XXIII Twenty Third Annual engineering · design expo 2016

FLYCAM

Flywheel Control and Monitoring

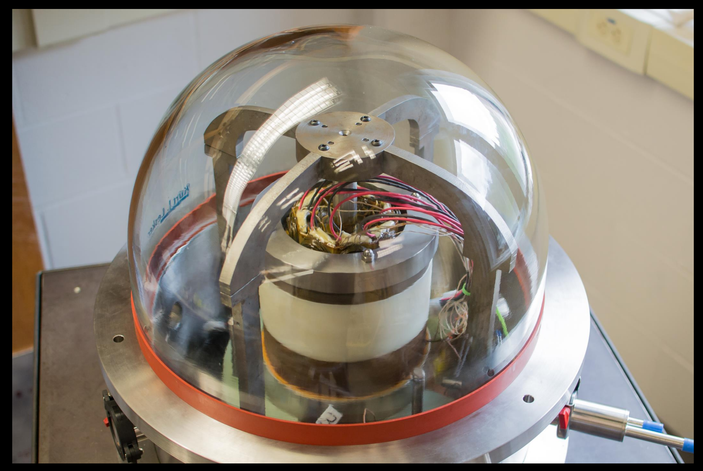
University of Idaho College of Engineering

The Problem

The Flywheel Energy Storage System currently in development would be useless without a user interface. To further research and development, the Flywheel needs a desktop Graphical User Interface (GUI) and a way to communicate with it.

Project Goal

The Flywheel Control and Monitoring Graphical User Interface (FlyCAM) shall allow for precise control and intuitive monitoring of the Flywheel Energy Storage System. Additionally, this project will entail the development of a protocol for communication between the GUI and a microcontroller on the Flywheel.



The inertial mass flywheel. This is the heart of the Flywheel Energy Storage System.

The Flywheel Interface Guys Team

Senior Design Students:

Eric Silk (EE) Ben Bolton (CompE) Jesse Jutson (CS) Thomas Hagen (CS)

Faculty Advisor:

Dr. Feng Li

Clients:

Dr. Michael Santora

Dr. Herbert Hess

The Flywheel Interface Guys (FIGs) team completed the FlyCAM project during the Spring 2016 – Fall 2016 Senior Design cycle.

GUI Design

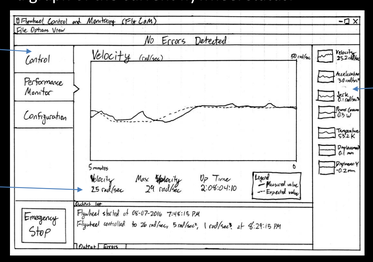
The following storyboards for the GUI demonstrate our design for fulfilling this project's functional requirements.

The performance monitor page, which displays a graph of the current flywheel status.

Vertical tabs for selecting different pages.

Persistent sidebar showing displays of all monitored values. Clicking a graph brings it into focus.

Display for the current value and max value of the selected component.



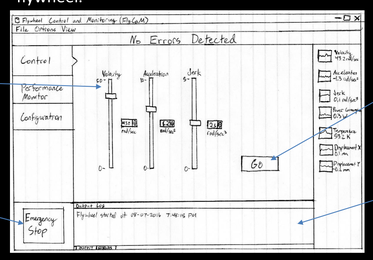
The control page, for setting the motion of the flywheel.

Sliders and spin-boxes for adjusting the given motion values.

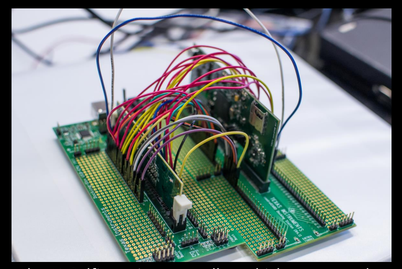
"Go" button for applying the given motion to the Flywheel.

Clearly labeled "Emergency Stop" button.

Output pane for messages to users, with a tab for errors.



Communication Design



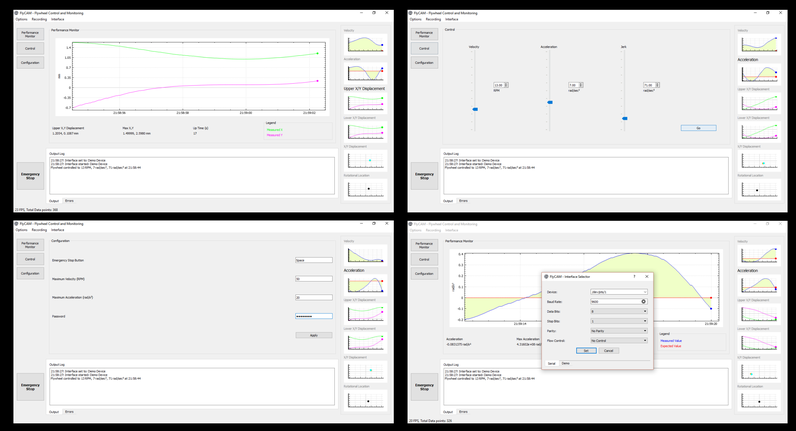
The TI Delfino microcontroller, which serves as the interface between the flywheel and the desktop GUI.

The Flywheel is controlled by a microcontroller, which interprets commands into actions that control the Flywheel. In order to control and monitor the Flywheel, our desktop program must communicate with this microcontroller. To do this, we used a universal asynchronous receiver/transmitter (UART) protocol.

Communication between devices is established using transmit buffers. These buffers store and validate the data transferred between devices. This is demonstrated in the diagram above.

The Final Product

The following screenshots show the desktop interface, as developed. The interface was developed in C++ using the Qt framework. It runs on Windows and Linux.



With the FlyCAM program, users can view graphs of the flywheel's operations and control its motion. Additionally, users may configure maximum values, keyboard shortcuts, and the serial port. Other features include recording values to a CSV file, password-protected settings, and graph options.

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