Advancement in Smart grid by Embedding a Last meter in an Internet of Things Platform

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Abstract: *The customer domain of smart grid usually a combination with smart home and smart building systems but ur proposed model are "**distributed centric**" rather than customer centric ,which is poorly scalable and there by user can be convenient by this model. Our model consists of detailed architecture and an implementation of "last meter smart grid" which is the last portion of the smart grid on customer premises and is to be embedded in an internet of things platform. Our approach consists of many new aspects and advantages over existing system, an addition of new application or routine with smart grid that work smoothly with smart home application in the same infrastructure; data gathering from many sources using sensor communication protocol; the data access is made secured and more customized; an univocal sensor an actuator is mapped to a common abstraction layer on which addition application can be built .a demonstrator has been built and tested with purposely developed zigbee smart meter and gateways, distributed iot server , flexible user interface.*

Key words: *AMI (Advanced Metering Infrastructure), Internet of Things, Smart Grid, and Telemetering.*

1. INTRODUCTION

A smart grid is an electrical grid which includes a variety of an operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy efficiency resources. Electronic power conditioning and control of the production and distribution of the electricity are the important aspects of the smart grid. Smart meter is the portion of the smart grid nearer to the home and one in

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Which customer interacts? It allows the two way data flow between the customer and electric utilities [2]. A Smart grid is a modernized electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviors of the suppliers and consumers in an automated technology to improve the economic, efficiency, reliability and sustainability of the production and distribution of the electricity .The Smart grid will have monitoring, controlling, analysis and communication capabilities to power generation and distribution. Real time information on cost, demands and supply of power will provide control at the every level of the system. Customers will both receive and contribute power to the smart grid from anywhere in the world.

Smart meter system are an integral part of the Smart Grid infrastructure in terms of data collection and communications. Functionally, It is an automated electric power system that monitors and controls the grid activities, ensuring the efficient and reliable two way flow of electricity and information between power plant and consumers and all points in between from customer preference to individual appliances equipment's .A Smart Grid monitors the delivery of electricity and tracks the power consumption with the help of smart meters, which is a two way transmission of energy consumption between consumer and producer through communication networks .the two nature of the smart meter system allows for sending commands to operate grid infrastructure device ,such as distribution switches and recloses to provide a more reliable energy delivery system known as distribution automation.

Smart meter are often promoted as a route for energy saving, real time pricing ,automated data collection ,avoiding human errors due to manual reading which would ultimately reduce the labor charges.

Based on their local area network the Smart meter technology defined by two categories, they are radio frequency (RF) and power line carrier (PLC) each of these technologies have their own advantages in their applications.in this paper we typically focus on the needs of power distributors to manage the complete power grid .they reach the customer's premises with an ad-hoc network of smart meters connected by general packet radio services (GPRS).

In this paper, we present an architecture of a last meter smart grid embedding in an Iot platform. Advantages of using our architecture are as follows;

1) The architecture integrates smart grid with smart home applications
2) It can gather data from sensor communication protocol, this architecture allows different wireless or wired protocols to be used for communications between meters, users and other parts of the system.
3) It provide secure access to the data
4) It simplify interaction with non-technical users, sensors and actuators.

2.1Features of smart grid

Reliability: the smart grid will make use of technologies that improves fault detection and allows self-healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disaster or attack.

Flexibility: flexibility in the network topology next generation transmission and distribution infrastructure will be better able to handle possible bidirectional energy flow, allowing for distributed generation such as photovoltaic panels on building roofs.

Classic grids were designed for one way flow of an electricity, but if a local sub network generates more power than its consuming, the reverse flow can raise safety and reliability issues. A smart grids aims to manage this situation.

Efficiency: numerous contribution to increase the overall efficiency of energy infrastructure is anticipated from the deployment of the smart grid technology, in particular including demand side management, for example turning of ac during short term spikes in electricity price.

Load adjustment: the total load connected to the power can vary significantly over time although the total load is the sum of many individual load of the consumers, the overall load in not a stable, slow varying.

Peak levelling and price: to reduce the demand during the high cost peak usage periods, communication and metering technologies gives information to smart devices in the home and industries when energy demand is high and track how much electricity is used and when it is used. it also gives ability companies the ability to reduce the consumption by communicating to the devices directly in order to prevent the system over loads

Sustainability: the improved flexibility of the smart grids permits greater penetration of highly variable renewable energy sources such as solar power and wind power, even without the addition of energy storage.

2.2 Components of smart grid

Smart infrastructure system: the smart infrastructure system is the energy, information, communication infrastructure.

1. Advanced electricity generation ,delivery and consumption
2. Advanced information metering ,monitoring and management
3. Advanced communication technologies.

Smart management system: the smart management system is the subsystem in smart grid that provides, advanced management and control services

Smart protection system: the smart protection system is the subsystem in the smart grid that provides advanced grid reliability analysis, failure.

Intelligent appliances: capable of deciding when to consume power based on preset consumer preference. this can be go a long way towards reducing peak loads which has a major impact on electricity generation costs addresses the needs for new power plants and cutting down on damaging greenhouse emissions. Early tests with smart grid have shown that consumers can save up to 25% on their consumption by simply providing them with information on that usage.

Smart power meters: two way communications between consumers and producers to automate billing data collection, detect outages and dispatch repair crews to the correct location faster.

Smart substation: that includes monitoring and control of critical and non-critical operational data such as power factor performance, breaker, transformer and battery status, security, etc.

Smart distribution: that is self-healing ,self-balancing, self-optimization including conducting cables for long distance transmission, automated monitoring and analysis capable of detecting or even predicting cable failures based on real time data about weather, outage history,etc.

smart generation : capable of "learning" the unique behavior of power generation resources to optimize energy production, and to maintain voltage ,frequency and power factor standards based on feedback from multiple points in the grid automatically.

Universal access: universal access to affordable, low carbon electrical power generation and storage.

2.3 Smart Grid Technologies

The smart grids are grouped into five following areas:

1. Integrated communication
2. Sensing and measurement technology
3. Using advanced components
4. Advanced control methods
5. Improved interfaces and decision supports

2.4Smart grid Benefits

1. Self-healing
2. Motivates and includes the consumer
3. Resists attack
4. Provides power quality
5. Accommodates all generation and storage option
6. Enables market
7. Optimizes assets and operates efficiently

3. Smart Meter

Smart meters are automated energy meter. This new type of meters are a replacement for the existing meters (referred to as "dumb" meters) and send electronic meter readings to your energy supplier automatically.

Smart meters consists of LCD display, which gives us the real-time feedback on the energy usage.

In addition we also have gas smart meters and electricity smart meters.

3.1 Working of Smart meter

A smart meter works by communicating directly with our energy supplier, so the supplier will always have an accurate meter reading and there's no need for manual reading.

Smart meters can work in a different ways, including using wireless mobile phone technology to send data.

The smart grid operates similar to how an accountant manages a financial institution. you first count the money that is the meter ,and then manage your finances that is the substation .the most important aspects of an efficient smart electricity grid is "peak load management " , which refers to maintaining control of load management devices to meet demand response. Facilities that use distributed energy storage technologies to store renewable energy created can pump excess power back into the electric grid during off peak periods.

Advanced Metering Infrastructure (AMI) is an electrical architecture that provides electrical grid with two way communications for measurement, analysis, and optimization of energy usage. AMI allows end user devices to communicate with smart meters, which then communicate with the substations to allow grid coordination and adjustment by meter data management system.

AMI plays a fundamental role in smart grid features like demand response, distribution, automation and other facts of electrical grid optimization, and the Industrial IoT makes smart meter and the smart grid even smarter.

3.2Benefits of having smart meter

1. Accurate electricity bills.
2. By having smart meters the end of estimated bills, and the end of overpaying (or underpaying) for our consumption.
3. No one has to come to our home to read our meter; don't have to submit meter readings.
4. Management of our energy use with a real time data display in our home.

4. Block diagram

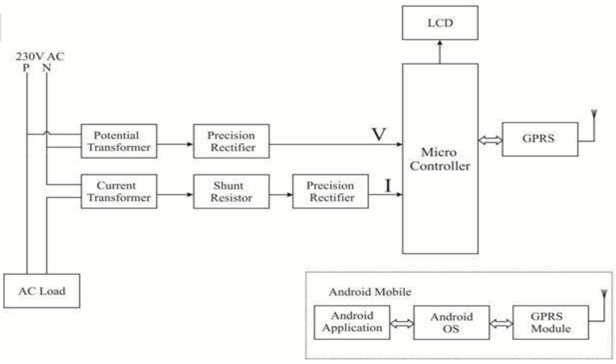

Fig 4. Block diagram of last meter in a smart grid in IoT

5. INTERNET -OF-THINGS

General concept of Internet of things is the ability of network devices to sense and collect the data from the world around us, and then it shares that data across the Internet where it can be processed and utilized for various purposes.

5.1 USES OF INTERNET-OF-THINGS

1. receiving warnings on your phone or wearable device when IoT networks detect some physical danger is detected nearby
2. self-parking automobiles
3. automatic ordering of groceries and other home supplies
4. automatic tracking of exercise habits and other day-to-day personal activity
5. Potential benefits of IoT in the business world include:
6. location tracking for individual pieces of manufacturing inventory
7. new and improved safety controls for people working in dangerous environments

5.2 ADVANTAGE

1. Tracking behavior for real-time marketing;
2. Enhanced situational awareness;
3. Sensor-driven decision analytics;
4. Process optimization;
5. Optimized resource consumption; and
6. Instantaneous control and response in complex autonomous systems.

5.3 NETWORK DEVICES AND THE INTERNET OF THINGS

All the ordinary household gadgets can work in an IoT system by modifying it. Wi-Fi network adapters, cameras, microphones, mobile and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. Home automation systems already implement primitive versions of this concept for things like light bulbs, plus other devices like wireless scales and wireless blood pressure monitors are the examples of IoT gadgets. Wearable computing devices like watches and glasses are also visualized to be key components in future IoT systems. The wireless communication protocols like Wi-Fi and Bluetooth naturally extend to the Internet of Things.

5.4CONSUMER APPLICATIONS OF IOT

Before 5 years ago, consumers rarely saw what the Internet of Things would mean to their private lives. Now a days, they are using increasingly not just because they are more interested in technology but mainly because all these applications are mentioned on every news outlet and website that covers technology.

Smart is a key concept in the evolution of the Internet of Things – from smart cities to smart social care but also empowered by smart devices and intelligent networks, Wearable's and smart watches, connected and smart home applications (with Google's Nest being a popular one but certainly not the first), you know the examples.

Although it is said that there is some technology fatigue appearing, the combination of applications in a consumer surroundings and of technology compulsion undoubtedly plays a role in the growing attention for the Internet of Things. That consumer fascination/applications aspect comes on top of all the real-life possibilities as they start getting implemented right now and the contextual and technological realities, making the Internet of Things one of those many widespread technological, leading to genuine digital transformation opportunities in several areas, digital disruptions and, simply, business opportunities in the broadest sense.

6. CONCLUSION

We have presented an architecture, an implementation, and a demonstration of the Customer Domain of the smart grid, based on IOT that can host a broad range of smart home applications. Modernity in this field must be found in the architectural concept, in the system integration, and in the prioritization of requirements. In this sense, our proposal has unique advantage sand elements of novelty with respect to the state of the art: it is customer centric, it minimizes the sequence of specific smart grid infrastructure, and it leverages possibly available smart home applications, sensors, and networks. We believe this is key for a widespread approval of smart grid applications and equipment to be deployed at home.

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