

**MICHIGAN STATE**  
**UNIVERSITY**

# Project Plan

## Boeing Factory Simulator

The Capstone Experience

Team Boeing

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*From Students...*  
*...to Professionals*

# Project Overview

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- Simulation of airplane construction processes
- No competing product has the required features
- Provides a cost effective way of trying different construction setups



# Functional Specifications

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- Accurate factory simulation game
- Construct paper airplanes
- With arrangement of different robots
- Player is the factory owner
- Multiple scenarios
- Results recorded into files



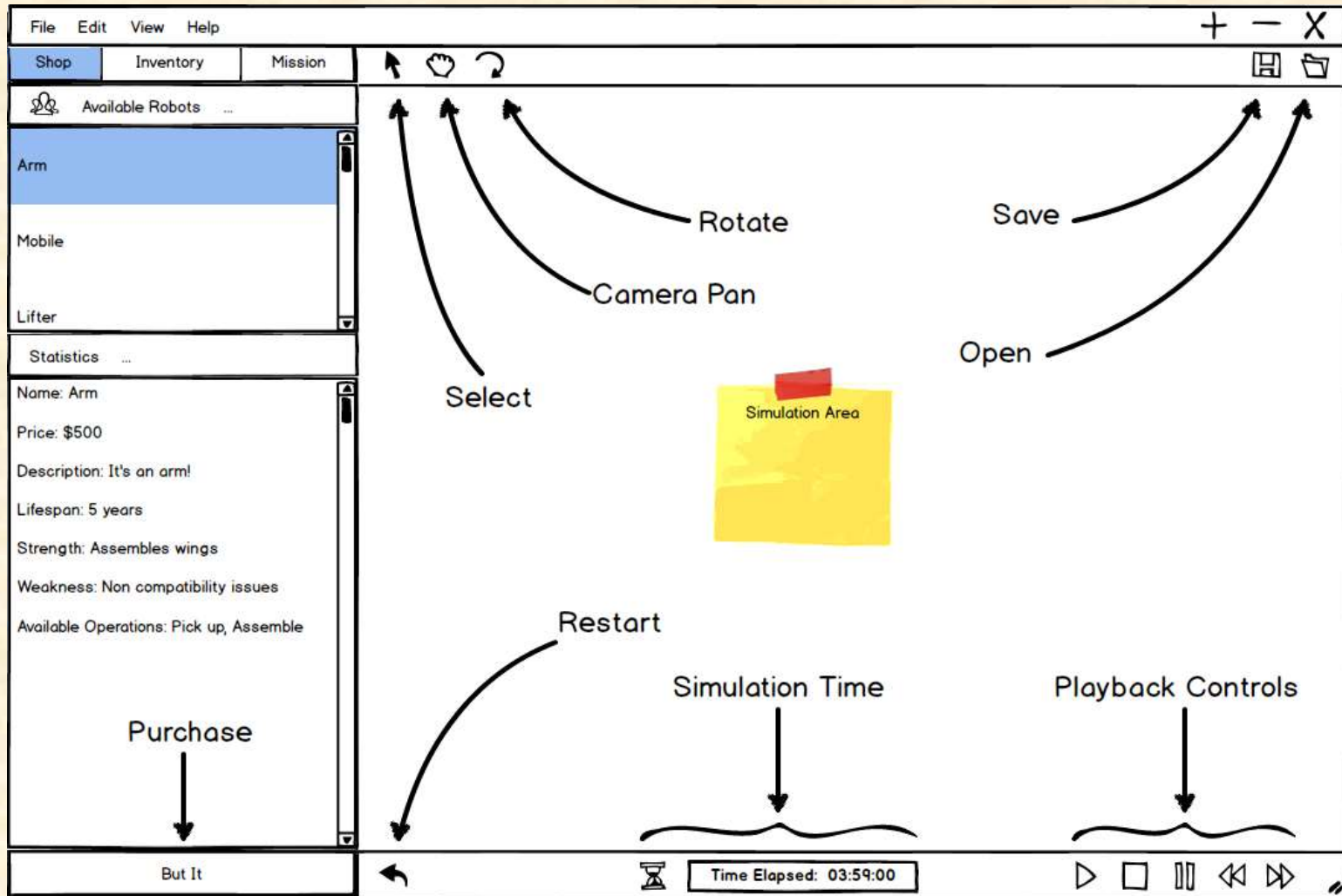
# Design Specifications

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- Game is divided into different factory scenarios
- Players are able to place robots to construct paper airplanes
- Physics of the game world must match closely to real world
- Users are graded on safety, efficiency, and cost
- All results and actions logged into files



# Screen Mockup: Main Scene



# Screen Mockup: Inventory and Mission

Shop	Inventory	Mission
Current Robots ...	Level Criteria ...	Level Criteria ...
<b>Arm</b>	<b>Budget</b>	<b>Budget</b>
Mobile	Initial Budget: \$100,000 Current Budget: \$50,000	<b>Efficiency</b>
Lifter		Number of Models Needed: 100 Number of Models Built: 20 Number of Models in Progress: 10 Human Efficiency: 90% Robot Efficiency: 70%
Statistics ...		<b>Safety</b>
Name: Arm		Safety Violation Threshold: 15 Number of Safety Violations: 10
Worth: \$500		<b>Speed</b>
Description: It's an arm!		Goal: 6:30:00 Time Elapsed: 5:30:00
Lifespan: 5 years		
Strength: Assembles wings		
Weakness: Non compatibility issues		
Available Operations: Pick up, Assemble		
Number available: 5		
Sell It	Efficiency	Safety
	Safety	Speed
	Speed	



# Technical Specifications

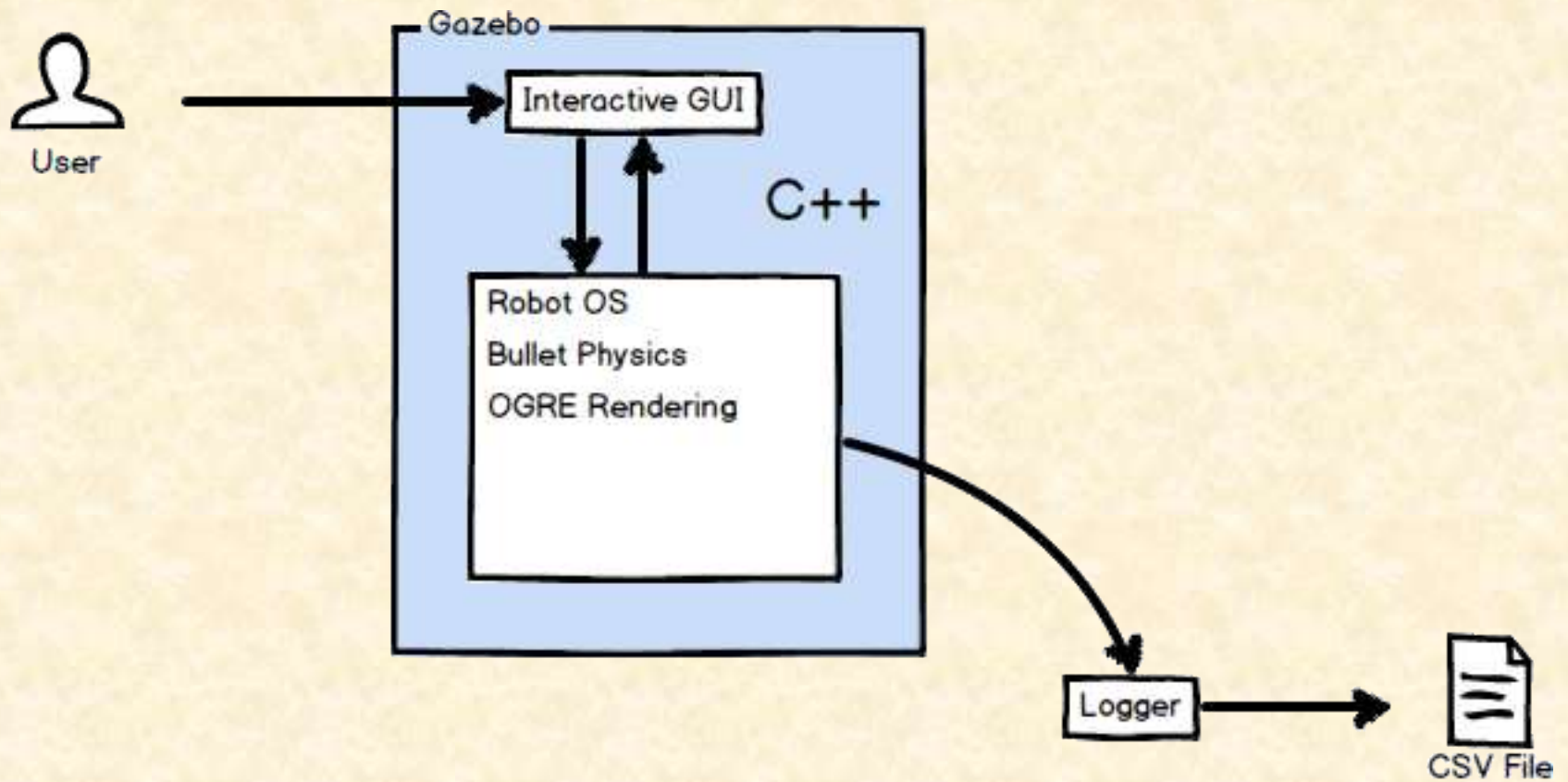
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- Program runs on top of Gazebo
- Uses C++ to customize the UI and simulation aspects
- Data is logged with custom application to CSV files





# System Architecture





# System Components

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- Hardware Platforms
  - Ubuntu 12.04 Precise officially supported
  - Other platforms are use at own risk
  - No required server component
- Software Platforms / Technologies
  - Built using Gazebo Simulator
  - Relies upon ROS, Bullet Physics, and OGRE



# Testing

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- Weekly functional builds
- Constant play testing
- Unit tests were applicable



# Risks

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- Working with a lot of open source software
- Simulation must run at real time with logging
- Three different parts that need integrating
- Very expansive project vision

