Advanced Robotics Project

Technical Plan

Author:

ACCVS Team

Outline

1. Overall architecture
2. Robotic modules
3. Operational environment
4. Version controlling
5. Test plan
6. Division of work

1. Overall Architecture

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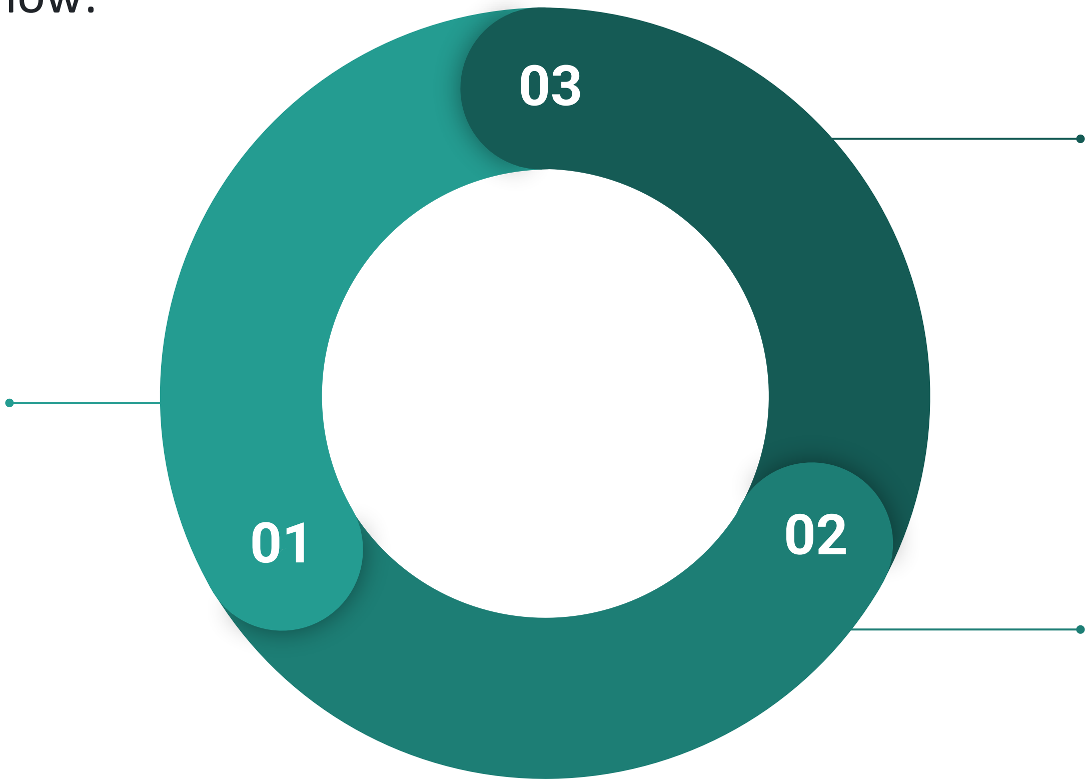
1.1 System Architecture Overview

The system consists of three cooperating robotic subsystems operating in a cyclic workflow:



Robotic Crane

Picks and places objects

Autonomous Vehicle

Detects and pushes object back

Conveyor Belt System

Transfers objects

1. Overall Architecture

1.2 Required Software Components

Component	Purpose
Webots Simulator	3D simulation and robot modeling
GitHub Repository	Version control & collaboration
Discord	Meeting and discussion
Word/PowerPoint	Documenting

1. Overall Architecture

1.3 Required Hardware Components (Simulated)

1. Rotational motors (crane joints)
2. Linear motors (conveyor movement)
3. Wheel motors (vehicle)
4. Distance sensors
5. Position sensors

2. Robotics modules

A. Crane Control Module

- Inverse kinematics (if multi-joint)
- Gripper open/close control
- Object pickup logic

B. Conveyor Control Module

- Constant speed motor control
- Object presence detection

C. Vehicle Navigation Module

- Obstacle detection
- Line tracking or distance-based movement
- Push control logic

D. Central Coordination Module

- Finite State Machine (FSM)
- Synchronization logic
- Error handling

3. Operational Environment

1. Webots installed
2. Compatible OS:

- Windows
- macOS
- Linux

3. Minimum specifications:

- 8GB RAM (16GB RAM is recommended)
- GPU recommended for smooth simulation

4. Runtime Requirements:

- Webots runtime libraries

4. Version Control

4.1 Repository Platform

- GitHub

4.2 Branch Strategy

- **main** → stable release
- **develop** → integration branch
- **feature/*** → individual tasks

4.3 Commit Guidelines

- Clear commit messages
- No direct push to main

5. Test Plan

Testing is divided into 3 levels:

6.1 Unit Testing

- Individual robot modules tested separately
- Verify:
  - Crane picks object
  - Conveyor moves correctly
  - Vehicle detects object

6.2 Integration Testing

- Full cycle execution
- Verify timing synchronization
- Confirm no deadlocks

6.3 System Testing

- Run 10+ repeated cycles

6. Division of Work

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Team Structure (4 Students)

Member 1 – Crane Engineer

- Develop crane kinematics
- Implement pick/place logic
- Test joint precision

Estimated: 35–40 hours

Member 2 – Conveyor Engineer

- Implement conveyor motor system
- Sensor trigger logic
- Timing synchronization

Estimated: 25–30 hours

Member 3 – Vehicle Engineer

- Navigation logic
- Sensor detection
- Push-return system

Estimated: 35–40 hours

Member 4 – System Integrator

- Supervisor controller
- Communication design
- Integration testing
- GitHub management

Estimated: 40–45 hours

Thank you!

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