P.V.I.R Proposal Presentation

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Introduction

What Is It?

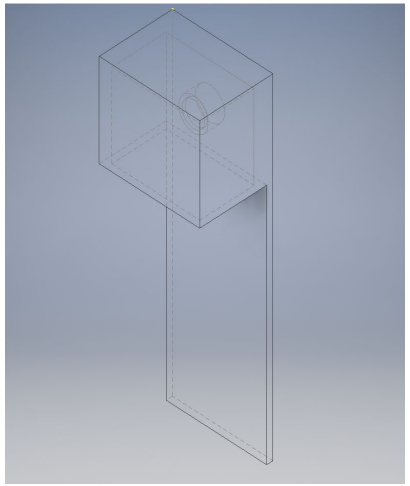
- Powervault Inspection Robot
- Will contain a movable robot with a sensor package on arm, testing environment for expo

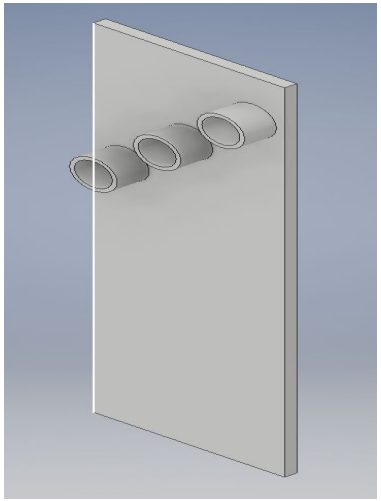
What is the purpose in industry?

- Reduces dangers for workers and speeds up repair and maintenance of vault

Goals

- Create boards with dummy gauges that represent a powervault setup
- Design remote controlled robot
- Display videofeed and sensor information





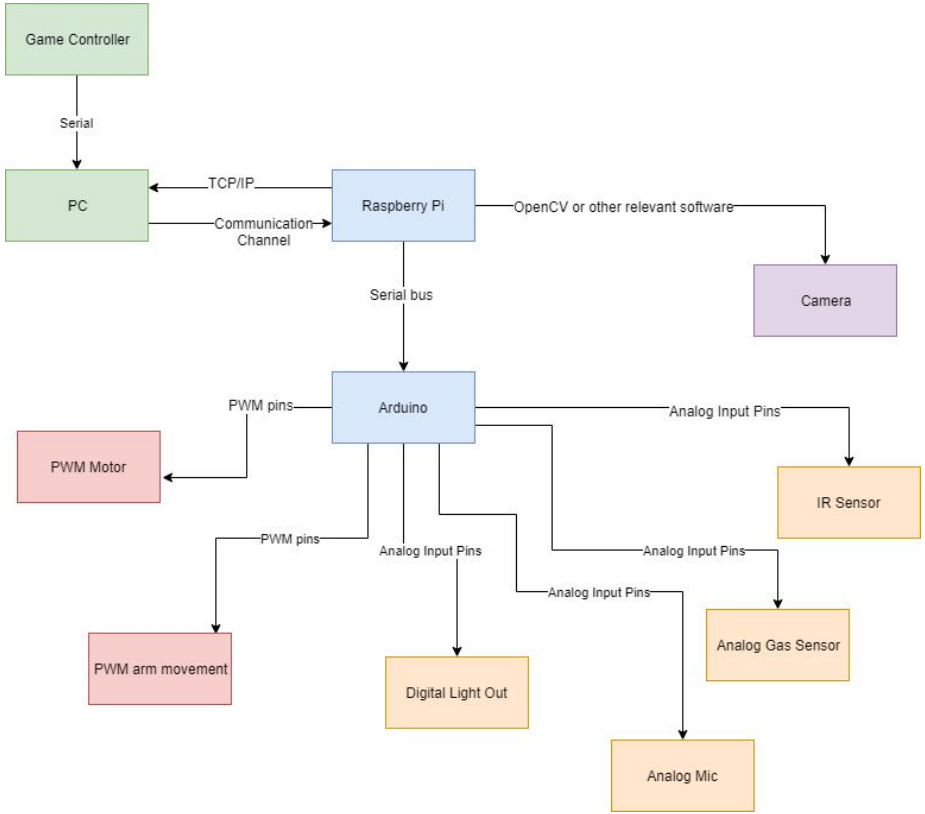
Specifications

Mechanical Arm Specs
Height : Variable height from 1 - 6 feet
Degrees of Freedom : 2 degrees of rotation
Base Size : Fits in a 760mm Diameter Manhole

Sensor Package Specs
Video : Can Stream Video to GUI
Gas Sensor : Check Air Quality
IR Thermal Camera : Record Thermal Images
Microphone : Record Sounds

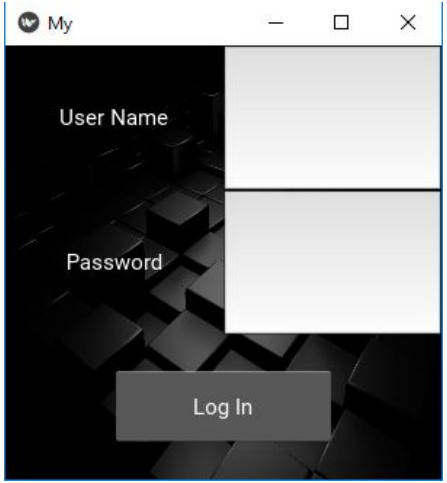
GUI Specs
Mobile: Usable on Mobile Platforms
Control Capabilities: Remotely Controllable Robot
Logging: Log Information
Data Streaming: Real-Time Data Streaming

Design Approach Overview



Design Approach (GUI)

		Kivy	Matlab App Builder	C#
1	Visual Graphical App Builder	✗	✓	✓
2	Easy Communication to a Python System	✓	✗	✗
3	Easy Parallel Task Completion	✓	✓	✗
4	Easily Exportable to IOS or Android	✓	✗	✓
5	Compatible with gaming controllers	✓	✗	✓

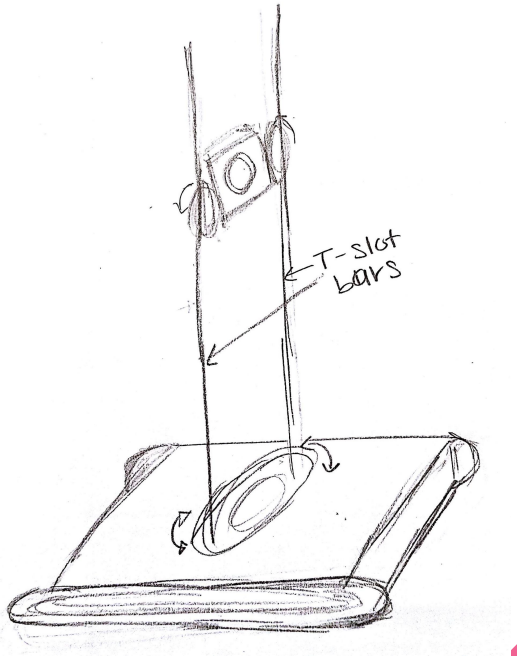


Design Approach (Control System)

- Perf Boards for mounting sensors
  - Aren’t enough connections to need a PCB
- Sensor Package protective casing
  - Needs to be exposed to the air
  - Needs to be water resistant
  - 3D printed
- Speed restrictions on motors
  - Restrict movement while arm is extended
  - Object detection to prevent collisions
- Ethernet Communication from PC to Pi
  - Easiest solution for our testing environment

Design Approach (Mechanical Arm)

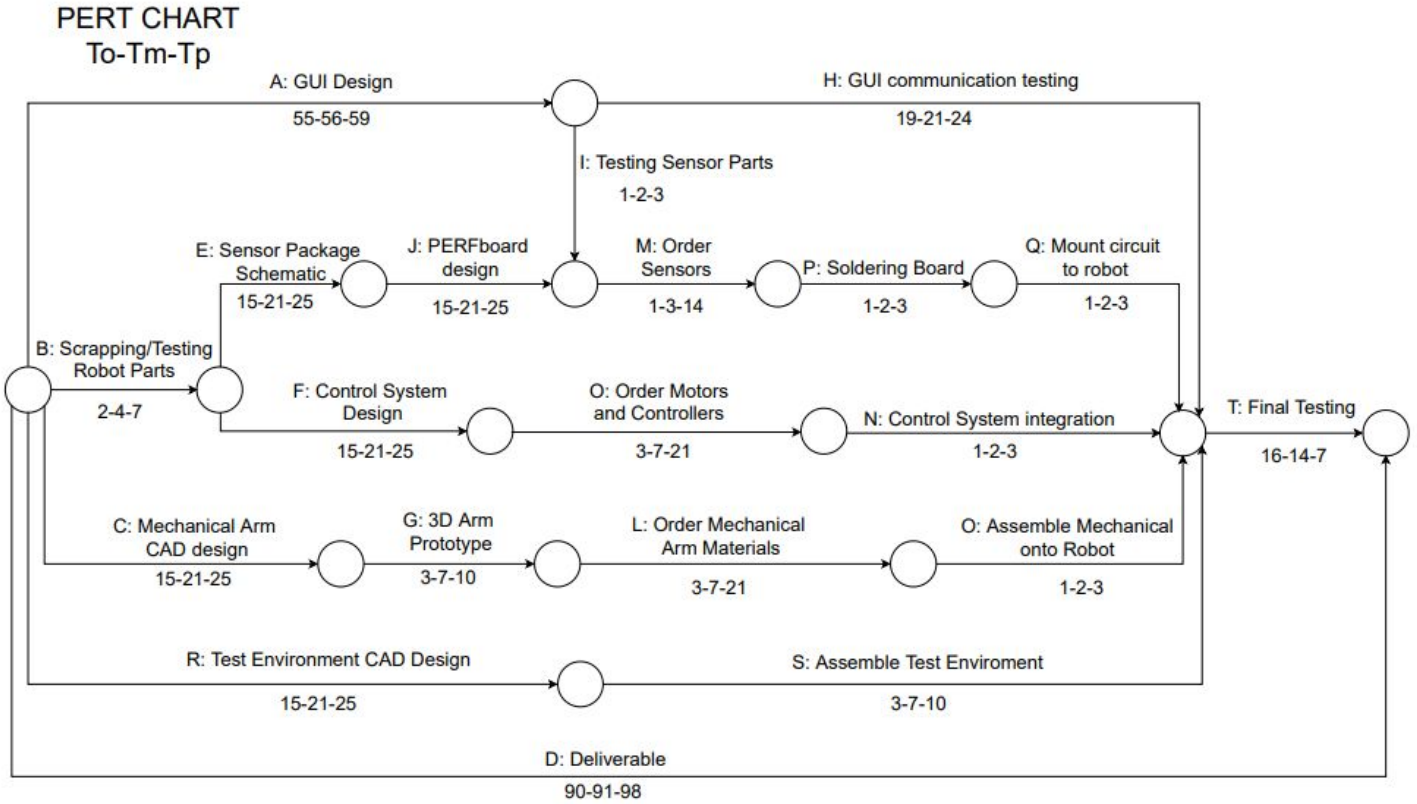
- Max Extension Height
  - 6 ft
- Degrees of Rotation
  - 360 degrees
- Material
  - Metal T-Slots
- Camera Movement
  - Can move up and down vertically
- Lights
  - Mounted to camera



Testing Procedure and Criteria

- Moving robot with a controller
  - Speed/direction tests
  - Control/latency tests
  - Xbox 360/PS3 wired controller compatibility
- Mechanical Arm Mobility
  - Weight distribution tests
  - Total movement (up & down; rotation)
- Sensors relaying data to GUI
  - Accuracy tests
    - Expo is an non ideal environment for practical tests
  - Readability (how easy is it to interpret)
- GUI
  - Displays sensor data and video feed

Schedule


PERT CHART
To-Tm-Tp
A: GUI Design
55-56-59
H: GUI communication testing
19-21-24
I: Testing Sensor Parts
1-2-3
E: Sensor Package Schematic
15-21-25
J: PERFboard design
15-21-25
M: Order Sensors
1-3-14
P: Soldering Board
1-2-3
Q: Mount circuit to robot
1-2-3
B: Scrapping/Testing Robot Parts
2-4-7
F: Control System Design
15-21-25
O: Order Motors and Controllers
3-7-21
N: Control System integration
1-2-3
T: Final Testing
16-14-7
C: Mechanical Arm CAD design
15-21-25
G: 3D Arm Prototype
3-7-10
L: Order Mechanical Arm Materials
3-7-21
O: Assemble Mechanical onto Robot
1-2-3
R: Test Environment CAD Design
15-21-25
S: Assemble Test Enviroment
3-7-10
D: Deliverable
90-91-98

Status

- GUI Design: 20% compete
- Previous Robot/Sensor Package: Scrapped

  Materials acquired from past project:
  - Microphone w/pop filter
  - 2 Raspberry Pi B+
  - 2 Servos
  - 2 Motors
  - Light sensor/ring light
  - 2 Speed controllers
  - 1080p WebCam
  - Physical Robot
  - Sensor board

  Robot currently located in West's lab

Status

- Mechanical Arm CAD design: 50% complete
  - T-slot bars designed in Solidworks
- CAD Model of Testing Environment: 95% complete
- Design Schematic: 50% complete
- Bill of Materials/Parts Ordering: 90% complete - On hold