MONITORING AND CONTROL OF MICRO GRID USING IoT

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Abstract : Microgrids are restricted systems of power sources and loads equipped for working as autonomous electric power frameworks or as a feature of a bigger electric network. Usage of microgrids would assist the general public with moving on from nonrenewable Coal based vitality age to cleaner and sustainable power source age. As of now, 25-half of the all out electrical vitality produced in India is lost in Transmission and Distribution. Replacing the Indian Power Grid as a big system of DC microgrids is picking up help on account of the potential it offers to lessen such misfortunes, improve working productivity, unwavering quality and adaptability of the system. The point of this paper is to build up a mechanized framework dependent on the idea of Internet of Things (IoT) that continually screens the electrical parameters to be specific flow and voltage coursing through different parts of a DC Microgrid, recognizes and controls the deficiency leeway process amid issue conditions. The client would be cautioned amid event of different faults. Communication assisted protection strategies are a common solution to protect the microgrid . Issues like sympathetic tripping, false tripping, blind zone, variation in fault levels and unwanted islanding are caused due to the impact of distributed generations.

***IndexTerms* - Component,formatting,style,styling,insert.**

I. INTRODUCTION

Auspicious recognition and clearance of Faults has dependably been one of the key difficulties looked by the power systems engineer. The most significant parameter to improve working proficiency and dependability of the power system is time taken to recognize and clear flaw conditions through ideal shortcoming freedom ways. Our nation utilizes a unified Power grid isolated into 5 zones to power the whole nation. This makes the grid extremely firm and requests exceedingly arranged and sorted out activities with respect to any progressions made in the power system to guarantee solidness and safe task of the National grid. The grid can be robotized and be worked with higher productivity if the grid is divided into littler parcels and worked as a system of such littler sections. The rise of DC microgrids implies that the size and multifaceted nature of the system to be controlled is decreased radically. The idea of Internet of Things (IoT) would help mechanize the power grid and empower the power systems engineer work as regulating expert of a computerized procedure . The CPC in a microgrid acts as the main control centre by monitoring all the electrical parameters of all the buses connected together in a microgrid. The CPC is also responsible for all the relay connections and disconnections which lead to reconfiguration of microgrids. This puts the responsibility of microgid protection on the shoulders of the CPC. Communication assisted protection strategies are a common solution to protect the microgrid . Issues like sympathetic tripping, false tripping, blind zone, variation in fault levels and unwanted islanding are caused due to the impact of distributed generations These faults require immediate clearance and thus the CPC should function autonomously. The establishment of an automated system is costly, requires large space, is subject to constant monitoring by individuals and requires proper maintenance. In this scenario it can be well said that taking the system online would remove all the above mentioned challenges and would be much more accurate

II. PROPOSED IoT BASED MONITORING AND CONTROLLING SYSTEM

The system proposed in this paper focuses on autonomously monitoring the current and voltage in each of the microgrid and alert the user during overcurrent faults, ground faults and short circuit faults. The system would also be capable of controlling suitable protection circuitry to remove critical faults immediately. As the operation of the microgrid is automated, the need for human decision making is eliminated and the minimum reaction time to react to fault conditions can be drastically reduced. To realize the proposed idea, transducers are to be installed at suitable locations in the buses of the microgrid based on ranges of operation of the transducers. The data acquired by the transducers is collected by the microcontroller, output signals from the transducers are converted to desired logic levels and then are uploaded to the cloud where raw data is processed to useful information in human understandable formats. The processed data can be viewed remotely by authenticated users. The system issues alerts in the form of SMS, e-mail and on-screen notifications to users when faults are detected. The system triggers safety circuitry actuators like relays, isolators and circuit breakers to immediately clear critical faults. The protection of microgrid is not only aimed at detection and clearance of faults but also deals with the accurate measurements of various parameters of the microgrid. The proposed Central Protection System should thus have the following capabilities:

• Acquisition of data from transducers (current and voltage transformers). • Transferring data to the cloud using proper hardware(wired/wireless) • Data analysis and error detection • Signal reception for reconfiguration of microgrid • Triggering signals for appropriate relays. The data to be monitored constitute mainly the voltage and current levels of various buses scaled down using current or voltage transformers and filtered to reduce noise content.

A. DATA ACQUISITION

In the current scenario, data from the transducers are relayed to the Control Centre, where qualified human personnel have to be deployed for monitoring the data. This system proposes to instead upload data from the transducers to the cloud using the concepts of IoT. The data in cloud is stored securely in remote servers and data encryption depends on credibility of the IoT platform. Efficiency of the system would also depend on the strength and reliability of the internet network being used. The use of Wired networks is preferred in industrial areas where Wireless networks cannot be used reliably. The proposed system is prototyped using ACS712 HallEffect current sensor as transducer. Voltage across the load can be easily measured from the current sensor by using Shunt resistors of suitable values. The digital signal output from the current sensor is acquired by the microcontroller and the current measured by the sensor is calculated using magnitude of the signal after suitable calibration of the sensor. The level of accuracy of the measured current depends on the resolution of the current sensor. The sensor used in the prototype has an accuracy of 66 mV/A.

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B. DATA INTERPRETETION

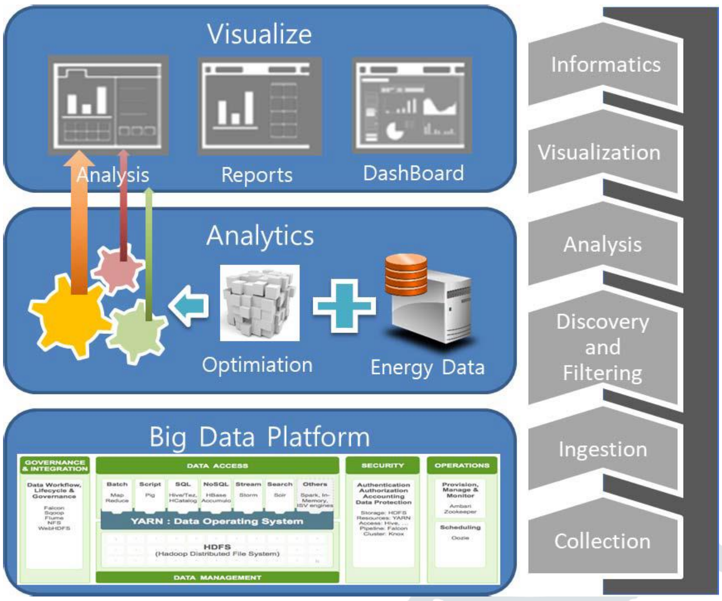
the data is stored in a server (Cayenne) which we have used in creating the prototype. The server data can be effectively visualized in the form of graphs which show us the changes in the measured parameters with time. After the data reaches the cloud it has to be properly analysed and appropriate signals are to be relayed. The current from each bus, on exceeding the threshold value set produces a triggering signal that flows through the transmitting medium to the Microcontroller unit(MCU). The triggering signal generates a response depending on the type of fault that has occurred. The prototype is realized using Ubidots IoT platform. The data acquired by the microcontroller is uploaded to the cloud using wireless or wired network. Uploaded data is then stored remotely in Ubidots servers. The IoT platform stores data from each sensor as a separate channel and produces real time graphs of the captured data for each transducer. The data is constantly processed by the IoT platform and the proposed system is authorized to trigger corresponding actuators when the transducer senses data of values greater than the preset threshold values, i.e the system is authorized to trigger corresponding protection circuity, relays, contactors and circuit breakers when a certain current sensor senses a value of current greater than the preset threshold value flowing through it. The system also alerts the user in the form of SMS and e-mails during such fault conditions. Multiple levels of threshold can be set for the transducers so that the system notifies the user and demands the user's plan of action during minor faults and operate autonomously during major fault conditions to protect the power system from hazardous fault conditions. The state of operation of each transducer and protection circuitry can also be monitored remotely by authorized users. Prototype of the protection circuitry is realized using relays whose state of operation is monitored using Arduino Uno microcontroller.

C. INTERNET OF THINGS

Internet of Things is a future system innovation in which data, for example, individuals, things, forms, and so forth., are altogether associated with the Internet to produce, gather, share and use data [2]. The Internet of things has not existed all of a sudden as of late, however has existed for quite a while. It has been portrayed in a great deal of names, and as innovation propels, its innovation and ideas develop. RFID/USN, and M2M (object knowledge correspondence) are the delegate ideas. IoT essentially implies associating everything to the Internet. Be that as it may, the main thing is 'the reason interface the things with the Internet' as opposed to 'how to interface with the Internet'. A definitive objective of the Internet of Things is to insight the attributes of things through the Internet association of everything around us, to computerize them through the insignificant human mediation, and to give learning and better administrations to people through data combination through different associations. To do this, it is significant not to associate PCs that were looked for in the current Internet, in any case, to interface human, item, space, and impalpable information, investigate different data assembled from them, and offer them.

III. IoT Energy Management Platform

IoT keen energy the executives administration is to expand energy proficiency through energy data accumulation, energy DR the executives and energy sharing/exchanging by creating IoT-based shrewd energy stage innovation for taking care of energy issues in a superconducting society. These IoT-based shrewd energy the board administrations give energy effectiveness improvement, energy sharing and exchanging benefits through interconnection and combination of energy supply-exchange use energy frameworks utilizing the Internet of things. It is conceivable to create and spread new energy administrations for taking care of the issues of national society, for example, constant increment of energy request, keeping away from power crest, what's more, adapting to future patterns. This is made conceivable by building up an energy Internet stage for IoT based energy request the board administrations, appropriated energy worldview building, and energy network based energy exchanging administrations. For these services, it is necessary to develop a web connectivity service implementation environment to provide smart grid interoperability and various additional services. In addition, it is necessary to develop energy service-based technology such as M2M-based energy information service, energy big data curation technology, smart energy fusion and hybrid sensor technology. This energy IoT framework and underlying technology can support the integration of power systems and components.

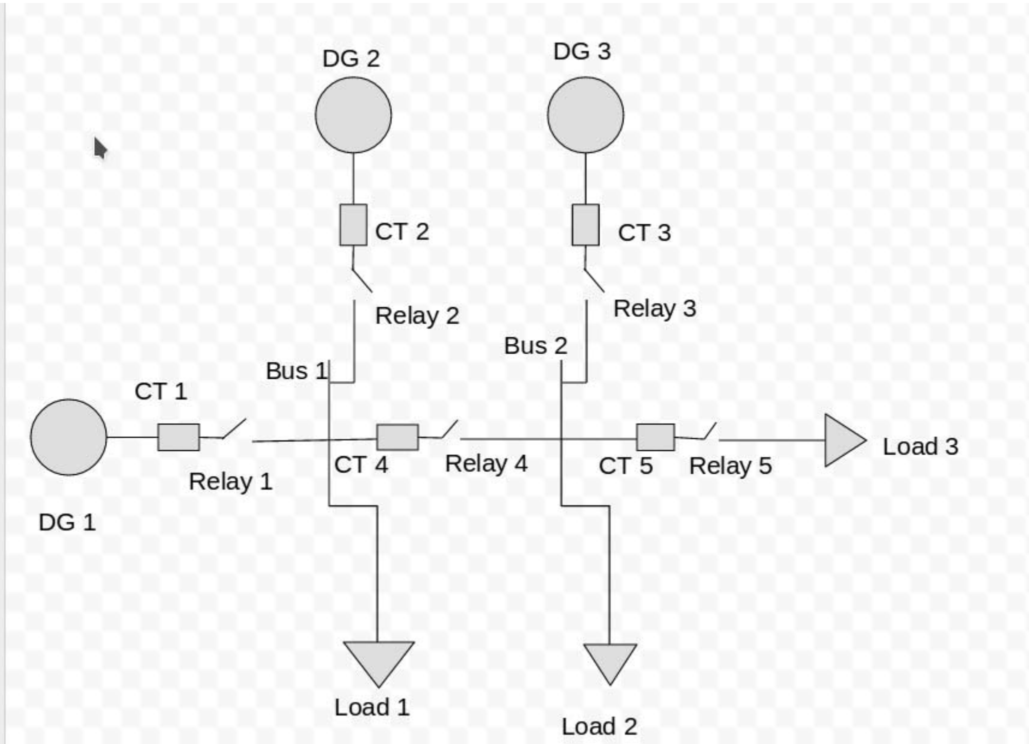


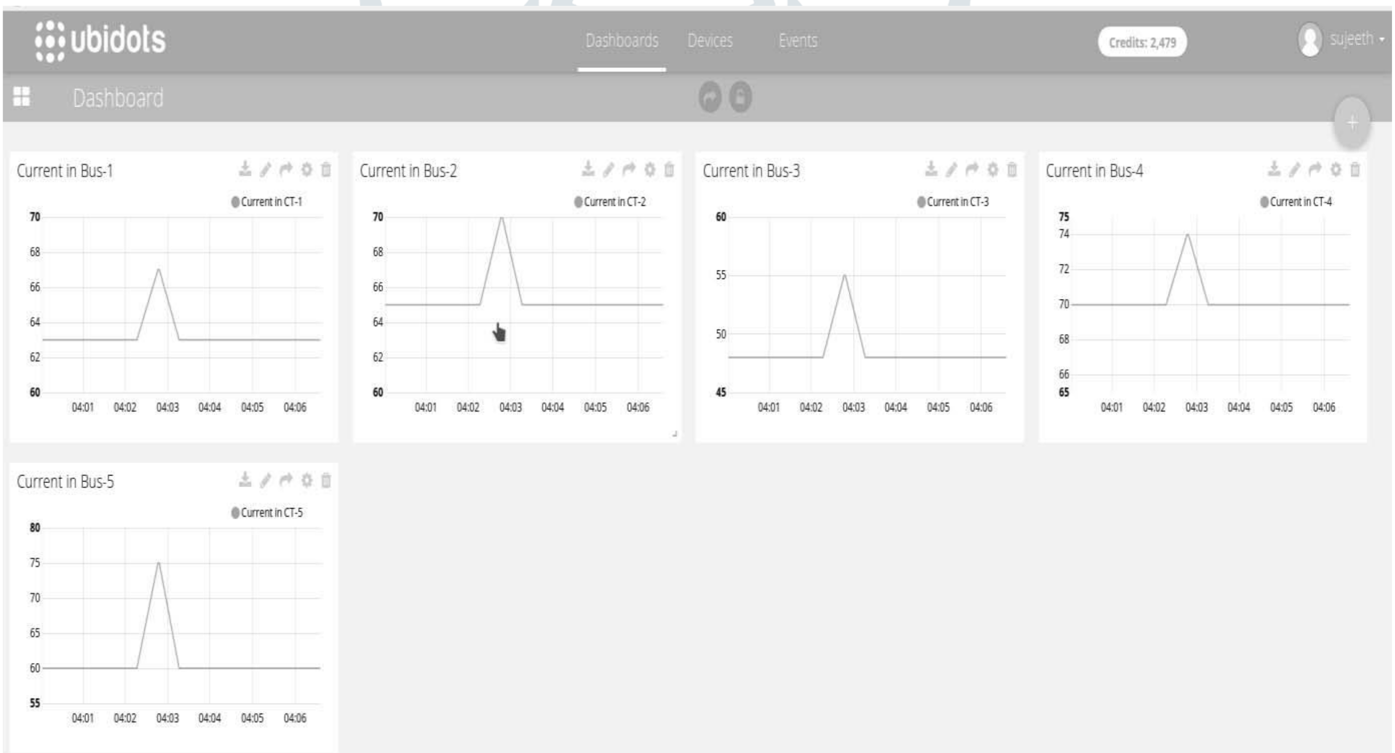
The Arduino Uno microcontroller cannot be directly connected to the internet. Ethernet Shield WS100 is used as the interface to provide internet connection functionality to the microcontroller. Ethernet is preferred over WiFi because Ethernet provides a more stable connection in industrial locations at reasonable speeds. The Ethernet Shield communicates with the microcontroller by Serial Peripheral Interface (SPI) communication protocol and uses digital pins 10,11,12,13 of the microcontroller.

To manage and monitor distributed energy resources efficiently, we need comprehensive management function by linking operation server and big data platform. Based on the estimation of power load and PV power generation by each station and the electricity rate by time zone, the operation schedule for 24 hours of ESS considering ESS depreciation is created. Use dynamic programming techniques to create an ESS schedule to maximize profits. Through ESS optimal operation, it is possible to reduce power base cost based on TOU rate plan and reduce power base rate through maximum power reduction. In actual operation, the ESS scheduling is performed in units of three hours in which the weather forecast is performed, thereby minimizing the ESS operation error due to the PV power

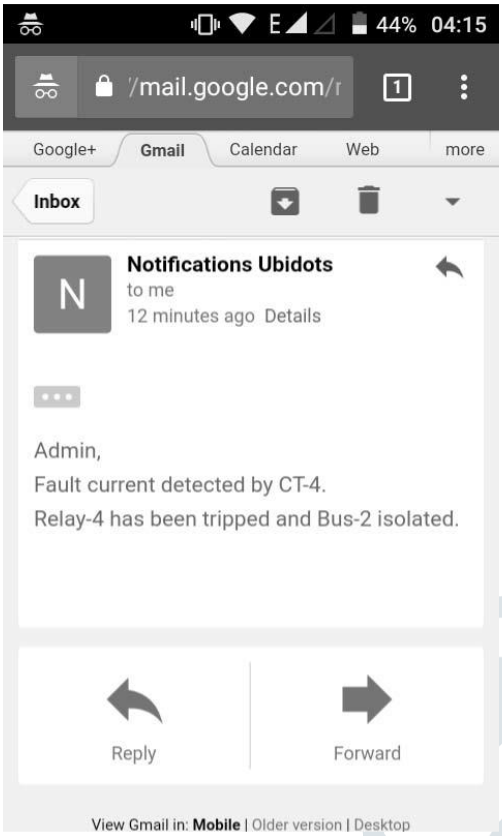
IV. RESULTS AND DISCUSSIONS

The working of the system is tested using a trial 2-bus network shown in Fig with 3 voltage sources, 3 loads, 5 current sensors and 5 relays. Momentary fault currents were introduced simultaneously and the behavior of each relay is captured by the system as individual graphs.





Also, the system is able to capture accurate values of current in each bus at 1 second intervals and the spikes during fault conditions are clearly indicated in the system's dashboard shown . The alert issued by the system as shown in Fig. was almost instantaneous, thus satisfying the system's purpose



V. CONCLUSION

Internet of Things is a future system innovation in which data, for example, individuals, things, forms, and so on.,are altogether associated with the Internet to produce, gather, share and use data [2]. The Internet of things has not existed all of a sudden as of late, yet has existed for quite a while. It has been portrayed in a great deal of names, and as innovation propels, its innovation and ideas advance. RFID/USN, and M2M (object insight correspondence) are the agent ideas. IoT essentially implies associating everything to the Internet. Be that as it may, the main thing is 'the reason associate the things with the Internet' as opposed to 'how to associate with the Internet'. A definitive objective of the Internet of Things is to knowledge the qualities of things through the Internet association of everything around us, to mechanize them through the negligible human intercession, and to give learning and better administrations to people through data combination through different associations. To do this, it is significant not to interface PCs that were looked for in the current Internet,be that as it may, to interface human, item, space, and immaterial information, break down different data accumulated from them, and offer them.

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