

Advanced Mechatronics Term Project Proposal - Team 6

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Project Title: Vision-Guided Maze Solver with Tilt-Platform Control

Problem Statement:

As manual maze solving is often tedious and time consuming, this project proposes an automated solution to navigate a physical maze efficiently.

Prerequisites:

Hardware:

- Raspberry Pi with Camera Module
- Arduino Uno
- Two MG996R Servo Motors with Tilt-table (180x180mm) for the maze
- 3D Printed Maze (180x180mm) with 10mm clearance for a ball (measurements are approximate)

Software:

- Raspberry Pi: Open CV (Edge Detection and Image Processing), Maze-solving algorithm (e.g., Depth-First Search, A*, etc.)
- Arduino Uno: Arduino C Code to receive control signals from the Pi and operate the servos

Proposed Solution:

The project leverages a Raspberry Pi for real-time image processing and decision-making. A Pi Camera captures a top-down view of the maze, feeding a real-time edge detection algorithm. This algorithm identifies walls and pinpoints the ball's starting position, creating a dynamic maze map for the Pi to execute the chosen pathfinding algorithm. Working in conjunction, an Arduino Uno controls a pair of perpendicular-axis servo motors attached to the bottom of a tilt-table holding the maze. Based on the real-time maze map and the chosen algorithm, the Pi transmits control signals to the Arduino, which precisely maneuvers the servos to tilt the platform and guide the ball bearing through the maze.

Expected Outcome & Conclusion:

In conclusion, this project envisions a versatile maze solver, navigating any maze with a chosen pathfinding algorithm. Success will demonstrate real-time image processing and automated control of physical systems through a collaborative Raspberry Pi and Arduino approach. Beyond functionality, it offers a platform for learning robotics, computer vision, and decision-making.