interchanges, for example, Zig-Bee and Wireless Sensor Network (WSN) in light of IEEE802.15.4.

Smart meters are being presented in many force systems worldwide to give continuous force utilization and value data to buyers. Keen Meters are electronic estimation gadgets utilized by utilities to impart data for charging clients and working their electric systems [2]. The blend of the electronic meters with two-way interchanges innovation for data, screen, and control is regularly alluded to as Advanced Metering foundation (AMI). Past systems, which used single direction correspondences to gather meter information, were alluded to as AMR (Automated Meter Reading) Systems[1]–[3]. AMI has created after some time, from its foundations as a metering understanding substitute (AMR) to the present two-way correspondence and information system. This paper proposes the utilization of brilliant meters in appropriated age which is still further developed than the current techniques giving productive transmission and departure of intensity.

THE CONCEPT ON SMART GRID AND SMART METERING

The expression "smart matrix" is commonly used to speak to the incorporation of all flexibly, system, and request components associated with an advanced update of intensity lattice with a solid, versatile, secure, and sensible measures based open data foundation which can give two way correspondences to offer various advantages for both the force providers and shoppers [4].

The Smart Grid utilizes clever gadgets and an advanced correspondence overhauled power system to upgrade the presentation of transmission and circulation matrices. Utilizing this computerized innovation, the wise systems can survey its wellbeing progressively, suit new situations, control dispersed asset incorporations and advance the reaction of smart machines of end clients [5]. The proficiency and dependability can be improved and dynamic jobs from end clients can be utilized in Smart Grid so as to set aside customers' cash.
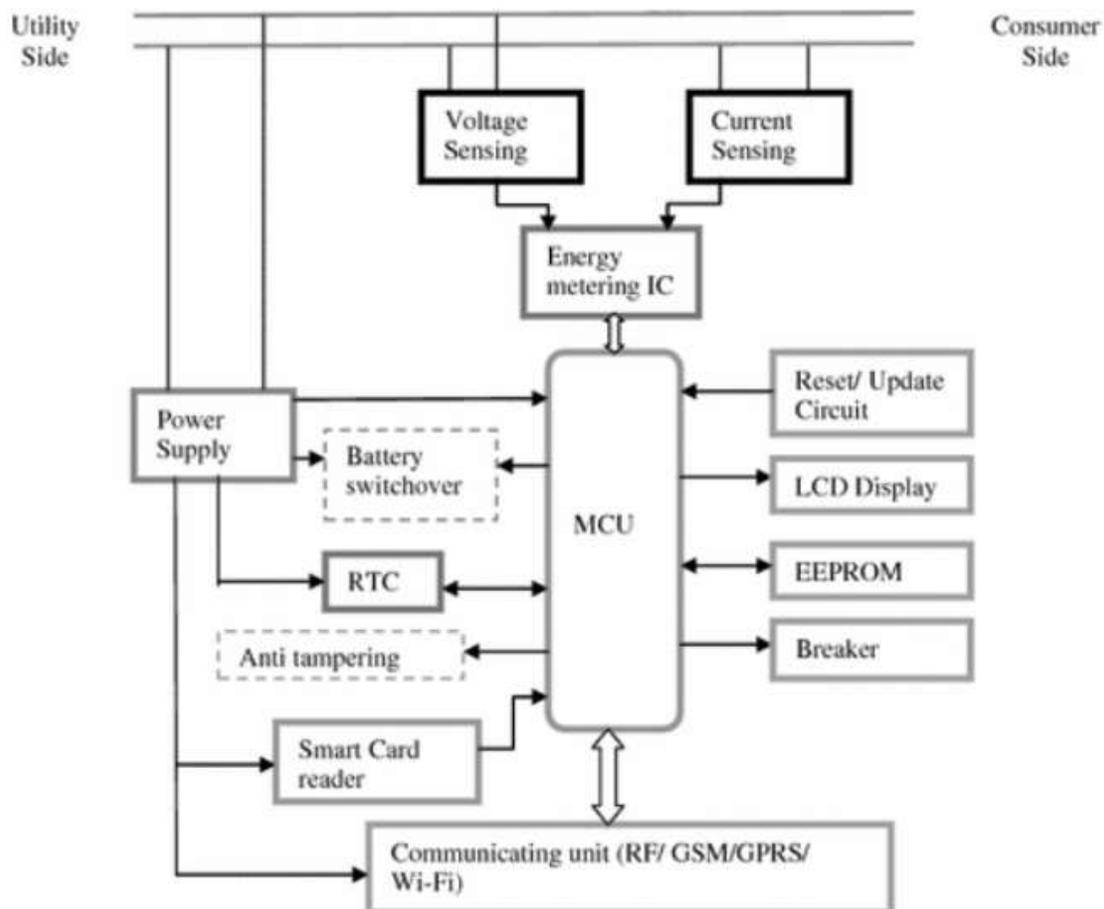

Fig.1. Hardware Structure of a Modern Smart Meter.

Execution of robotized meter perusing (AMR) hardware has been built up since such huge numbers of years prior. In those years, remote hardware or telephone lines were utilized to move information. This hardware were planned such that information were gathered by a radio connection introduced in a vehicle going along the road close to the meter, or through telephone lines or remote stations getting information from meters.

Smart meters must be fit for metering fundamental and other valuable parameters. These meters must have the option to give legitimate correspondence ports to react to demands for gathering fundamental information, to orders gave by the focal access server to turn on or off, and, if there should arise an occurrence of any control, to report any occasions and blames. This meter must have an interface to associate the In Home Display (IHD) for client mindfulness. A smart meter

ought to be equipped for demonstrating the all-out expense of the expended energy. Likewise, it ought to have the option to enlist information identified with utilization every hour, permitting the supporters of deal with their utilization [6].

Correspondence systems can send the control orders gave by the station to the smart meter and to move the information gathered by the meter to the focal access server. The most significant bit of leeway of putting resources into keen metering systems is sparing the expense of the dispersion system work. In the event of consistent and ceaseless perusing, and the requirement for controlling on/off of endorsers because of not covering the tabs or driving on in the wake of taking care of the issue, utility would not have to dispatch a specialist to the spot; the entirety of this should be possible by smart meters[4], [5]. This can diminish the yearly use of utility to an incredible sum. Utilizing Home Area Network (HAN), indoor presentations to show the data about the utilization, this system can advise the endorser with respect to how to utilize energy in top time, which can lessen the supporters charge. AMI comprises of a lot of hardware, systems, PC systems, conventions and sorted out procedures which are utilized to gather and send information identified with power utilization of the endorsers utilizing force and dissemination lattice. People call this system progressed in light of the fact that it can gather information as well as it is so secure, protected and quick, self-upgradable and created. AMI innovation empowers the utility to complete a few capacities precisely and effectively.

ADVANCED METERING INFRASTRUCTURE (AMI)

AMI is certifiably not a solitary innovation; rather it is a designed foundation that coordinates various advances to accomplish its objectives. The system incorporates smart meters at the customer end, correspondence systems at various degrees of the foundation chain of importance to associate two finishes, Meter Data Management Systems (MDMS) and the way to coordinate the gathered information into programming application stages and interfaces at utility supplier or head end [8].

The executing the brilliant meter can go from observing and controlling the utilizations of the utilities at their association with a structure, to checking and controlling the outlets to all the apparatuses in the structure. It is expected that every part of the AMI is particular and driven by the clever operator. Since, the client would be engaged to utilize every segment independently just as in a system, and the measured quality of AMI would consider fitting the metering and control structure to deliver a vigorous system [6]–[8].

The astute multi-specialist AMI can be modified to give the standard execution pointers of the system: Specific, Measurable, Accurate, Relevant, Timely, Evaluative, and Recordable. The service organizations would need to introduce a solitary gadget at the customary situation of a specific utility meter and have the option to get the standard utilization patterns at set interims. The client is outfitted with a propelled strong state electronic meter that gathers time sensitive information. These meters can transmit the gathered information through generally accessible fixed systems.

The metered information are gotten by the AMI have system. Hence, they are sent to a MDMS that oversees information stockpiling, examinations and gives the data in a valuable structure to the utility specialist co-op. AMI empowers two-way correspondence; accordingly, correspondence or issuance of order or value signals from the utility supplier to the meter or burden controlling gadgets are additionally conceivable [10].

PROPOSED METHOD OF WIRELESS COMMUNICATION IN SMART METERING

GSM Short Messaging:

Global System for Mobile Communications (GSM) is the world's most well known standard for portable communication systems .GSM is utilized by over 1.5 billion individuals across in excess of 212 nations and domains. GSM additionally spearheaded minimal effort usage of the short message administration (SMS) which permits gatherings to trade postpone lenient short instant messages. The prominence and wide inclusion of cell systems have pulled in specialists to consider the utilization of SMS administration. Anyway there are sure flawed issues seeing GSM system, for example, its versatility, unwavering quality and security, particularly under high burden.

The genuine information taken from a genuine GSM arrange in India has been analysed. SMS conveyance achievement rate was seen as 94.9%; 73.2% of the effectively conveyed messages reach to the goal inside 10 seconds; about 5% of them require over 90 minutes. Utilizing SMS for AMR administration will build the progression of messages hugely. GSM utilizes a few cryptographic calculations for security. The advancement of UMTS presents a discretionary Universal Subscriber Identity Module (USIM), which utilizes a more extended verification key to give more prominent security, just as commonly validating the system and the client[7]–[9].

Zig-bee:

There are different topologies for correspondence in Smart Grid. The most drilled engineering is to gather the information from gatherings of meters in nearby information concentrators and afterward transmit them utilizing a backhaul channel to headquarters, where the servers, information putting away and handling offices just as the board and charging applications live. Since various kinds of engineering and systems are accessible for acknowledgment of AMI, there are different mediums and correspondence advancements for this reason also: Power Line Carrier (PLC), Broadband over electrical cables (BPL), copper or optical-fiber, and cell, WiMAX, Bluetooth, GPRS, Peer-to-Peer, Zig-bee bee and a couple of others.

At AMI level, correspondences are between gadgets in a home while at upper layer, they happen between Home Area Networks (HAN) and the utility supplier. These two, to put it plainly, could be called inhome and utility systems. HANs associate keen meters, smart gadgets inside the home premises, energy stockpiling and age (sun powered, wind, and so forth.), electric vehicles just as IHD and controllers together. Since their information stream is prompt instead of constant, HANs required data transmission shifts from 10 to 100 kbps for every gadget, contingent upon the errand. The system, notwithstanding, ought to be expandable as the quantity of gadgets or information rate may increment to cover places of business or enormous houses [12].

Table 1: Comparison of Different Smart Grid Wireless Technology

Description	WIMAX	Power Line Carrier	WLAN	Zig-bee
General usage	Point-to-point wireless transport for voice, data, video, etc.	Also known as power line communication, Broadband over Power Lines; Systems for carrying data on a power conductor, for WAN applications;	Wireless networking for LAN and WAN; widely used for indoor wireless LAN.	Low data rate, long battery life and secure networking; In-between Wi-Fi and Bluetooth.
Frequency range	2.3, 2.5, 3.5 GHz licensed bands; 450 MHz, 700 MHz also used	1.7-80 MHz. Most providers rely on the 1-30 MHz spectrum bandwidth for BPL transmission.	Unlicensed: 2.4 and 5 GHz; Direct Sequence Spread Spectrum (DSSS), OFDM	868 MHz, 915 MHz, 2.4 GHz (unlicensed); Direct Sequence Spread Spectrum coding.
Channel bandwidth	20 or 25 MHz (United States) or 28 MHz (Europe)	Wide band 1200 (Hz); Medium band 600 (Hz)	20 MHz for 802.11 a/g; 20/40 MHz for 802.	Nominal bandwidth of 22 MHz.
Coverage capabilities	3-4 miles; longer distances capable with lower bit rates	Distances of more than 15 km can be achieved over a medium voltage network	Indoor: up to 100 m; Outdoor: up to 250 m	Up to 50 meters
Peak single user data rate	Typical 4-16 Mbps	Low-frequency (100-200 kHz) carriers: Few hundred bits per second; Higher data rates mean shorter ranges. Speeds up to 10 Mbps have been achieved.	802.11b: up to 11 Mbps; 802.11a/g/h/j: up to 54 Mbps; 802.11n: >100 Mbps	20 to 250 kbps, depending on frequency band.
Cost	Moderate	High cost of implementation and lack of vendors.	Low - widely used and deployed in the consumer market.	Low - intended as a low cost, low power product for low bandwidth applications.
Technology maturity	Mature; 500+ deployments worldwide.	More popular in Europe than North America.	Wi-Fi is a mature, proven interoperable technology.	Fairly new; specifications ratified in 2004, ongoing specifications still in process.

The determined unwavering quality and acknowledged postponement are additionally founded on the thought that the heaps and utilization are not basic. Given the above prerequisites and thinking about the short separations among hubs that empower low force transmission, remote innovations are the prevailing answers for HANs. These innovations incorporate 2.4 GHz WI-Fi, 802.11 remote systems administration conventions, Zig-Bee and HomePlug [13]. Zig-bee bee depends on the remote IEEE 802.15.4 norm and is mechanically like Bluetooth. HomePlug, then again, transmits information over the current electrical wiring at the home.

There is still no one of a kind norm or practice for inhome correspondence available; be that as it may, Zig-bee bee and to lesser degree HomePlug and Z-Wave are the predominant arrangements. Preferences of Zig-bee bee incorporate giving remote correspondence, low force utilization, adaptability and financial proficiency. The principle hindrance of Zig-bee bee is the low data transfer capacity. In business structures, a wired innovation named BACnet is the conspicuous correspondence convention. As of late, a remote adaptation of BACnet has opened up utilizing short range remote systems, for example, Zig-bee bee.

WIMAX:

In the keen system brilliant meters, home doors, and purchaser gadgets server and separate customers convey by means of remote correspondence. Additionally customer can turn out to be

little scope providers by creating environmentally friendly power energy at home, expend this force locally and offer the overabundance capacity to the utilities. The developing IEEE 802.16 Broadband Wireless Access innovation WIMAX permits interoperability and joins the advantages that different remote systems administration advances offer exclusively and leads a way towards 4G.

The WIMAX range utilizes for voice, video, and information all viewed as expansive band Wireless Access applications. WIMAX innovation empowers universal conveyance of remote broadband assistance for fixed or potentially versatile clients, and turned into a reality in 2006 when Korea Telecom began the arrangement of a 2.3 GHz form of portable WIMAX administration called WI-BRO in the Seoul metropolitan region to offer superior for information and video up to 50 km. Utility needs and issues are frequently planned in exceptionally free terms, for example, "astute burden shedding," "insurance system against significant unsettling influences," and "check fell line stumbling." These requirements must be separated to physical wonders, for example, assurance against: transient edge unsteadiness (first swing), little sign edge shakiness (damping), recurrence insecurity, momentary voltage flimsiness, long haul voltage precariousness, falling blackouts[10]–[12].

The most essential prerequisite in any electrical system is appropriate over flow assurance to keep the heap from overheating and electrodynamics associations. This article give a detail customer server bidirectional burden insurance system model for wide territory Smart Grid system and spotlight on over current Power System Load Protection execution in MATLAB/SIMULINK utilizing WIMAX. The paper likewise features WIMAX transmitter and recipient model for wanted wide region checking and control.

CONCLUSION

Energy meters in India have predominantly been electromechanical in nature yet are step by step being supplanted by progressively advanced and exact computerized and electronic meters. A high level of power income is lost to control robbery, mistaken meter perusing and charging, and hesitance of shoppers towards taking care of power tabs on schedule. In this paper brief presentation about smart system and keen meter are given and furthermore the development metering foundation examined. Here different remote correspondence utilized in smart meter innovation is portrayed and furthermore the correlation of four distinctive innovation is given. Here all infer that PLC technique has high introductory expense and Zig-bee bee strategy has minimal effort, long battery life and increasingly secure so Zig-bee bee technique is progressively best for smart metering correspondence application.

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