

Fault Control with Smart Circuit Breaker for Deregulated System

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ABSTRACT: Restructuring of intelligent power system is incorporated round the globe in all sectors generations, transmission and distribution. This paper proposes IOT (Internet of things) based smart circuit breaker in deregulated system at substation to ensure safety of line man who maintains the system. Today lack of communication between maintenance staff and operator, critical electrical hazards has been occurred with line operator. In addition to it the paper suggests the method in order to surge the quality of service by discover the fault at the particular location. Further the paper proposed the intelligent system which generates the report resulting in making the decision and recommends the better plan of action to the competent authority. The smart circuit breaker uses the microcontroller based technology. The paper is useful for deregulated system and further research in this field.

KEYWORDS: Breaker, Deregulation, Smart Grid, Fault, Microcontroller

I. INTRODUCTION

Power system planning [1][2] has a significant role to deal with system security and reliability. The researchers are continuously working to improve generation, transmission and distribution system in smart grid system. Faults are always occurred while the system is fully secured. The line man has to work on faulty system and take shut down from substation operator. But sometimes due to miscommunications, hazards are occurred. This paper is presenting a new proposed model smart circuit breaker [3][4][5]. Line operator need not to take shut down. The operator will work on system and then on the circuit breaker. Circuit breaker is activated / deactivated by a lamp that

turns on or off. It will not only provide the secure system but also save the operating time. This paper is based on microcontroller [6][7]. Further this paper explains the components, working diagram and real time system which is beneficial for power system.

II. SYSTEM COMPONENTS

Software is one component which is used in this project. Author has used ATmega328p based arduino microcontroller in this paper. The hardware are arduino UNO microcontroller connected with WiFi module ESP32, Number Keypad, 4 Channel Relay, LCD Display (16x2), Transformer (12-0-12), Diodes, Capacitor, 7805 Voltage Regulator, Soldering Iron, Soldering Wire, Zero PCB, Connecting Wire, LED Light, Resistor and Wire Lead [8]. Think speak has been used for the cloud storage.

III. PROPOSED SMART MODEL

Circuit Breaker is used to protect the electrical circuit by overloading which happens due to excess current or short circuit. This paper explains the advance functionality of the circuit breaker by implementing the mechanism of Internet of things. This technology enhances the functioning of the circuit breaker by making the decision. Traditionally fault detection is very troublesome. Electricity has to shut down for inspecting the faulty manually [9] [10]. Further lineman could be hurt due to miscommunication with base station. This paper focus on monitoring/controlling, maintenance and report generation of the circuit breaker deployed at the different locations of the particular city. Author try to propose the method which makes the smart circuit breaker which are capable to taking

decisions, secondly improves the quality of service. This proposed method is very beneficial for developing the smart cities. In order to build the smart circuit breaker, it has to connect with the microcontroller (Arduino) with wireless facility, so that it is able to communicate with the base station. Fig.1 shows the block diagram of proposed smart circuit breaker. The working is given as below.

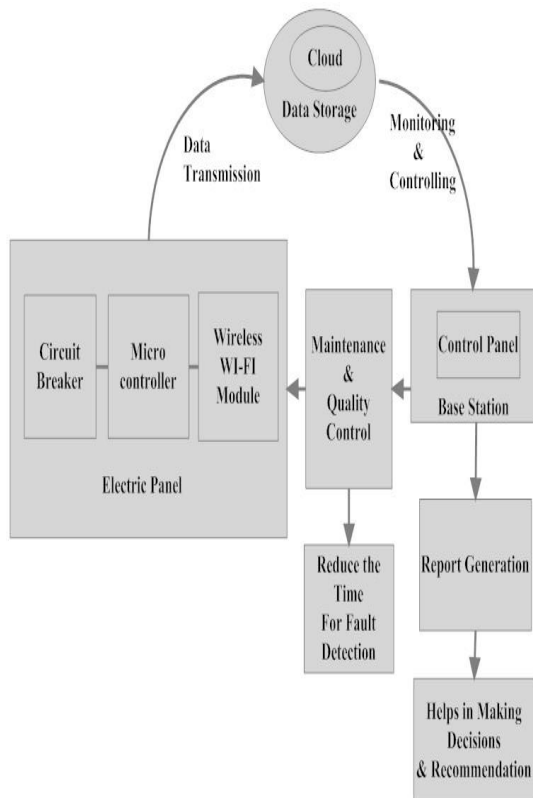


Fig. 1. Block Diagram

A. Monitoring and Controlling

Current and voltage sensors are used in the circuit breaker which is continuously sending the information to the microcontroller. This information is sending to the cloud through wireless interface connected to the microcontroller. There is a control panel which is installed at the base station which shows the information regarding the current flow in the circuit breaker. Base station master can easily monitor the display on the control panel. Further all the data should be saved on the cloud. There are clouds available free of cost for example think speaks etc. Base station master can easily detect the fault caused in the circuit breaker which is deployed in the city. It can also calculate the load on the particular circuit breaker. The microcontroller sends the alert in the form of signal to the base station which tells the present state of the circuit breaker like frequency of tripping,

overloading. It will send the information prior which explains the condition of the circuit breaker. It also recommends that there is a need of replacement of the circuit breaker this reduces the accident. Sensors are also used to detect the current flow from the output and the input of the circuit, difference in the current flow lead to the fluctuation in the houses which results the damage of home appliances and machineries. This information helps to point those locations across the city. The microcontroller also detects the overloading on the particular circuit breaker and alerts the base station which reduces the casualties. This mechanism diagnoses the health of the circuit breaker and takes the decision accordingly. It increases the quality of service.

B. Maintenance

When there is power failure, base station has to shut down the electricity of the whole city. It affects the work which needs electricity. Secondly it takes time for rectification because failure detection takes long time when it is done traditionally. The system proposed by this paper reduces the time of detection and improves the quality of service. When there is a power failure due to overload or overheating results in the damage of circuit breaker, this information is send to the base station through the wireless communication connected to the microcontroller. This helps to point out the particular circuit breaker which needs the immediate attention. Base station master easily detect the faulty circuit breaker by seeing the control panel. There is no need of shut down of entire city. Now the base station master can send the work order to the lineman through registered mobile number. When the job is done and microcontroller is reset then it generates the OTP on the display panel connected to microcontroller which is entered by the line man. This ensures that the job is done successfully and circuit breaker is working properly. There is no human intervene all the work done by the smart circuit breaker by sending its information to the base station before it gets damaged. It reduces the failure detection and maintenance time and increase the quality of service.

C. Report Generation

This feature is used for accountability of the circuit breaker and secondly it helps in requirement generation of the circuit breaker on the basis of the report received monthly, quarterly, half yearly or annually. The report shows the health report of the circuit breakers in the particular time frame. It is used to make better decisions on

replacement of the circuit breaker. It also determines in which area load is increased which results in the urgent replacement of the circuit breaker which is able to tolerate the heavy load. The report explains the present condition of the circuit breaker which includes frequency of tripping, replacement, service, load distribution, overloading, under loading. The competent authorities can take appropriate after analysing these reports. It also helps in making the predictions that will help in making the recommendation of the particular area of the city. The proposed technological features would be useful for deregulated smart cities. In order to preserve the quality of proposed model all the attributes discussed above have a significant role. The proposed model has all features using latest technology which give more precise results for the power system.

IV. CONCLUSION

Proposed smart Circuit breaker has a significant role in deregulated power industry. It plays a very important responsibility in maintaining system security and load sharing. It will definitely give a secure, reliable and less hazardous system. The proposed system uses the microcontroller with wireless facility which is an automated system. The lineman and system both can work efficiently and also reduce the risk due to miscommunication. The customers are also benefited due to fault recovery in less time and load sharing. It will be beneficial to develop smart cities project.

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