Probot

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Client: Hitachi Global Storage Technologies (HGST)

Problem: The goal of the project was to develop a robotic system that can move an oscilloscope probe to any via on a 2.5” form factor hard disk drive (HDD). The robot should be able to operate remotely, allowing the engineer to control the positioning of the probe without intervention from a local technician.

Users: HGST Product Development Engineers

Uses: Debugging HDD Hardware Issues

Operational Environment: HGST laboratory

Budget: $883 / $1500

Functional Requirements:

- Hold, move, and manipulate LeCroy Oscilloscope Probes
- Place the probe on via with enough force to make a good electrical contact
- Have a calibration method that ensures accurate placement of probe
- Support positioning of at least one probe

Non-Functional Requirements:

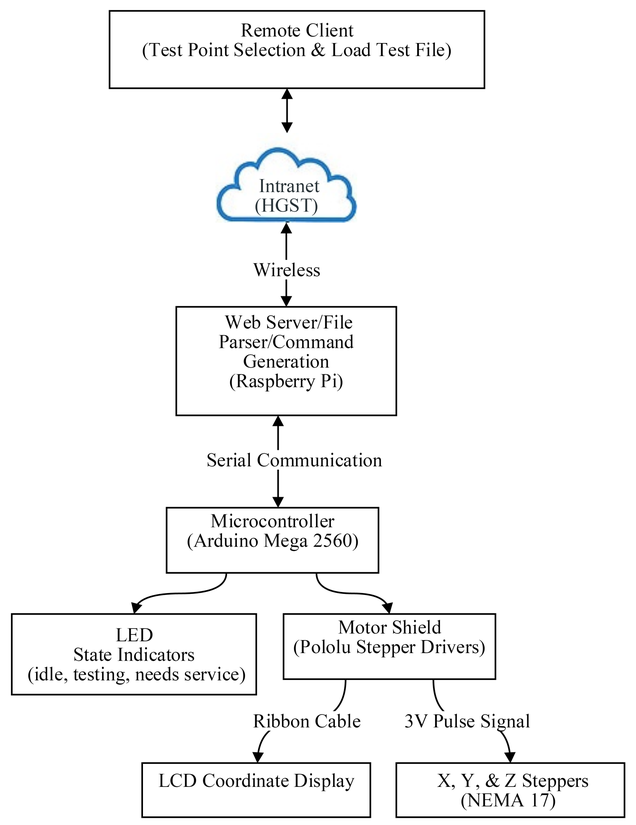
- Move to any point within 60 seconds
- Have LEDs that indicate to others when operational
- Have an LCD to display coordinates
- The robot should take up less that $4ft^3$
- Robot should support a manual operation mode

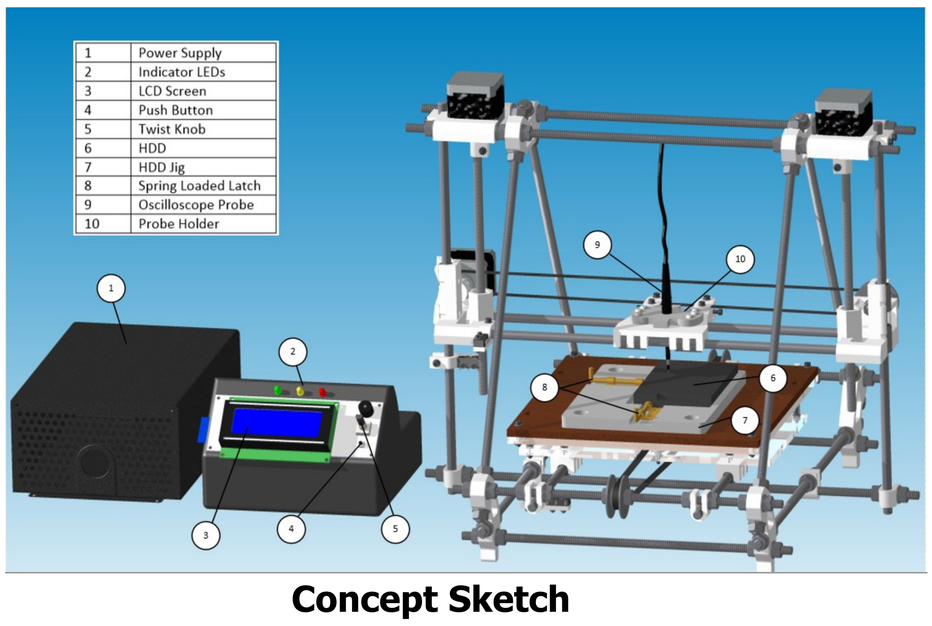
Operation:

The local user will manually place a 2.5” HDD into a jig and manually calibrate the robot through a LCD UI. The remote user will then access the robot through the HGST Intranet using a web browser. Next, they will then import the drill board file into the web application. The Raspberry Pi web server will parse the file; thus finding all the via locations and then plot all test via locations onto a template HDD in the GUI.

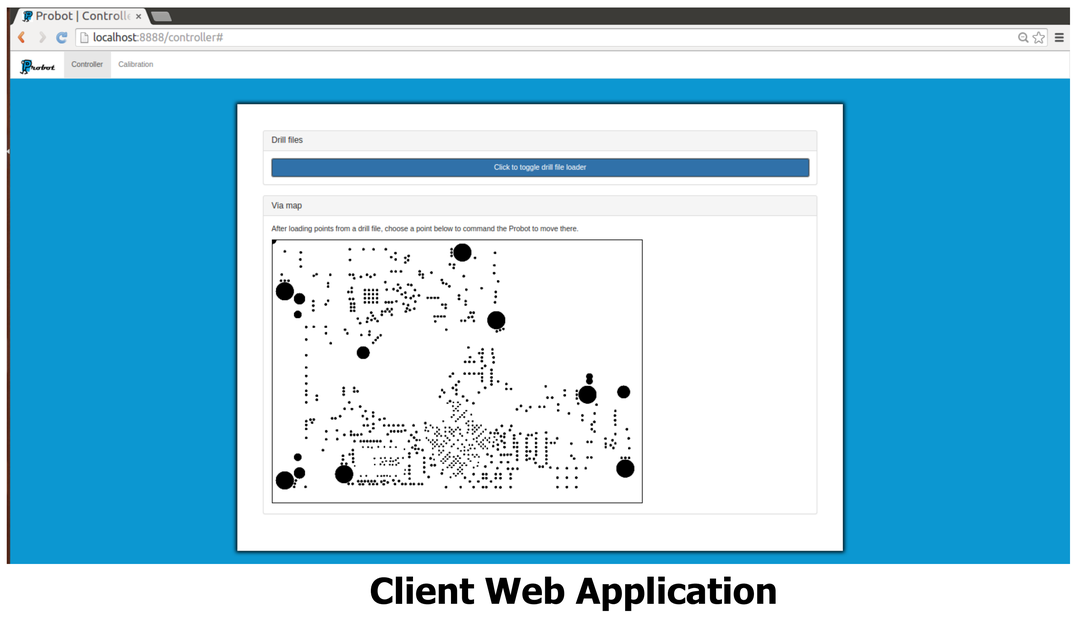
Once the file is parsed and the test points are displayed, the user can then proceed to select a via to test. The web server will then take the test point via and current probe coordinates to generate the corresponding G-code commands. The Arduino receives these commands, and then controls the motor appropriately.

Upon receiving a test command, the Raspberry PI will activate the status LEDs, and indicate others that the robot is in use. The current coordinates of the oscilloscope probe are displayed on the LCD.





Concept Sketch



Client Web Application

Major Technologies:

- Mechanical — RepRap Prusa Mendel i2, 3D printed parts, Aluminum machined parts
- Hardware — Raspberry Pi, Arduino, RAMPS motor shield
- Operating System — Raspbian
- Languages — HTML, CSS, Javascript, Python, C
- Libraries — Bootstrap, Marlin, Printrun, Mecode, Tornado

Testing:

	Goal	Actual	Notes
Transition time	60 sec	16 sec	Average of 80 randomly selected vias
Accuracy	80%	86%	Average of 80 randomly selected vias