Distribution Fault Location

By

Tracy Adams
Tierra Byrd
Henry Cobb
Hassan Disu
William Reid

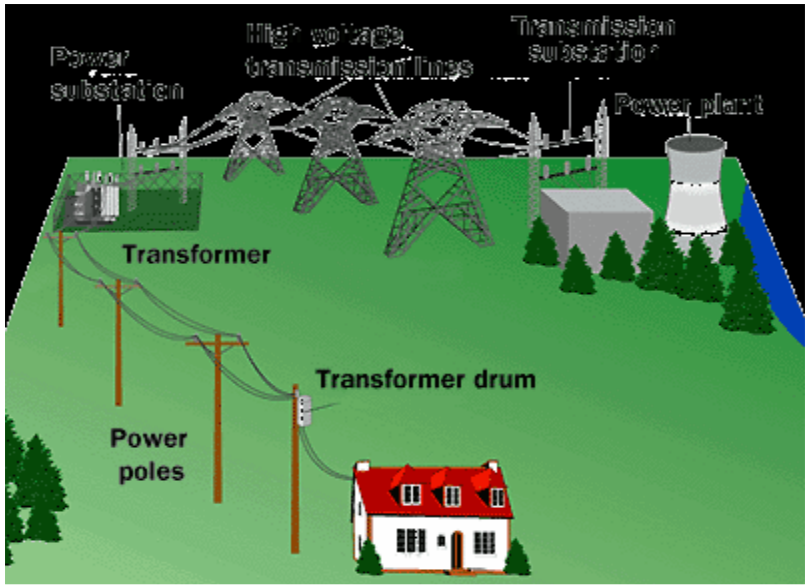
Overview

- Background
- Problem Formulation
- Design Requirements
- Current Status of Art
- Solution Approach
- Tasks and Project Management
- Verification Plan & Deliverables
- Cost & Resources
- Conclusion

Background:
Fault Location on Distribution Lines

History

- Naturally occurring faults and normal system disturbances
- Confidence that a fault has occurred
- OMS system created comprised of a customer phone number grid
- Algorithms created to locate fault distances from substations
- Data bases created with load data to be used for fault locating and other analysis



Background (cont)

Customer

- Needs and demands:
  -shorter outage times
  -better use of new technologies

Industry

- SDG&E:

-Smart Grid/ OpEx20/20

-New OMS (Customer Calls)

-PQView/ EPRI

-Fault Indicators

-SCADA

Problem Formulation

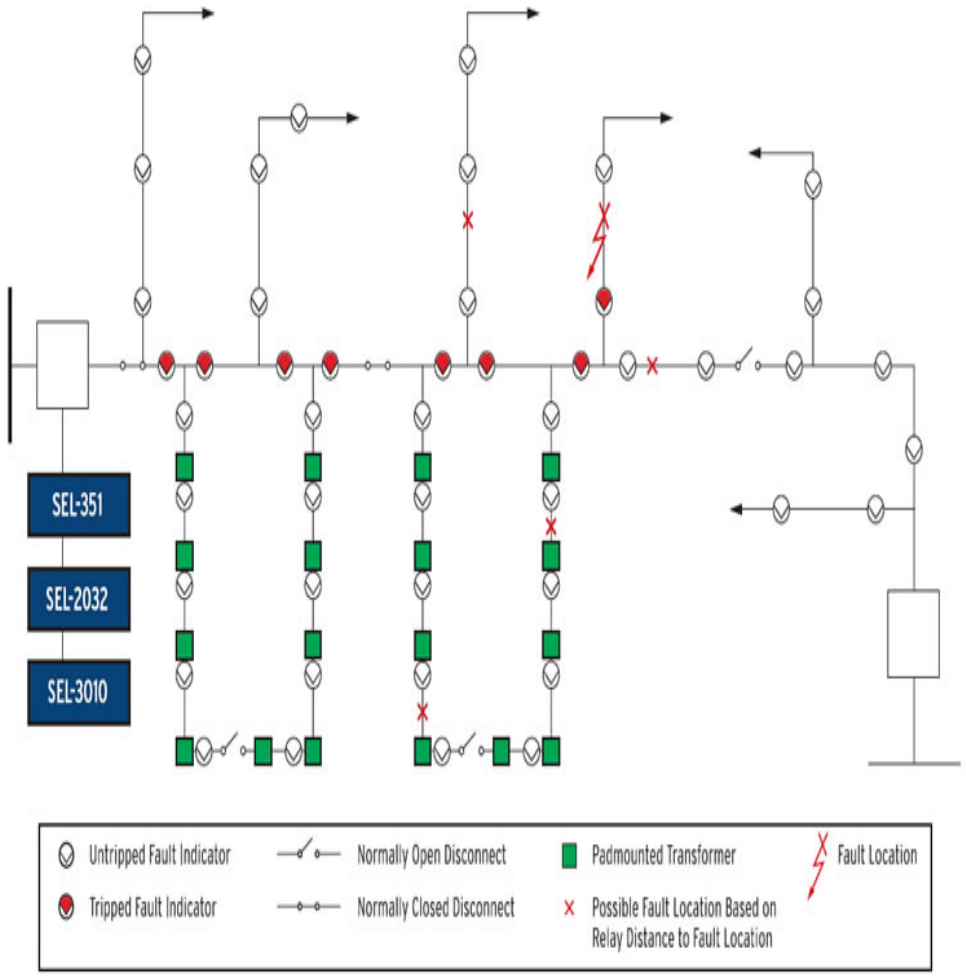
- Maps show multiple fault locations or inaccurate position
- SCADA (V/I) information is not being used properly
- Fault distances are difficult to interpret
- Current OMS is not efficient

Design Requirements

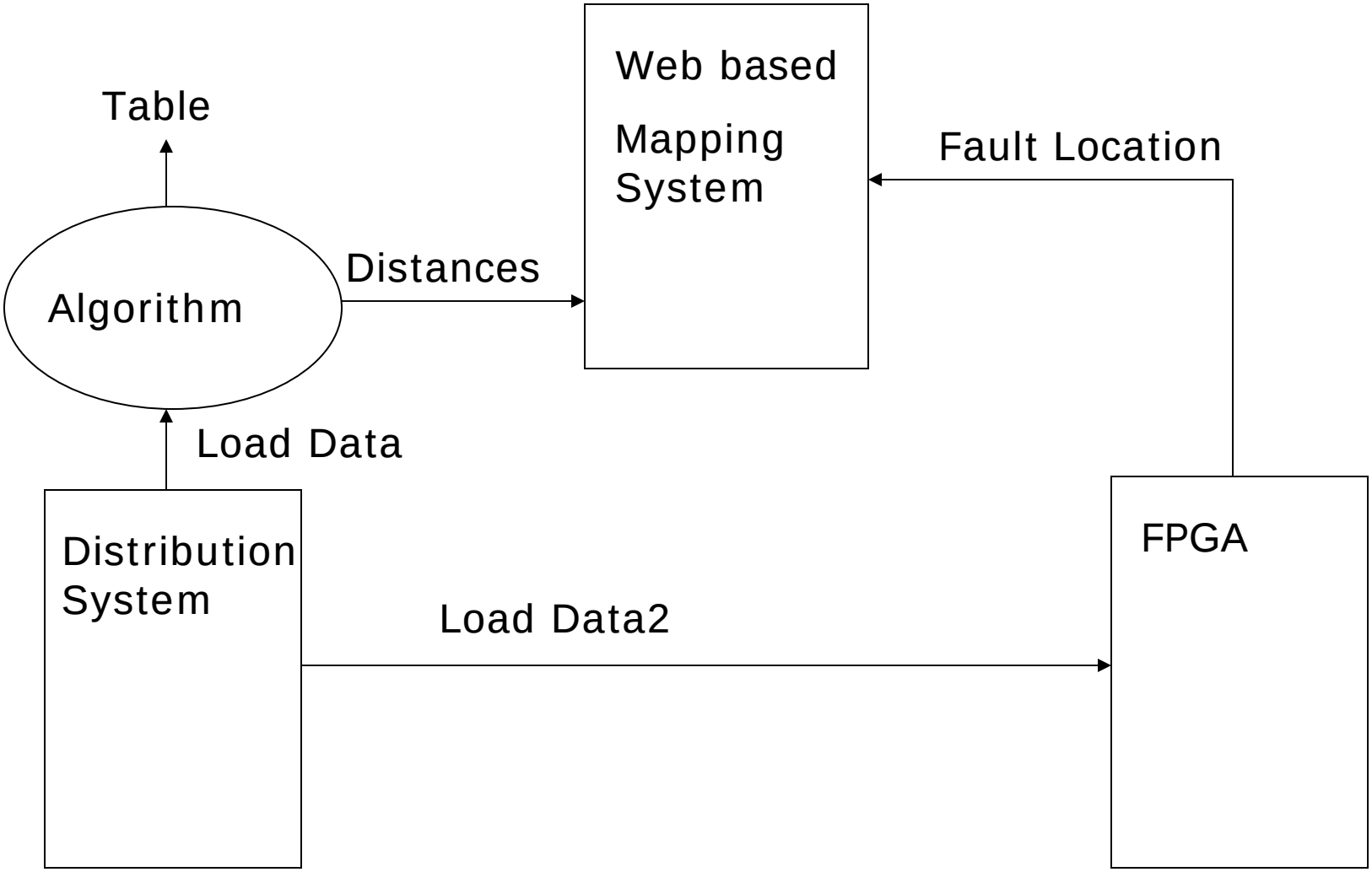
- The overall function of the project is to take a variety of fault data and accurately integrate it in real-time to locate a fault.
- Our final design will demonstrate the overall function of our project for a phase-ground fault. We are predicting an accuracy of 90% providing an 10% error.
- Regulations:
  - Department of Energy
  - California Energy Commission
  - Federal Energy Regulatory Commission

Current Status of Art

- Fault Indicators
- SCADA Systems
- Outage Management System
- Voltage/Current Algorithms

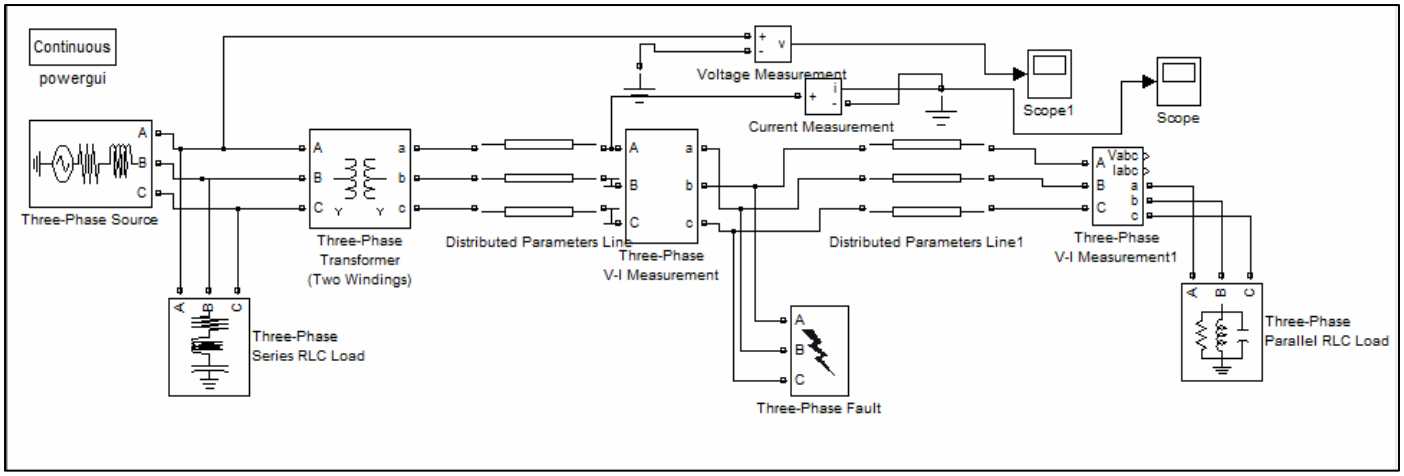


Solution: Primary Approach



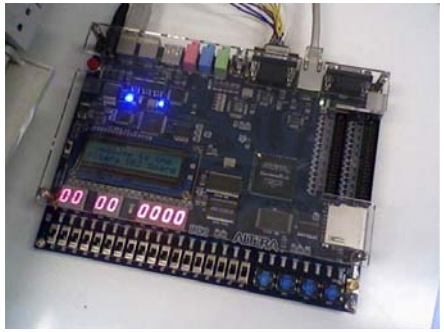
Primary Approach: Electrical Engineering Side

- Build a scale model three phase distribution network
- Use this model to test and simulate a fault
- Implement a measurement device for voltage and current data



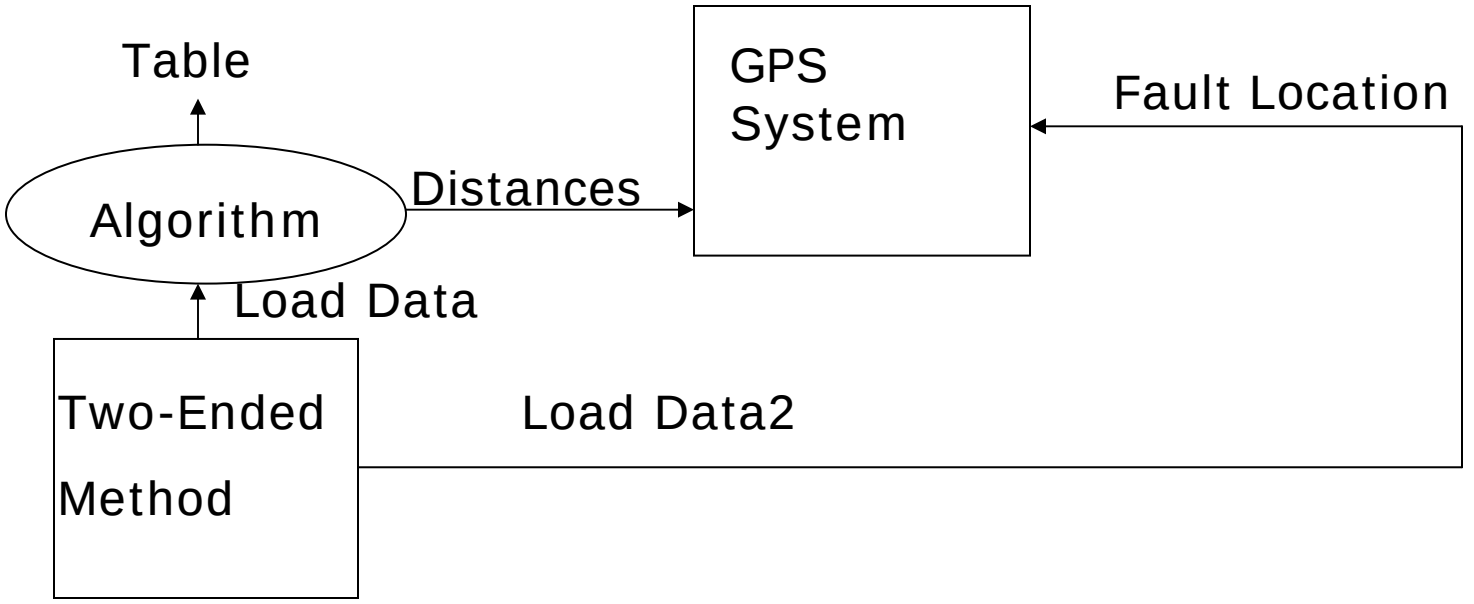
Primary Approach: Computer Engineering Side

- Use VHDL Code and FPGA board to determine fault line
- Use a mapping system to show fault locations using fault algorithm
- Apply wireless communication systems to our OMS system to connect all components



Alternative Solution with Two-Ended Method

- Two ended method that uses synchronized voltage and current measurement
- Sensors placed at both ends of the line
- Connected through GPS



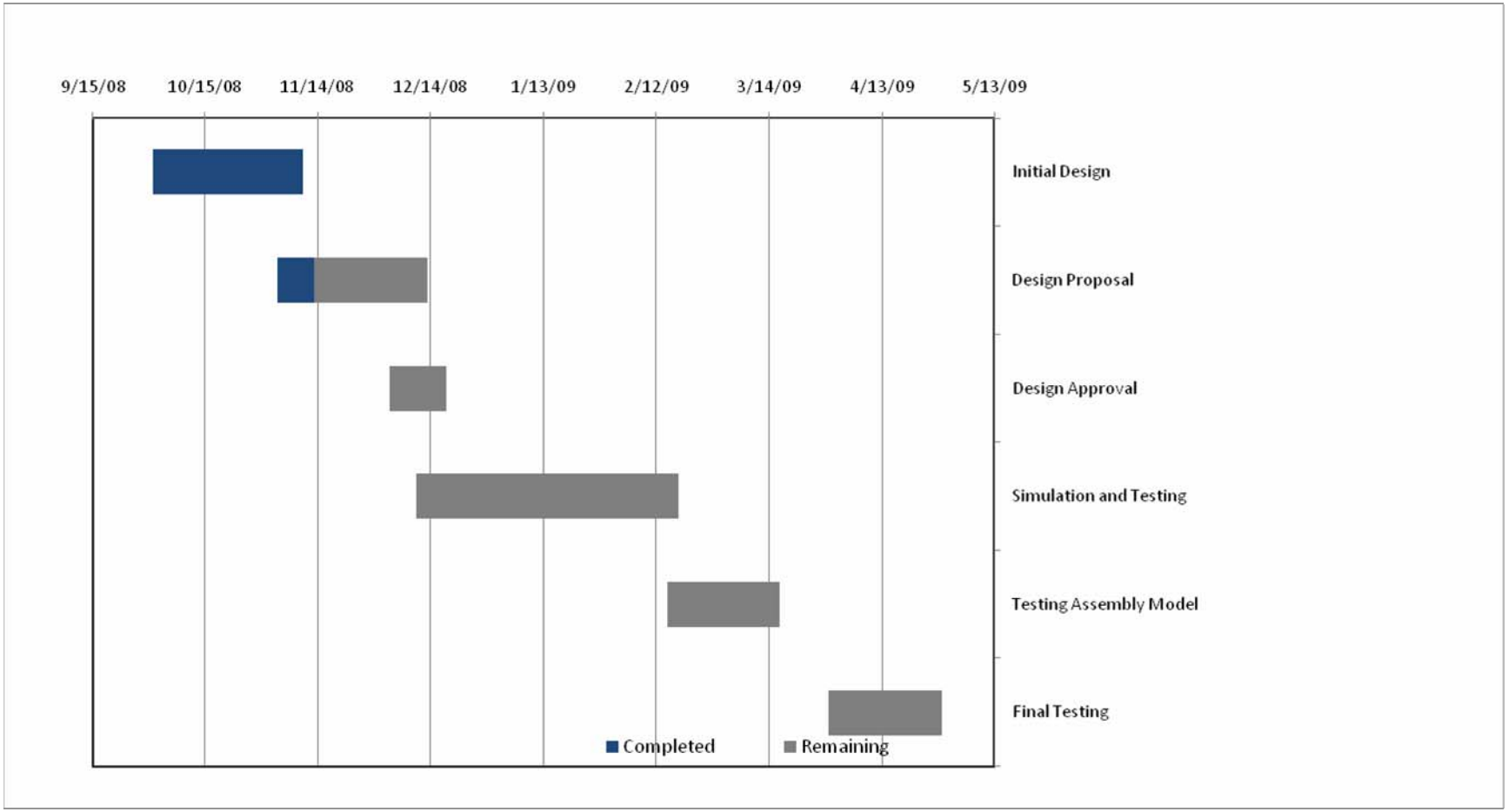
Tasks

- November/ December
  - Simulations and testing of single and three phase power systems with faults in Simulink
- November / December
  - Research wireless transmission of data and options for data storage
- January
  - Get approval to begin building small scale power system
- January/ February
  - Creation of the three-phase network with phase to ground faults
- January/ February
  - Create digital system using FPGA board and VHDL code
  - Create XY node mapping system
- February/ March
  - Combine all systems to create OMS system

Project Management

- Will
  - Simulations and testing of single and three phase power systems with faults in Simulink
  - Creation of the three- phase network with phase to ground faults
- Henry
  - Simulations and testing of single and three phase power systems with faults in Simulink
  - Creation of the three- phase network with phase to ground faults
- Tracy
  - Create digital system using FPGA board and VHDL code
- Tierra
  - Create XY node mapping system
- Hassan
  - Research wireless transmission of data and options for data storage, bring solutions to team

Project Management (cont)



Deliverables

- OMS system with phase to ground fault detection using a digital/ mapping system
- The mapping system
- Fault algorithm applied to a three phase power system
- Web-based data collection system

Costs and Resources

- Matlab and Simulink Student Version.....$99.00
- Simpower Systems Toolbox.....$59.00
- PSAT.....Free Download
- Labview..... $1249.00
- Power System Equipment $150.00
- FPGA board.....$120.00
- Misc.....$500

Total cost ≈ $2177

Conclusion

- Effective fault location minimizes outage time
- Utilizing the databases that are made available can make fault location more efficient
- Incorporating new technologies will make our design more competitive in the utility markets