Team RoboShow

Team Members: (Back row) Kevin Witkoe, Kyle Kausen, Jacob Herrington, (Front row) Will Edwards, Andrew Gregory, Stephen Goodwin

Project Background

- Background
  - Boeing Donation
  - VS-6557G: A 6 degree of freedom manufacturing robot
  - Enrich Undergraduate experience in manufacturing automation

Goals

- Develop a multi-purpose robotic workstation
- Bring operational knowledge to the department and college
- Increase research ties with Boeing
- Create a stunning engineering showcase for visitors

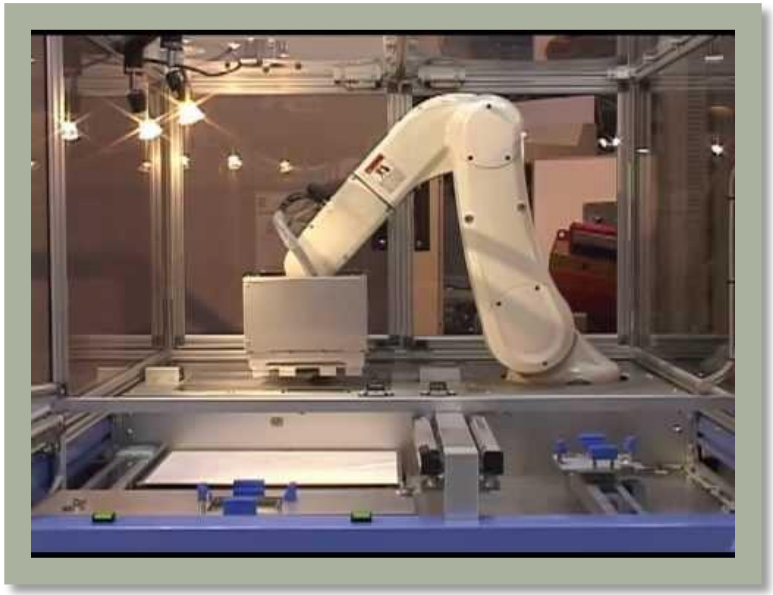
Project Deliverables

- Acquire necessary hardware and software for operation
- Operate the robot in manual and automatic modes
- Design and manufacture a safe workstation
- Create Demonstrational Programs using multiple platforms
  - Teaching Pendent
  - Wincaps
  - Orin
- Document setup, operational, and programming knowledge for future students
- Create duplicates of final hardware for ECE department

Project Research

Undesirable Attributes

- Restricted workspace
- Open Cage Design



An example of a typical industrial robotic cage

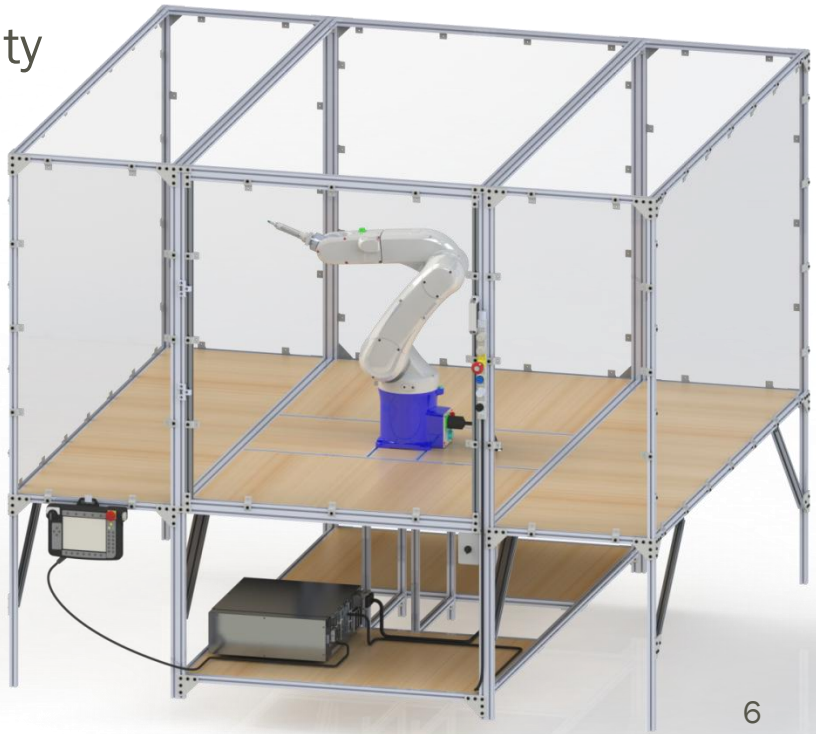
An example of a typical college robotic lab

Desired Attributes

- Industrial Style
- Fully Enclosed
- Safety standard Compliance
- Quick Operation

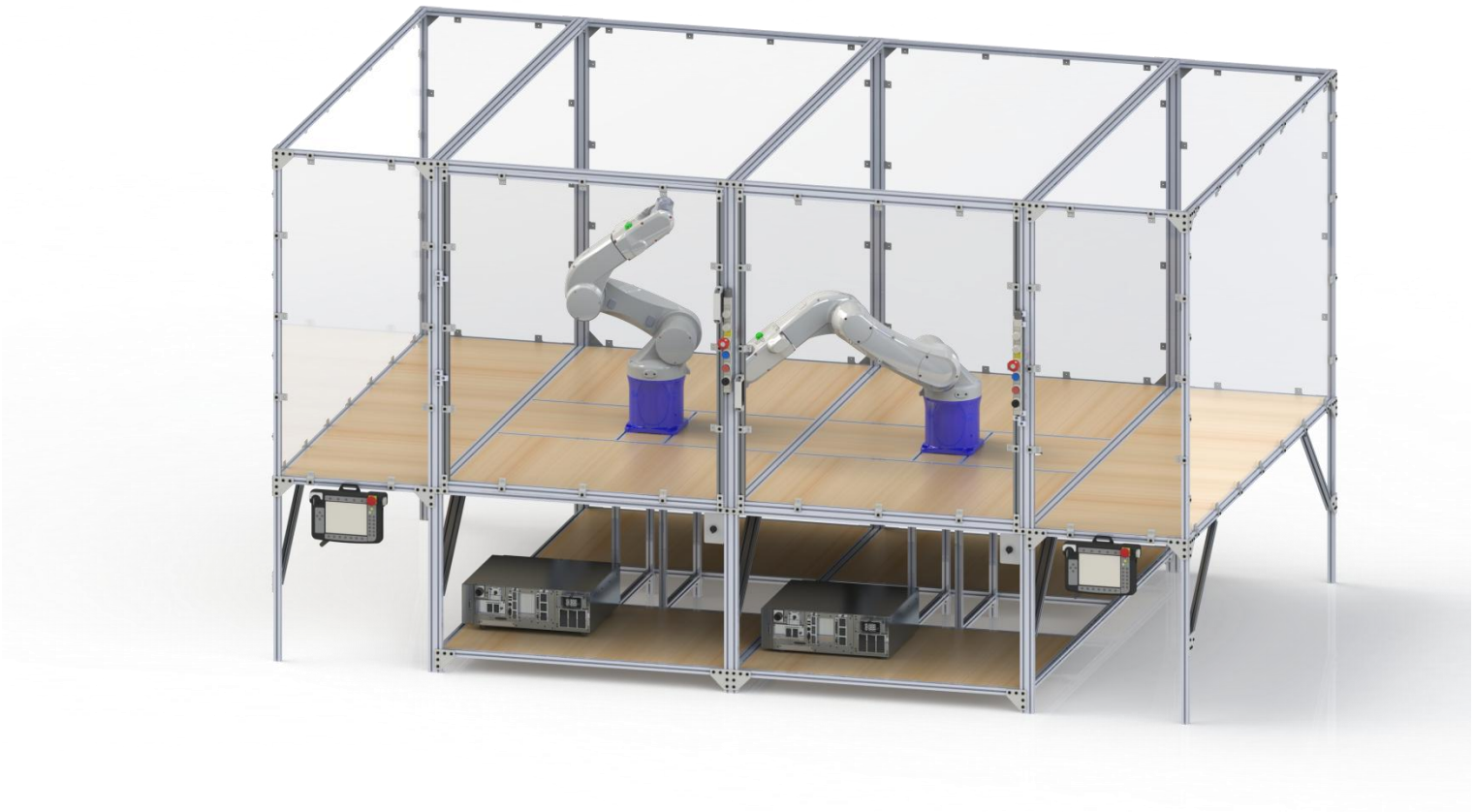
Final Enclosure Design

- Design Features
  - Conforms to OSHA and NFPA-79 safety standards
  - Impact Resistant Poly-Carbonate Paneling
  - Aluminum extrusion for project flexibility
  - Modular and portable design
  - Uninhibited robot workspace
  - Integrated Electronics



Final Enclosure Design - Double

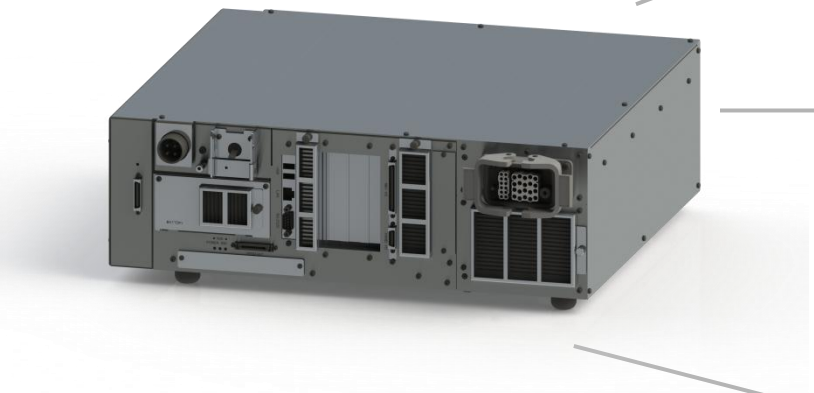
The enclosure can be reconfigured to accommodate multiple robots with a shared workspace.



Controller Electronics

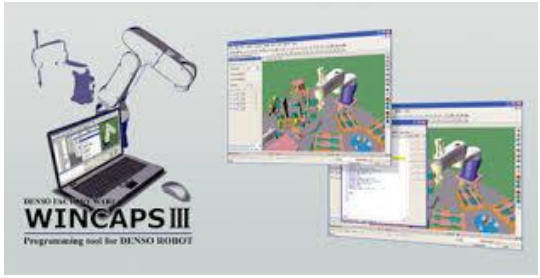
RC7M Controller

- Global Type Safety
- Mini IO
- Category 4 Safety
- Internal Memory

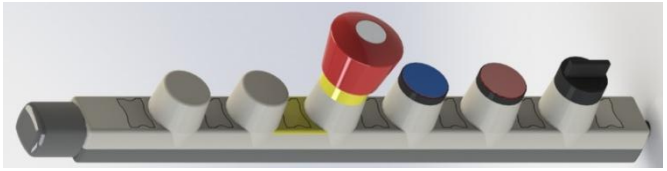


Teaching Pendant

Wincaps III



eGard Interface

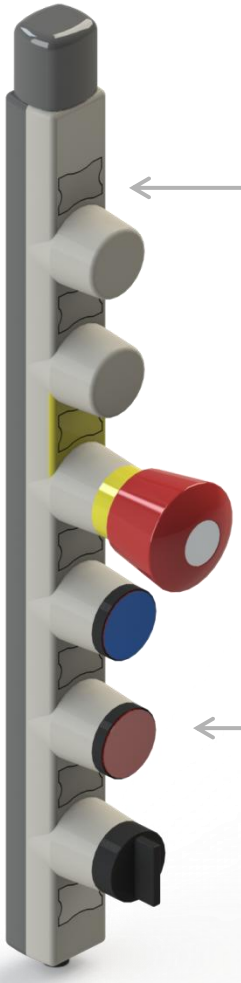


eGard Interface

Safety relay
- Cuts power when door is opened

Start / re-start
- Re starts the specified program

2 Position selector switch
- Select from 1 of the 2 pre uploaded programs



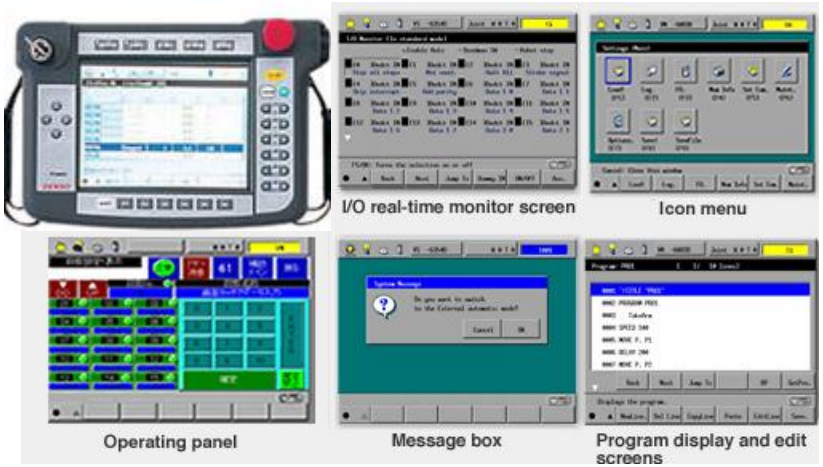
Solenoid locking system
- Locks door when the robot is powered on

Emergency stop with key reset
- Allows for locking the enclosure when not in use

Illuminated stop
- Gently stops at next coded position

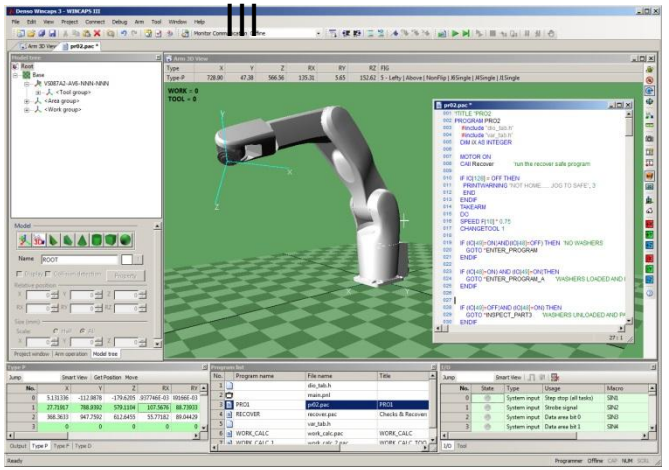
Programming

Teaching Pendant



- Internal control
- Direct programming features
- Auto/Manual/Teach modes
- Emergency stop
- Deadman switch

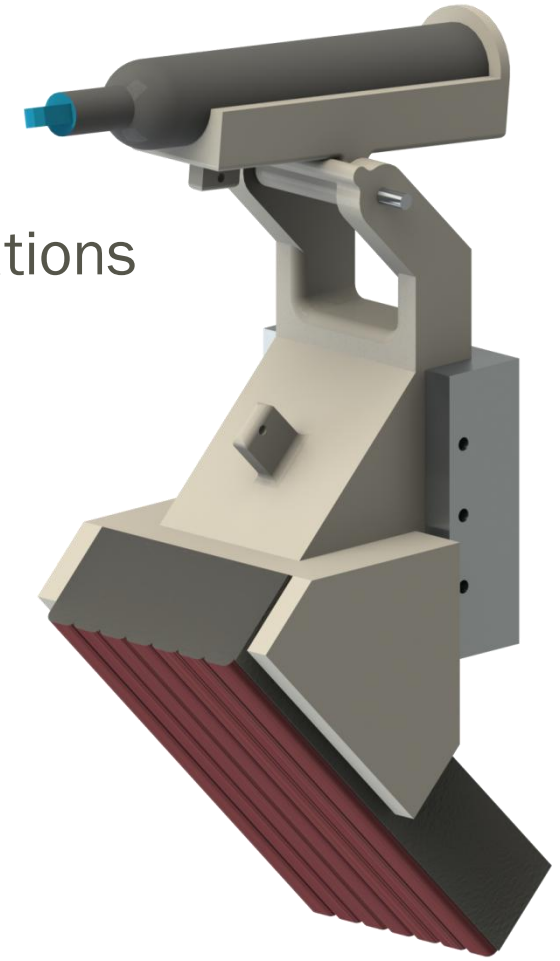
Wincaps III



- Offline programming
- Real time monitoring
- PAC debugger
- 3D simulations
- Upload programs via Ethernet to controller

Demonstrative End-Effector

- EXPO Whiteboard Marker
- Whiteboard Eraser
- Spring-Loaded Compliance
- 3-d Printed used for rapid design iterations



Project Demonstration

- Autonomously drawing and erasing on a whiteboard
- Manual operation of the robot

Summary and Future Recommendations

- Current State
  - OSHA and NFPA Compliant Safety Enclosure (x2)
  - Ability to demonstrate robot's capabilities
  - Documents outlining setup, operation, and programming
  - Thorough research on pneumatic end-effectors

- Recommendations
  - Purchase industrial end-effect and integrate with demonstrations
  - Investigate vision system
  - Coordinated Motion with Multiple Robots

Acknowledgements

Team Robo-Show would like to thank

- The Boeing Company
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- Dr. Eric Wolbrecht, Dr. Michael Santora, Dr. David Alexander

We are now happy to entertain any further questions