sdmay18-13: Measuring Voltage and Wire Continuity

Week 4 Report
September 24 - September 30

Team Members

Aaron Eaton ***— Chief Engineer***
Mohamed Almansoori ***— Report Manager***
Christopher Williams ***— Test Engineer***
Samuel Kline ***— Meeting Facilitator***
Matthew Kelly ***— Meeting Scribe***

Summary of Progress this Report

Voltage:
Made a circuit diagram using a delta-y transformer to get the neutral voltage from the three phase wires and another circuit diagram that measured voltage relative to the Arduino ground. We identified issues with both of these approaches and need to come up with a new strategy.

Wire Continuity:
Conducted research on how to use Time Domain Reflectometry as a potential solution to measuring wire continuity. We identified several issues with this approach, such as needing a fast oscilloscope to get good measurement results.

Pending Issues

Voltage:
Need technical details about circuits (eg how exactly would a delta-y transformer work). Need a circuit which is compatible with the arduino's specifications (can't require a polling rate that is too high).

Wire Continuity:
There are several requirements for using Time Domain Reflectometry as a solution to wire continuity that our group cannot fulfill, such as the need for an oscilloscope. We need to find a different approach to determining wire continuity that can be implemented for our specific system and with the resources that we have available.

Plans for Upcoming Reporting Period

Voltage:
Create circuit diagram that measures the voltage of each lead (L1, L2, L3) in a three phase system relative to the other leads, and uses those measurements to determine voltage.

Wire Continuity:
Create a diagram of a new solution for wire continuity involving a switch circuit. Continue research on alternate methods of determining wire continuity.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours

Aaron Eaton	Researched time domain reflectometry as a potential solution to wire continuity, found out that it is the process of sending a high frequency signal down a wire and measuring the reflection of the signal. The interpretation of the signal can be used to determine the length of the wire which will solve our wire continuity problem. I am not sure how we could implement this into our device, if we could send a high enough frequency signal, and how we could read the reflection.	5	25
Mohamed Almansoori	Researched more into different solutions we could use for Wire Continuity. I did research on Time Domain Reflectory circuit TDRS and how it functions in checking the wire continuity. Indeed, TDRS can be used to locate the problem type and in which place along the cable the fault is by sending a pulse down a cable will get reflected and by analyzing the reflected waveform we can determine whether or not the cable is working. One problem of using this circuit is that we need a fast oscilloscope to get nice measurement results from the TDR measurements. Also, I have worked in the lightning talk #2 slides for the project which include project's key technical goals.	6	23
Christopher Williams	Made new proposed circuit diagrams which took into account the information from last week's meeting. The new proposed solution used a "delta-y transformer" to get the neutral voltage from the three phase wires, and then digitized the waveform with the arduino. While this circuit was functional in theory, it had several flaws. First off, the exact design of the delta-y transformer was unclear. Additionally, it wouldn't work correctly if any of the wires were broken (not good in a device meant to detect broken wires). I proposed an alternative version of the circuit which took the voltage reading relative to the Arduino ground, but this approach might not have had enough resolution to show when there was 3V in the circuit. It was decided that the best way to measure the voltage was with each lead (L1,L2,L3) relative to the others. The goal now is to create a circuit which can take those	6	22

	relative readings in the three phase system and make sense of them.		
Samuel Kline	Learned about more electrical components, how to draw them in a circuit diagram, and what equations are commonly associated with them. Some components I learned about were capacitors, diodes, transformers, and oscillators. These components were used by other companies in their solutions. I started to look at some simple circuit diagrams demonstrating how resistors and capacitors could be used to step down voltage, but did not make my own circuit diagrams. I searched for a transformer that had the necessary conversion ratio for our project, but was not able to find one that was suitable.	5	21.5
Matthew Kelly	Contribution: Researched the idea of using time-domain reflectonomy (TDR) to solve the wire continuity problem. TDR seemed to be a solution, but a drawback of it is that it requires a high frequency oscilloscope to determine if the waveform sent was actually received. I did some research to remember what complex power, apparent power, and reactive power are and how they are related. A step-down transformer seems to be required to bring the voltage down to a level an Arduino can handle (5V). One useful equation for the step-down transformer will be Vp* np = Vs * ns, or the primary voltage is related to the secondary voltage with respect to the number of turns in the primary winding versus the secondary winding.	5	22