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Real Time Monitoring of Substation by Using Cloud Computing

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ABSTRACT
Recent development of the grid provides actual time control and monitoring of the system which consists of bi-directional communication. Grid is required to develop reliability, adaptability, security, cost effectively actual administration of its construction. By considering all the need from consumer side, we make a project based on application of cloud computing which is used for energy planning and information management of the grid. This project overcome the disadvantages of smart grid without cloud computing. We also implement the alarm system in this project which indicates the current value exceed by its demand value.
Keywords: cloud computing, real time reading, smart grid.

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I. INTRODUCTION

Grid consists of combinations of various electrical networks, communication Infrastructure and information Technology. With developments of data management and bidirectional grid provides electrical power flow more reliable, cost effective and proper management. Grid monitors power use and match power consumption with system load. The digitally controlled grid gives self-monitoring, self- healing and two way communication for energy generation, transmission, distribution, control and monitoring of power which balance the supply and demand [1]. It is essential to manage the millions of meter in grid with safe ways. Utility must prolong their interconnection and manage all the data in data center. So, Cloud computing are one of the most recently use developed technology which play role to encourage for the design of the future grid. By using cloud computing consumer can enter to their applications all the time by a connected devise to the system. Cloud computing application for grid gives efficiency and security [2]. Our project based on one of application of cloud computing for actual time monitoring of substation. In this project alarm system is present for exceeding the demand value of current. This gives the message on mobile.

II. CLOUD COMPUTING FOR MONITORING AND CONTROL

Control of various devices in the substation can be done remotely from the data center of substation. Now day substation automation plays a very important role for controlling process of the power system. This will control the various issues in the in system. Maintenance can be done by the controlling data of the system. Consumer wants flexibility in the system which will achieve by remotely controlling of substation. Various issues are generating during the operation of the system which will in terns change the normal operation of the devises working in power system [3]. According to the need of grid it is essential to make bidirectional communication between the utility and consumer. For the better energy management of the grid require maintaining balanced in demand and supply for the utility and supply [4]. Grid able to fulfill this requirement by using energy management devise in it. This devises are home energy system, claim system and building power administration [5]. For proper management of demand and supply, grid utilize solar and wind renewable energy sources.

In the grid, number of devices is connected like home appliances, micro grid, sensors, communication devices and substations [7]. Thus, it is very important to protect all this devises by making suitable solutions for it which will give flexibility and reliability in the electric supply system.

As we know grid consists of different energy management devices in it. So, management of this data is very important. This meter provides actual time monitoring data and communicates with utility [8].

Layered architecture must require in the grid as it consists of different stages like electricity generation, transmission and distribution. This may give the perfect management of system [9].

Heterogeneous built up supports various appeal response, disburse formation and authentic time pricing of grid. It is important character of smart grid [10].

Security is one of very important case to secure the privacy of any field [11]. Cyber security, data outage, threat detection are various issues required for preventions. For customer motivation proper privacy policy should need to keep secure at their end [2],[3].

For fulfillments above explained terms, cloud computing is very useful technology in recent development of grid. It consists of following properties [4],[5]:

1) Optimization of cost by actual time monitoring and controlling of various parameters [6],[7].

2) According to the energy usages at consumers end they can make payment by using some specific applications or software.

3) Carbon emissions in the grid is very serious issue. It may lead to control this problem through inclusion of hydro, solar and wind power generating stations [8].

4) Proper balance of demand and supply. This is done by accessing the data to the customer utility side.

Our goal is to calculate the reactive power from the substation and provide compensation on it. For this project data from the cloud plays a very important role. For accessing the cloud we had taken space at server and we can see the daily consumption of electrical power by using our login id and password. We already had created an account there. We can see various parameters like reading for voltage, current and power factor. Hence by using basic formulae for active and reactive power we calculate their respected readings.

III. SMART GRID AND CLOUD COMPUTING

3.1 Smart Grid: A grid is the combination of information technology with intelligent devices in power system. It also uses bidirectional communication between customer and utility [9]. As we have discuss grid make reliability over the generation, transmission and distribution. In generation of electrical power various power plants includes for generation. Transmission provides generated power from generating substation to the distribution station [20]. It is very important to make realize customer to control the use of electricity at their end. Grid work under these requirements. Grid provides various intelligent devices and provides bidirectional communication between customer and utility to fulfill the distance between demand and supply. The following discuss terms are very important in grid for the above mentioned points:

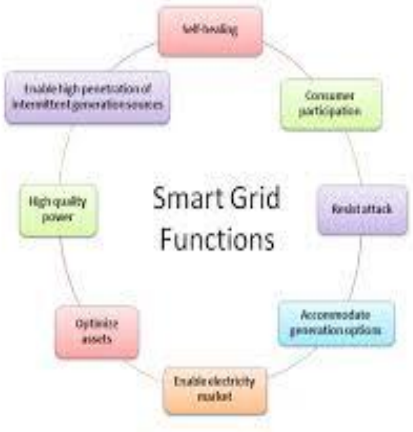

Fig1: Grid

a) Smart Meter: Substation automation provides flexibility in the power flow. Recently developed grid consists of various infrastructures in it with smart meters at the consumer end which make them know their power consumption [2]. This smart meters help to store the regular information of power consumption and maintain the record for the same. Advanced metering infrastructure is use to determine the actual time monitoring at the customer end and can be remotely controlled [22]. This is located at distribution end and able to record the energy consumption. By the use of bidirectional communication consumer and utility are always in contact with each other. Consumers are aware about the power use at their side. They can ask about the record what they want to utilities. Also customer can calculate the whole day energy consumption at home by taking the readings from smart meters. This may help the cost of power use that's why they will alert to save the energy consumption. Smart meters are actually designed this purpose to know the power use and one should control the use of power [23].

b) Micro grid: Matching the demand and supply creates various challenges at utility supply system. Electrical supply systems need to work under energy efficiency, energy autonomy and diversify the energy sources. Micro-grid used for the demand management, energy generation and energy storage. Penetrations of distribution generation from renewable sources like solar, wind and hydro must be done in the system. Basically micro grid is one of very important solution which is required to maintain demand at consumer end. It allows using various sustainable energy sources such as wind, hydro. Micro grid use to integrate these distributed energy sources and distribute the energy to the consumers to fulfill the requirements [24].

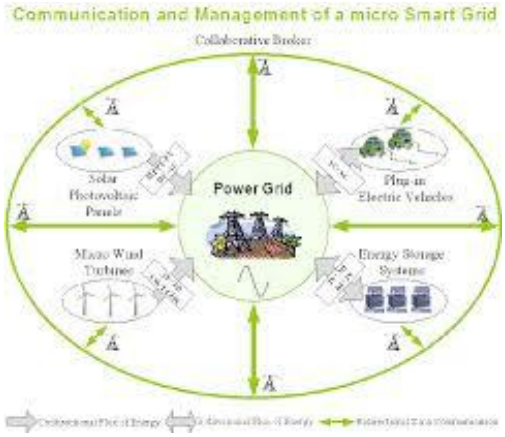

Fig 2: Micro grid

Fig 2 shows the conceptual set up for micro grid .This architecture shows the basic steps from generation electrical supply with storage and integration of distributed energy sources. This figure show the electricity generated by using fuel like coal at thermal, water at hydro and wind energy for generation of energy which provides at transmission level. From the transmission substation it will step up or step down with the help of a static devise (transformer) then it sends to distribution level. From the distribution substation energy provides to the consumer according to their requirements.

3.2 Cloud Computing

Cloud computation is recently developed technology for grid which provides a computation model that will prevent on demand model and also store various records which can be seen at the connecting device [25]. Cloud use the data taken by the various smart meters in grid. Cloud computing includes following properties:

On-demand function: cloud computing provides the data stored at every stages to the consumer according to their requirement this can be used to know them their use of energy. By using this information consumer will be aware and they wants to save energy and the money also. Customer can primarily see the data from cloud which will help them to calculate the energy consumption at their home. So to save their money they make control on use of energy. This facility of cloud is very important one which provides the information according to the demand of consumer.

Broad network access: cloud can be able to handle through a browsers which are available anywhere now a days. Heterogeneous consists of thin or thick can be used for making network for cloud. People are very introduced with surfing of internet so can easily use the broad network access built with the cloud. Cloud can be handling from anywhere.

Rapid elasticity: This function having the control over the consumer that can read the data from the cloud. Data is can be support to store in memory devise. This data can be expand or reduced according to the consumer demand. So there is elasticity in the data storing at the cloud.

Resource pooling: There are no limits on the location of the consumer. They can easily access with cloud from anywhere and should read the data from cloud. Cloud computing model serve multiple consumer in resources pooling.

Measuring devise: As discuss earlier cloud computing provides advanced metering devise at consumer side to know them their power usage that is help them control on power saving. By use of meters consumer can be easily estimate the cost of power at home. And this cost should paid by them.

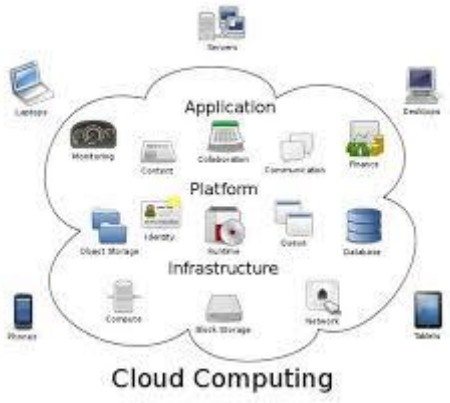

Fig 3: *Cloud Computing*

Fig3 shows various stages in cloud computing. This technology provides various facilities to consumer. This will help them to introduce with new technology. Cloud computing categorized into different stages they are required characteristics, model and implemented models. In this essential characteristics broad access network, rapid elasticity, measuring devices and on demanding self-services. Service model consists of various services. In the new implemented model public, private, hybrid and community are the various terms perform. The above model visualize by National Institute of Science And Technology [26].

Energy Administration

Energy authority is very common concept in grid. Researcher always tries to solve this issue by doing implementation in previous project. Our project based on the management of energy. This project shows the true power and receptive power and providing compensation of reactive energy. It is important to overcome the reactive power from the circuit. Our project provides the data from the cloud to the consumer. They can see the reading for active

and reactive power. We make a software based programming for this. The data from the cloud automatically taken by the program and we get values for active and reactive power. In the previous project we have observed that the capacitor bank located in the circuit continuously working while this can lead to voltage drop across the capacitor and increase the cost of the circuit.

(a) **FFig4.Energy Meter for actual time monitoring of grid**

IV. CONCLUSION

We have discussed various advantages of cloud for grid. Grid consists of smart measuring devices from which data store at cloud. Cloud computing provides various functions in the grid. Cloud computing provides managements, information managements and provide bidirectional communication between consumer and utility. By solving the problems of consumer, utility try to balance demand and supply. We observed data stored in the cloud and analyzed it for calculating the current demand in the system. This project have an advantage of indication of increasing current demand from which we can turn off the system and energy save.

(b)

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