Michigan State University
College of Engineering; Dept. of Electrical and Computer Eng.
ECE 480 Capstone Design Course Project Charter

Sponsoring Company/ Organization: Daifuku/Jervis B. Webb Company

Contact Information:
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Background Information:

Business Case:

SmartCart Predictive Diagnostic Software

Our automatic guided vehicles, SmartCarts, operate in industrial environments performing time-critical operations for companies, such as Nissan, Harley-Davidson, and General Motors. When a failure occurs, production is interrupted and our customers lose money. Currently, our vehicle detects failures when they happen, but by then, the interruption has occurred. If the vehicle software would monitor vehicle operations and detect conditions pre-failure, production interruption could be avoided.
This feature would be a powerful selling point for our customers. They are looking not just for the lowest price, the lowest total cost of ownership. In addition, the software would become a driver of service calls and parts sales.

Our competitors are jockeying for position in terms of technology, ease of use, capacity, speed, and other features. We believe that this is an area that has not been addressed. Adding these features to the SmartCart products will give us a competitive advantage. We will be able to advertise higher reliability.

We will offer this feature at the following service levels:
- On-vehicle only alarming. The alarm goes to the vehicle and allows the control system to react to the alarm by routing the vehicle to a maintenance area.
- Reporting and vehicle/fleet maintenance history reporting through our off-vehicle fleet management software system.
- Alarm annunciation via text/email to maintenance staff.
- Alarm and follow-up response from Daifuku via text/email to Daifuku support center.

Currently, competitors are not addressing this area. It will be important to address both vehicles for future delivery and allow retrofit to vehicles already in service.

Our competitive advantage will depend on maintaining or pricing position, maintaining our ease-of-use reputation, and developing the support center response element.

Project Intellectual Property Considerations:

We will ask the team to sign a non-disclosure agreement for the project. We will allow posting of work, subject to our review and subject to redaction of our identity. Some elements of the software system within which this will work are covered by patents. The end software will be protected via embedding in our controller system.

Opportunity Statement:
- What **clearly defined Customer Problem** you hope to solve with this project?
  - Maximize production output by limiting equipment downtime
- Does this problem exist now, or in the future?
  - This opportunity exist now and will continue to exist. First to market is a significant competitive advantage.
- Who is the customer?
  - Internal
    - The customer is the Sales manager for SmartCarts.
    - The ECE 480 team will deliver the project to the Sales manager and the engineering manager for SmartCarts.
    - The project will provide a value add sales feature for the SmartCart products.
  - External
    - The customers are industrial manufacturers.
    - The project maximizes the production output of the manufacturers' processes.

Deliverables:
- Describe what is to be delivered at the end of the semester.
  - A set of parameters and their effective measurement criteria to detect failures.
  - Design of additional hardware, if required, to monitor parameters.
  - Working, extensible software sub-system ready to fit into the overall control system to implement the parameters.

Goals:
  - Identifying a set of parameters and their measurement criteria
    - Develop measurement strategies and instrumentation.
    - Testing the set of parameters
    - Incorporating the parameters within the design framework
  - Produce an extensible design framework for:
    - Measuring parameters against bounds (ie. Motor current against a threshold).

- Producing an alarm when the boundary is violated.
- Interfacing the alarm to the existing vehicle control and communication framework.
  - o **Time Bound** – 13 week working semester

Scope:
- Addition of hardware sensors to detect parameters that are not currently monitored.
- On-board alarm framework software is within scope.
- Vehicle control software and off-board software are out of scope.
- A set of twelve parameters tested and implemented are in scope.

Constraints:
- List all constraints on the project team.
  - o Must interface with existing software.
  - o Works with Texas Instruments software development suite.
  - o A test vehicle can be provided.
  - o Extensions to existing software interface must be coordinated with Daifuku team.

Project Team: (Completed once semester begins)

Name	Responsibility

Faculty Advisor: (Assigned by ECE Dept . based on project requirements)
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