IOT Based Feeder Protection And Monitoring System

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Abstract—*Internet of Things (IoT) technology is bringing a revolution in the digital world after the discoveries in the field of computer and Internet. So we can use the concept of IoT tec hnology in the power system. Today the world is moving fast t owards the more effective and efficient smart grid technology by replacing the existing old technologies with the smart grid. So we can use both the technologies to make the existing powe r system more effective and efficient. Iot and smart grid will be a perfect blend of two technologies which will result in impro vement of the existing power structure in India. In addition to that there will be many advantages of using this technology. M any existing problems that are present in the conventional po wer grid structure can be solved. The motive of the paper is to improve the sharing out of power in India where problems lik e load shedding a common situation.*

Index Terms—smart grid ; Internet of things ; Power grid

INTRODUCTION

Systems are programmed using the microcontrollers. These systems are popular in industries at present as through programming we can perform various automatically. In this advanced age, majority of the systems are designed to process automatically .In country like India there is a problem of demand gap , that is the total power which is generated cannot meet the demand of consumers. This affects the industrial areas where there is need of continuos power, due to lack of constant power production of various industries also gets adversely affected. Using SMART GRID can help us in solving such d [1,2].But this system is expensive, so there is a need for development of cost effective system in India. Now a days every system is moving towards automation, these systems are usually combination of one or more systems like power systems, control systems, mechanical systems etc. Microcontroller based system can run all these complex systems without any problem and with more efficiency and flexibility.[3,5]. In India there are mainly four types of feeder we are currently using. These are Agricultural feeder, industrial feeder, Residential feeder and Commercial feeder. Out of these feeders we have set them up in their priority wise order ie. The industrial feeder has the top most priority followed by agricultural, commercial and residential feeder. Normally what happens is if the system is having three feeders (industrial, agricultural and residential).Suppose we have a capacity to supply 1 KVA of load and if the industrial and agricultural feeder need 0.5 KVA each. Then by seeing the priority list we will supply the load to top two feeders(industrial and agricultural) and shut down the supply to the least prioritized feeder(Residential feeder). Currently we have to shut down the system manually. But by using IOT (Internet of things) concept we can take the data (V, I & P) from the power line and give it to the cloud server. We can access the data from server and whenever a fault occurs the microcontroller will send data to cloud through GPRS and the system gets shut-down automatically and the most prioritized feeder gets the load. The remaining part of the paper is arranged in following order. Section II presents the project model. Section III discusses the role of IoT in SMART GRID. Online feeder monitoring using IoT is being written in detail in section IV. The features of GSM is discussed in section V. The various applications that can be done using this technology is discussed in section VI .Paper ends at section VII with conclusion.

PROJECT MODEL

The essential components used in this project is a microcontroller that does the processing work that is required and it also controls all the other devices which are connected to it. For example the relay or the LED etc. If a preset value or condition is reached, it will send a signal to GSM modem.

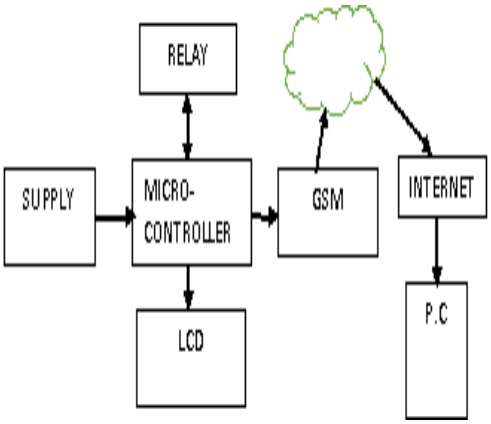

Fig 1.Block diagram of IOT based Monitoring system

The GSM modem[6] helps in monitoring the operation from a remote location or a far off place like a monitoring station. This helps the operator in a far off station to monitor the Power system easily and detect problems and act accordingly. LCD is also installed for the operator in the local environment, so that the operator can monitor system locally. The microcontroller is powered with a rectifier

circuit. The rectifier circuit converts the 230 V AC to 5 V DC which is the desired voltage level required by the microcontroller.

IOT:

The technologies of IoT which are applied in SMART GRID are:

1. Communication technology

We need accurate and reliable information of the devices present at remote location so that the state of the system can be known. There are many communications technology present. Some of the well known communication technologies are WiFi , Bluetooth, ZigBee and GSM/3G/4G, in addition to this many new networking options have come out into view like Thread as another choice from home automation applications and whitespace TV technologies that are put into effect in many countries for IoT-based applications. On the basis of application, there are many factors such as range, information needs , privacy and energy requirements and life of battery will determine the choice of one or various mix of technologies. Some of the important communication technologies used are Bluetooth , Zigbee ,Thread , Wifi , Cellular, NFC, Z-Wave,6LowPAN. Now we are using cellular as a communication technology in our paper. Application that requires IoT which operate at long distances can use the beneficial technologies like GSM/3G/4G to complete the requirements of their application. The fourth Generation of cellular technology can send large amount of data over large distance in small amount of time. But the drawback is it requires large amount of power consumption and the cost required for doing this process is also very high. But in case of sensor-based low-bandwidth applications which require very low amount of data that is to be transmitted through the internet. These technologies can be classified the in two broad categories such as short range technology and long range communication technology.

2. Sensor technology

Sensors are considered as sensing equipment which are used to process, transmit, analyze the physical data such as hot conditions, power, light, electricity, sound .These sensor are classified into different category on the basis of output wave , material used and the manufacture process through which it is produced. Due to advancement in nano-technology there has been a drastic improvement in the field of sensor technology which is used to provide unique methods of production of sensors such as nano electro mechanical systems.

3. Smart Grid communication technology for harsh conditions.

The IoT application having greatest significance is to work in different environments providing reliable communication. Self –healing is also one of the most important application and for self-healing to be performed successfully there is a need of reliable communication technology. The actual environment also decides the performance of IoT. Therefore we need to design the IoT technology carefully so that it will be capable of overcoming the harsh environmental conditions and perform in these harsh conditions. For example, if some devices in the system are not able to give the data then through self-healing the plan for transmission of data is reorganized and the whole system is saved from being affected and thus the reliability of the whole system will not get affected by any means.

4. Capability of withstanding hv

Since the equipment is installed in remote locations, power transmission lines, substation they undergo severe conditions such as vibration, electromagnetism, humidity, etc. So in order to prolong the lifetime of these equipment and to cope with the above problem we have to come up with new technologies in manufacturing such as dustproof, anti-electro-magnetic, waterproof etc.

5. Information security technology

This is one of the most important aspects while using IoT. We know that for IoT to work properly we need an internet connection continuously. There should be Internet connection between device and the server. This ensures that the real time data is being continuously fetched to the server, which will help us in better analysis. But there is also a huge security problem, the data from the server can be hacked. So in order to avoid the data theft we should have sufficient amount of security layers.

IoT based online monitoring

Feeder monitoring is an important application of IoT. In India over the past few years load shedding has caused many problems to the power system there by threatening the reliability of the power system. Some of the challenges are the power security, stability and reliability, and also all of the monitoring equipment which are used are being operated manually. This leads to low efficiency, power loss and more time for completing the operation. By using IoT based monitoring we can overcome the above challenges. At present in India none of the grids which is being used is monitored online on the basis of real time data. We can use some of the wireless networks that are available in Indian market. Some of the options available are IP based internet, power line carrier ,optical fiber, and cellular networks such

as 2G/3G mobile communication network, Time division long term evolution(TD-LTE) 4G network and satellite communication. But we also have constraints such as huge cost of using the technology etc. Moreover the transmission lines are spread over a wide area so it is not possible to take data from each part of the large transmission line. We have to choose some points in a way such that some points are near the load and some points are near the point of generation. Also there is a problem of connectivity in India as there as still many remote areas where cellular technology such as 3G and 4G have not reached and even it has been installed in these areas the speed of data being transmitted is very low, which proves as a hindrance to the continuous transmission of the data which is required in these type of technology which has to be used in online monitoring. Now while using IoT we can use any type of sensor, some of these sensor include current sensor, voltage sensor, temperature sensor, pressure sensor. The current transformer and potential transformer detects the voltage and current in the transmission line and gives their output to the microcontroller. The micro-controller then processes the data and sends it to the GSM module for further action. Through this GSM module we further send the data to the cloud and the data gets stored. In this manner the data gets saved continuously on the server. If there is any change in the parameters such as voltage, current and power then suitable action is taken immediately. By continuously saving the useful information/data to the server we can monitor the transmission line on real time basis. Also we can get the changes in voltage and current on real time basis. If the parameter are changing continuously only at a specific time of the day then we can solve the problem and eliminate it. This makes the device smart which is the ultimate goal of using IoT. Similarly we can observe real time load profiles and plan according to that. So by using IoT we can perform many tasks easily and smartly. With the help of online monitoring we can establish the pattern of fault occurrence and eliminate it in the future so as to maintain reliability of the power system.

FEATURES:

SIM 800L is a quad band GSM GPRS module which works on frequencies like GSM 850Mhz, EGSM 900Mhz, DCS 1800Mhz and PCS 1900Mhz. SIM 800L supports coding schemes such as CS-1,CS-2,CS-3 and CS-4.

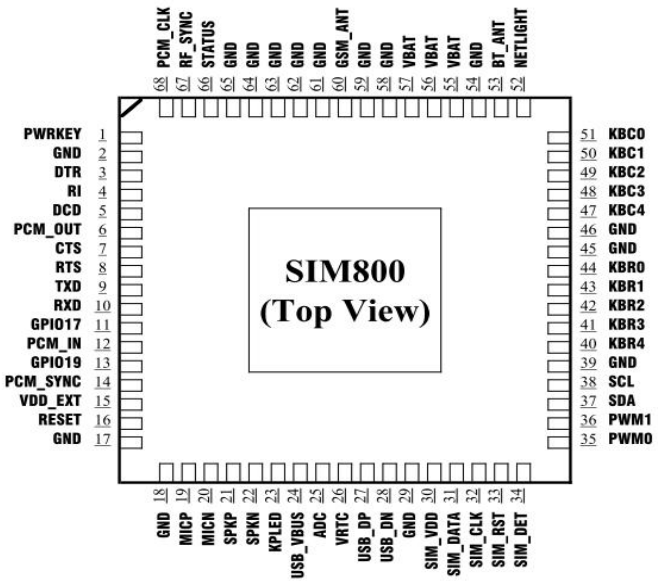

Fig.2.Pin diagram of SIM 800L

SIM 800L is of very small size and can be used in all applications that require small space/area like smartphones, PDA and other mobile devices. It has a total of 88 pins of lga which provides interface between module and the applications in which it is used. SIM 800L has very low power consumption therefore it can save energy. It is powered in the range of 3.4 to 4.4 v. The temperature range for normal operation is from -40 to 85 degree Celsius which means that it can operate over a wide range of temperature and can withstand severe conditions . It has a maximum downlink transfer of 85.6 kbps and also an uplink of same value. It has an integrated TCP/IP protocol, it consist of CSD transmission rates of 2.4, 4.8, 9.6 and 14.4 kbps .

APPLICATIONS

Today most of the countries are moving towards the field of automated power control and its distribution system. They are using SMART GRID system to solve their existing problems.[. As India have the problem of demand gap therefore using the prioritized base feeder monitoring we can distribute the load among the feeders according to their priority number. The GSM module is used in this paper. As SIM800 can read the messages, we have done c programming so that we can control the feeders automatically.

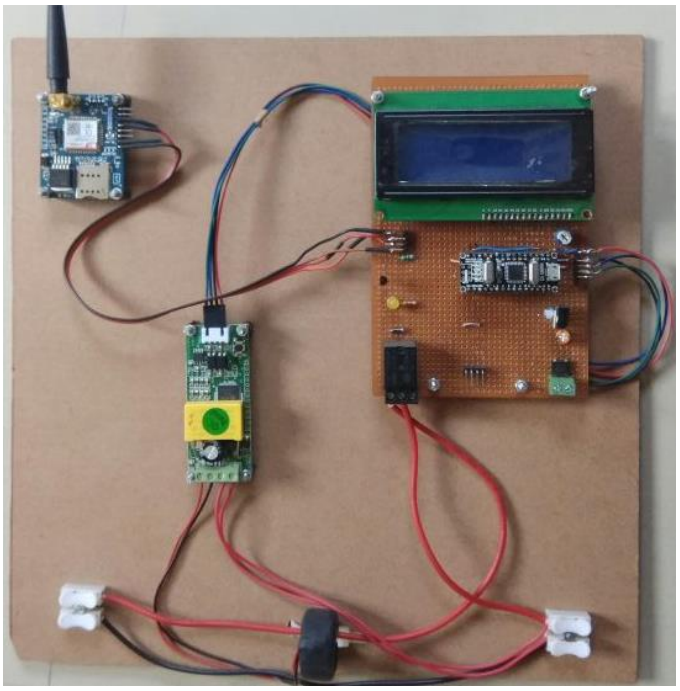

Fig.3.Micro-controller interfacing with LCD & GSM

Apart from the regular monitoring of the power line. We can also use this project to monitor the weather and its effect on the power system. With this we can get an idea about the weather patterns[7] near the power transmission line and we can predict which event is going to occur based on the data we have collected. Also in India the problem of power theft is common, so in order to avoid this problem we can take the help of IoT an prevent the power theft.

CONCLUSION:

Iot is a new technology which has various applications. Now a days the transmission systems India are moving towards the development of SMART GRID with the government trying to change our age old systems into smart grid systems. IoT based feeder monitoring will reduce losses to the systems with real time data which will keep us up to date with changes and gives us a pattern which we could use in the future to predict the failure and stop damages to the system, which only leads to nothing but losses. If the change is made it will help to monitor the power system and increase the reliability of the system.

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