Motor Protection Using the ATmega328p Microcontroller and Blynk Phone Application

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Internet of things (IoT) has been an ever-growing area with new technologies on each horizon. It encompasses communication between devices over the Internet. These devices collect data from sensors and send them over the Internet to be computed or stored. Induction motor protection systems provide a way to prevent costly motor repairs and dangerous motor damage. However, modern induction motor protection systems are not only expensive, but they are limited to the remote connectivity the user has with the system. With the use of Blynk, this process can become easy and affordable.

The goal of this project is to develop an affordable easy to use 3-phase induction motor protection system that can be monitored and controlled remotely from the Blynk app installed on either IOS or Android devices. The Blynk app allows the user to collect data that is sent to the Blynk cloud from analog inputs of certain microcontroller that are connected to the protection system. The goal is to use an affordable microcontroller to monitor the voltage, current, temperature, and speed of a 3-phase induction motor. The microcontroller will not only monitor the environment of the system but will also control a solid-state relay that will disconnect the motor from the system if any threatening scenarios arise. This microcontroller will be connected to the Internet via an Ethernet shield to send measured data from the protection system to the Blynk cloud.

The design of the project will incorporate an ATmega328P microcontroller to sample measured data from the system and locally compute values to be sent to the Blynk app. The microcontroller is connected to an Ethernet shield that is used to translate the measured data to a TCP/UDP protocol that can be sent to the Blynk cloud and then accessed by the Blynk app. The measured data is coming from eight analog inputs. The first three are from current transformers that take a current between 0-10 amps from all three phases of the motor and step it down to a safe and measurable current for the microcontroller. The next set of analog inputs are from three voltage transformers. These transformers take high voltage from all three phases of the motor and step them down to a voltage of 12V. This AC voltage is then rectified and divided for the 5V limited microcontroller input. The system also uses a Platinum RTD type PT100 thermistor to measure the temperature of the motor. This thermistor has a linear relationship with rise in temperature and increase in resistance that make it easy for the microcontroller to sample. Lastly, the system uses a LM393 speed sensor module with a 20-hole encoder disk. The speed sensor module outputs a square pulse for ever hole of the encoder disk as it rotates through the infrared coupled LED and diode. The pulses are then measured to compute the revolutions per minute of the rotating motor shaft. The measured data is sent to the Blynk cloud and then accessed by the Blynk app. The measured data is displayed on widgets for the user to see. When the motor protection system detects a harmful environment and disconnects the motor, the Blynk app will send a notification to the user that the motor has been disconnected from the system. It will also show a short, detailed description as to what caused the motor to be disconnected.

Test results show that with changing environments of phase unbalance, overvoltage, overcurrent, high temperatures, and high motor speeds that the system responded effectively and positively by safely disconnecting the motor from the system, preventing any damage. The user was then notified by the Blynk app of the change and disconnection of the motor from the system.