sdmay18-13: Measuring Voltage and Wire Continuity

Week 5 Report
October 1 - October 7

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: Proposed a circuit diagram for reading voltage. It involved taking voltage readings from L1 to L2, L1 to L3, and L2 to L3. It used transformers to reduce the voltage to a level that the arduino could handle, and shifted the voltage using op amps.

Wire Continuity: Proposed a new switch circuit that could be helpful for measuring the wire continuity. Continued research on usefulness of TDR, determined how it is used to measure wire continuity and identified some requirements for using this method.

Pending Issues

Voltage: Transformer that was in our proposed circuit didn't have the correct specs so we need to find a different one. We need to keep in mind that using a big transformer might not be the best solution, so we need to continue looking at different options for stepping down voltage. We have made several circuit diagrams so far, but haven't derived many equations to prove that the design is feasible.

Wire continuity: need to find new solutions to how to solve wire continuity problem to propose to advisors.

Plans for Upcoming Reporting Period

Voltage: Get equations for circuit presented this week which symbolically show L1, L2, L3 values based on measurements taken in the circuit and component values. Research how a multimeter measures AC voltages and, if possible, design a circuit which can read the 3 phase voltage in that way. Search for a better transformer that has better step down. Look into using 'non inverting op amps', look at the op amp chapter in the EE textbook.

Wire Continuity: change switch drawing to connect switches directly to power lines. Learn how power over ethernet works, look for a potential solution in inductive coupling.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Aaron Eaton	I made a drawing for a switch circuit that could be a potential solution, we reviewed it and decided that i should change the drawing	4	34

	so the switches connected to the power lines instead of a wire connecting to the power lines because we would have no way of knowing if the wire came disconnected. The new issue is knowing if the switches come disconnected from the lines. I am waiting to hear from our industry advisor to change anything else on this drawing. If we agree that the switch circuit solution will not work i will try to find a possible solution using inductive coupling or help Mohamed with finding a solution using time domain reflectometry.		
Mohamed Almansoori	I was researching and looking more into TDR circuits in implementing it in checking wire continuity. By analyzing the reflected signal, we can locate the fault type and in which place along the cable the fault is. In this case, we will need an oscilloscope which makes a TDR not a promising solution for wire continuity. Our advisor faculty emphasizes on researching for ethernet over power which will be helpful in terms of wire continuity. This allows a single cable to provide both data connection and electric power.	5	32
Christopher Williams	Designed the circuit mentioned in the summary section. It involved digitizing the waveform from L1 to L2 etc by scaling it down with a transformer and shifting it with a summing op amp. Researched possible transformers that could be used in the circuit. Communicated with Mark Hockert to get IP/Non disclosure forms filled out. Made half of lightning talk slides and presented. Next week I will research how a multimeter measures AC voltage and design a circuit similar to that if possible.	6	33
Samuel Kline	I looked at how resistors can be used to step down voltage. I learned the equations needed to calculate what resistance was needed for our edge cases (3V and 600V). I looked up some examples of how an Arduino could control the resistors in order to keep the input voltage readable, but did not draw my own diagram. I read some webpages about the Arduino's accuracy specs (example: http://www.skillbank.co.uk/arduino/measure	4	29.5

	.htm). I did not completely understand all of the units of measurement being used, I will have to work that out in the future. To understand the circuit diagram that was proposed at our meeting, I learned (mostly from transformer wikipedia page) about different applications and uses of transformers, as well as how they step down voltage. I looked at some articles about delta-Y transformers, but I will have to read more about them and/or find some examples of circuits that use them in order to fully understand how they work.		
Matthew Kelly	I learned that a delta-delta system, which means the sources are in a delta, and the loads are in a delta configuration, will not be affected if a single source is an opened circuit. This is unlike a wye system where the loads will be affected in terms of the voltage across the loads. An open-circuit test for transformers is done by connecting a voltmeter, ammeter, and wattmeter to the low voltage side with the high voltage side being an open circuit. On contrast, a short-circuit test is when the voltmeter, ammeter, and wattmeter are connected to the high voltage side, and the low voltage side is shorted. I also learned the difference between line to line voltage which is the voltage across one line with respect to another line, like L1 and L2, and phase voltage which is a single line voltage or line to neutral voltage. Unbalanced three-phase systems are different than balanced three-phase systems and require more complex equations to determine the voltages.	4	30