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Electrical Control Panel Monitoring System based on microcontroller by using IOT

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ABSTRACT:

The control panel is a cabinet which contains electrical components in order to control mechanical equipment's. It is a centralized system which is capable of controlling loads that are located at some distance apart. Often control panels are used in some remote areas which are not easily accessible. E.g. Wind power plants are located far away from main cities. Hence, if there is any fault occurrence in the system, it is not easily detected and the fault location cannot be identified easily. Hence, in order to take quick action based on the fault occurred, the fault finding time needs to be reduced, which is possible with the help of control panel monitoring system. This project is meant to monitor the electrical parameters such as voltage, current, frequency, temperature, etc. in a control panel. We can also monitor the State of the devices. The project consists of 3 stages namely, Sender side, Intermediate stage and Receiver side which is further elaborated in the paper. This information is conveyed to the authorized personnel with the help of a notification on the phone. A cloud based server helps to keep track of all the process and the overall monitoring process. Hence, this project makes the fault finding process easy and helps to take a remedial action based on fault.

Keywords: CP- Control Panel,CS- Cloud Server, IOT- Internet of Things, Monitoring, CT- Current Transformer, NC-Normally closed, NO- Normally open.

INTRODUCTION:

The control panel is a cabinet which contains electrical components in order to control and monitor a mechanical process. It is a centralized system installed in order to achieve control of multiple processes at one particular location. The control panel is a metallic enclosure in which multiple electrical components are mounted over the DIN rail and connections are made according to the wiring diagram. The control panel consists of multiple electrical components such as the Main circuit breaker, surge arresters, relays, contactors, transformers, CT's, PT's, Power Analyzers, etc. As, there are a number of components used, it is very difficult to find the fault location and is very time consuming. As relays are the main fault sensing components, relays get tripped in case any fault occurs. It becomes a very tedious job to find the relay that has been tripped.

Similarly, for heavier loads such as motors, contactors are used and they might disconnect the circuit in abnormal conditions. Hence fault finding requires a lot of manual work. Not every panel can have the PLC and HMI for its process monitoring. Hence, a simple and easy solution to this problem is using IoT (Internet of Things) in order to monitor the processes in a control panel. This will require a number of components such as the sensors (Current Sensors, Voltage Sensors, Temperature & Humidity sensors, etc) to be interfaced with the centralized CPU (Micro-controller) to process the incoming data and give required output. The data will further be given to the Wi-Fi module (Node MCU ESP8266) to upload the data to the cloud server. The cloud server will show all the live electrical parameters in the control panel and also keep a track of all the changes that have occurred over a period of time through a cloud server. It is capable of showing the state of all the devices. This information can be accessed only by the authorized personnel through a mobile application. If multiple clients are there, then, each client will be given a unique access ID that would help them easily access the correct control panel. In case if any fault occurs in the system, the notification will be sent to the authorized person on his/her Smartphone along with the fault location. So, necessary actions can be taken quickly to resolve the fault. Hence, making this whole process time efficient.

Problem Statement:

In remotely located control panels, there often is a fault occurrence. This fault needs to be compensated as soon as possible in order to ensure the continuity of the process. The main delay to resolving the fault is the finding of the fault location. Using IOT, we can accurately sense the location of the fault and the type of fault and take immediate action based on the problem.

WORKING:

A. Sender Side:

All the monitoring process will take place on the sender side with the help of Internet based system consisting of Micro-controller which acts like a brain to the whole system. The various sensors such as Current sensor and Voltage sensor will sense the magnitude of Current andVoltage present in the system. The various loads will be controlled by giving a signal to the relay or contactor through the Micro-controller. Also, the state of these devices (ON/OFF, NC/NO) can also be monitored with the help of this system. The sender circuit consists of all the components as shown in the block diagram in fig(1). This circuit will be installed in the metering section of the Control Panel.

B. Intermediate Stage:

The intermediate stage includes the cloud server that is continuously fed with the live monitoring parameters and can be accessed through the client software.

C. Receiving Side:

The receiving side contains a laptop or a smartphone that will allow access to the cloud server in order to see the monitoring parameters and the state of devices. In case a fault occurs on the sender side, the receiver will be notified with a notification on the device using as long as the client is logged in with the unique id.

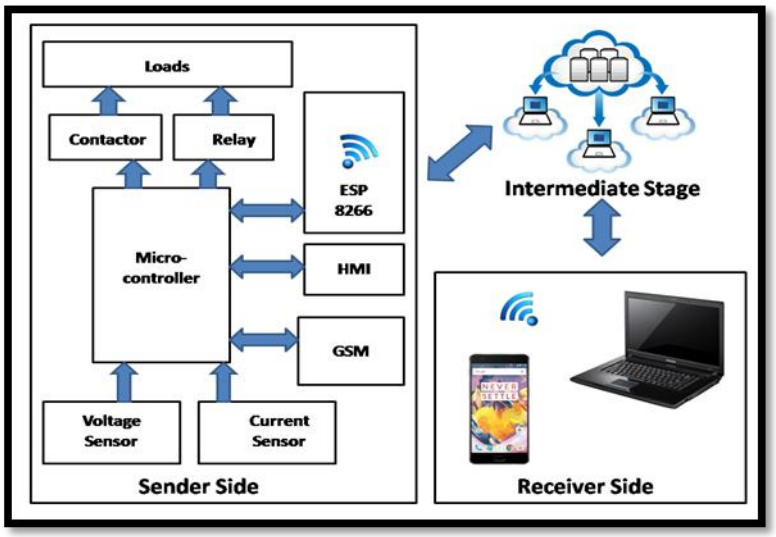


Figure 1 Block Diagram

LITERATURE SURVEY:

The Internet was a network of networks, linking various government and academic computers together to share information. What has changed increasingly over the past two decades is the ability to connect remote and mobile "things" or "machines" or "assets" to the Internet or corporate Intranets through the role of wireless communications and low-cost sensors/computing/storage. In a sense, the Internet is amplifying from a net of computers to a network of things. Object in the Earth is transitioning to become a data processor that happens to be linked to a network using the IP protocol. The confluence of efficient wireless protocols, improved sensors, cheaper processors, and a number of startups and established companies producing the necessary management and application software has finally arrived at the concept of the Internet of Things mainstream. The driver of all this connectivity is basically the desire to "add value" to products or services. These additional profits from connecting everything to the Internet are roughly evenly distributed between increased asset utilization, increased employee productivity, better logistics management, better client experiences, and increased R&D productivity. The applications that appear to be prime for IoT disruption include home automation, appliances of all cases, wearable computing devices, home health care, retail and warehousing inventory management, connected farms/agriculture equipment, solar energy generation and likely many more are still being formulated.

In sum, the IoT will create tens of billions of dollars of new revenues per year for telecom service providers, semiconductor vendors, software application vendors, and merchandise vendors, and potentially create substantial market share shakeups, especially in end markets not used to the pace of engineering-based competitor. IoT is one of the quickest-developing technology trends, where all types of devices and machines are connected and "talk" to one another.

To come up to this issue, control panel companies can embrace the Internet of Things, also known as the Internet of Everything. Generally defined as the universe of more Internet-connected endpoints designed with machine-to-machine interactivity, IoT has the potential to dramatically transform energy companies, according to Cisco. For instance, a control panel company can put in sensors on panels to monitor their execution and

provide real-time insight to site management teams. Solar automation can be described as introduction of engineering inside the panel environment to provide convenience, comfort, security and energy efficiency to its occupants. With the entry of the Internet of Things, the research and implementation of automation are getting more popular.

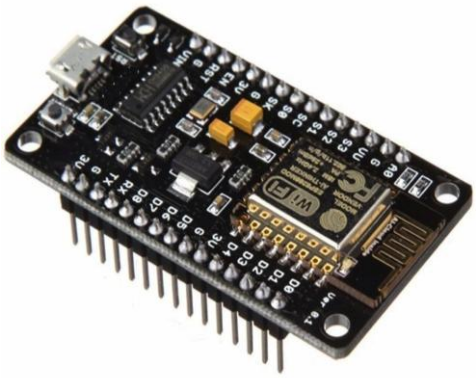
REQUIREMENTS:

A. Software Requirements:

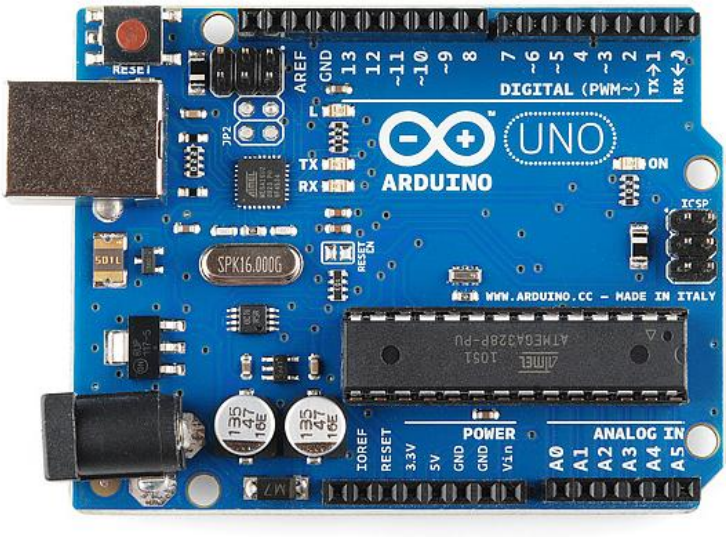
1) Operating System: Windows XP Professional or Above
2) MIT App Inventor: Android Phone v4.0 or above.
3) Arduino IDE.

B. Hardware Requirements

1) Node mcu (ESP8266) Wi-Fi module:



2) Arduino UNO Micro-controller:



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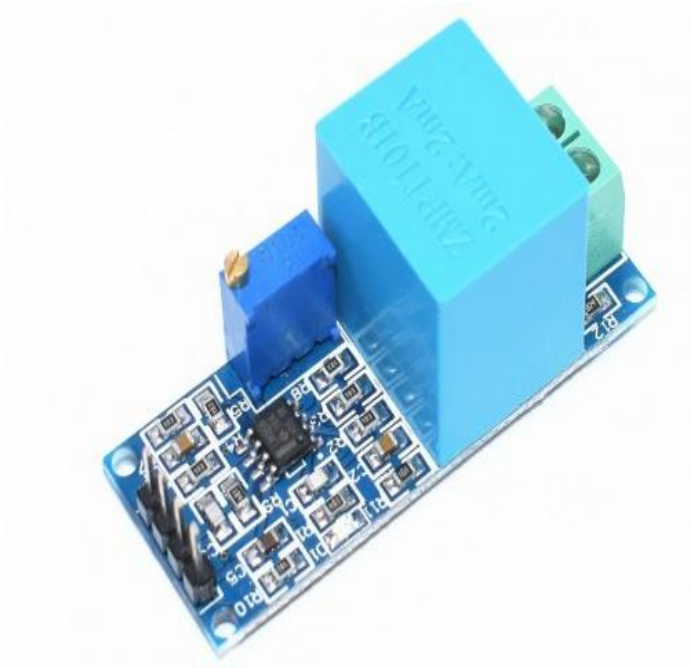
3) Current Sensor (0-30A):

4) Voltage Sensor (0-230)



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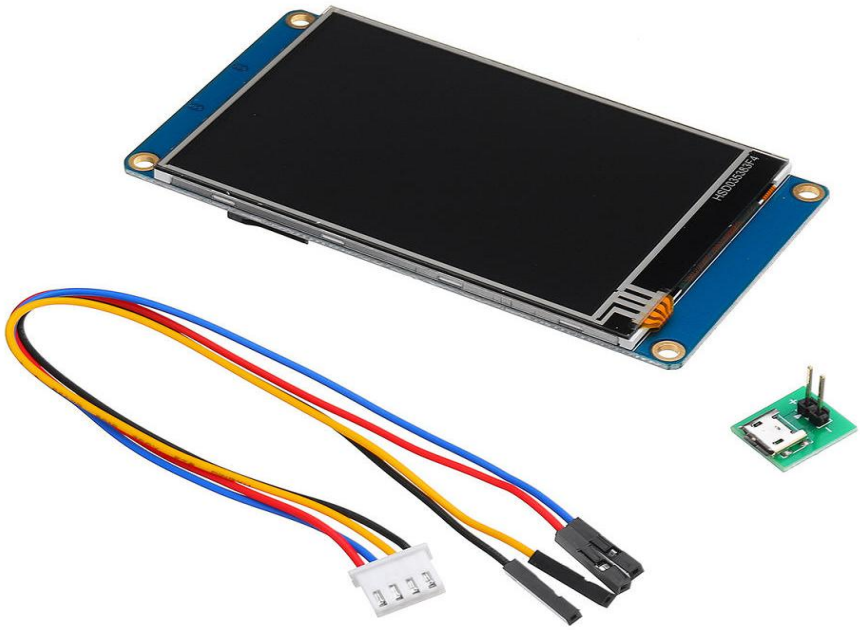
5) GSM Module 800C

6) Nextion HMI:



ADVANTAGES:

1. Accurate detection of the type of fault and the fault location.
2. Remote monitoring is possible.
3. Fault finding time is reduced.

DISADVANTAGES:

1. Cost.
2. Requirement of Auxiliary Supply.
3. Need of Internet Connectivity in Remote areas.

CONCLUSION:

- By using IOT in not only industries, but our day to day life, it increases the comfort level and customer satisfaction.
- IOT helps increase accuracy.
- The fault finding time in such applications is reduced.
- Increased safety level.
- Remote access to the system by the authorized personnel.

APPLICATIONS:

1. Remotely located control panels.
2. Control panels installed in any industry.
3. Electric Vehicles Monitoring System.
4. Hazardous Areas.

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