Web-Controlled Wind Tunnel
Functional Requirements List and Performance Specifications

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Introduction

This project is centered around the upgrade and improvement of the Mechanical Engineering department's wind tunnel system. During the course of the project, remote control abilities will be added for all wind tunnel functions. In addition new functionality will be added using closed-loop control methods to accurately set and control the wind velocity and angle of the part being tested.

Goals

- Allow for remote starting and stopping of the wind tunnel

- Improve capabilities of the wind tunnel

- Creating an interface that is intuitive and easy to use

- Designing an embedded controller that could be mass produced for similar controls type applications
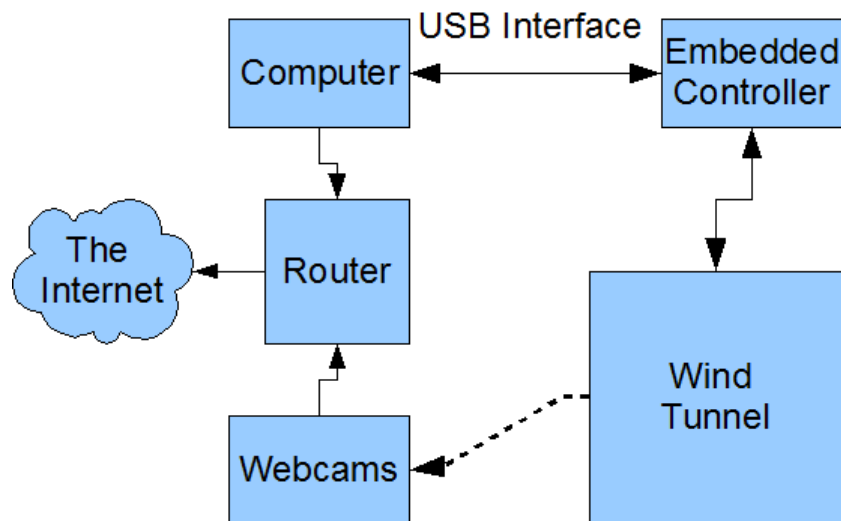
High Level System Block Diagram

Figure 1 - System Block Diagram

Functional Descriptions

Wind Tunnel

The wind tunnel block consists of a large blower turbine attached to a damper which then leads to the testing chamber. This damper can be opened or closed to adjust the speed of the air flowing through the system. The wind tunnel also has a platform where the piece being tested sits. This platform has a linear actuator which can angle the test part up and down. Connected to this platform are two pressure sensors which are used to measure the lift and drag forces on the test part. There is also a fog machine attached to the wind tunnel which is used to visualize the flow of air over an airfoil.

Embedded Controller

The embedded controller block consists of an embedded platform which takes a series of inputs from the wind tunnel and can actuate the various controls on the wind tunnel and take measurements from the various sensors present. The controller will communicate through a USB interface to the host computer and interface to either Matlab or Labview. A webserver will collect this data and allow for remote access.

Computer

The computer will communicate with the embedded controller platform and also host the web server which will serve the video streams and data to remote clients. The remote users will use a Java applet based GUI to send commands through the host computer to the embedded system to operate the wind tunnel.

Webcams

The webcam block consists of three webcams situated around the wind tunnel system. These will be placed to allow the user to see how the part being tested is performing in the wind tunnel as well as allow them to see the status of the surrounding area of the wind tunnel. The webcam handling will be modular such that more webcams can be added to the system without any reconfiguration. They will merely need to be plugged into the router beside the current three webcams.

Router

The router will enable the webcams and computer host to be internet connected. It will also handle the port forwarding necessary to allow the multiple camera streams to be embedded into the web-interface page.

Requirements

- Controlling the wind speed within 5%

- Data rate of at least 10Hz

- Controlling the angle of the test bed to 5%

- Support for at least 10 simultaneous clients