Final Project Proposal

Year: 2024 Semester: Spring Team: 05 Project: Dodgebot

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Team Members (#1 is Team Leader):

Member 1: Yusuf Jarada Email: yjarada@purdue.edu

Member 2: Maximillian Drach Email: mdrach@purdue.edu

Member 3: Carlos Cotera Email: ccoteraj@purdue.edu

Member 4: Ayman Motoda Email: aelnamr@purdue.edu

**1.0 Project Description:**

**Hardware Components:**

**Robot Body:**

* Design a simple and compact robot body that can move on an axle.
* Ensure that the design allows for easy bunching and dodging movements.

**Axle and Motor System:**

* Choose motors that can control the movement of the robot along the axle.
* Integrate an axle system that allows the robot to rotate and dodge punches.

**Camera System:**

* Select a camera with sufficient resolution and frame rate for real-time detection.
* Mount the camera in a way that provides a good field of view for detecting punches.

**Color Detection System:**

* Use sensors or image processing techniques to identify brightly colored gloves.
* Implement a system that can accurately distinguish the gloves from the background.

**Microcontroller or Single-Board Computer:**

* Choose a microcontroller or single-board computer (like Raspberry Pi or Arduino) to process camera input and control motors.
* Ensure it has the necessary processing power and interfaces for camera and motor control.

**Software Components:**

**Image Processing Algorithm:**

* Develop an image processing algorithm to analyze the camera feed.
* Identify and track the position of the brightly colored gloves in real-time.

**Control Algorithm:**

* Create a control algorithm that takes input from the image processing module.
* Implement a dodging strategy based on the detected glove positions.

**Motor Control:**

* Write code to control the motors based on the output from the control algorithm.
* Ensure the robot can move quickly and accurately to dodge punches.

**Integration and Testing:**

* Integrate the hardware and software components.
* Test the prototype in controlled environments to ensure accurate glove detection and effective dodging.

**Refinement:**

* Refine the algorithms and adjust parameters based on testing results.
* Fine-tune the robot's movements for better dodging performance.

**Safety Measures:**

* Implement safety features, such as emergency stop mechanisms, to ensure the safety of users and the robot itself.

**Documentation:**

* Document the design, code, and testing procedures for future reference or improvement.

**2.0 & 2.1 & 2.2 & 2.1.1 Team Member Expertise and Team Roles and Responsibilities:**

Team Member: Carlos Cotera – Software Lead

* Responsible for design and implementation of source code. Undertakes functional prototyping efforts early in the semester to mitigate risk in the later stages of the design process.

2.1.2 Team Member: Maximilian Drach – Systems Lead

* Responsible for high level functional overview of the system, including the theory of operation, block diagram, and component selection. Ensures components and systems on project work together coherently.

2.1.3 Team Member: Ayman Motoda – Hardware Lead

* Responsible for design of printed circuit board electrical schematics and layouts, often in charge of circuit board construction and packaging assembly

2.1.4 Team Member: Yusuf Jarada – Team Lead

* Maintains communication among team members, ensures team is progressing and assists fellow team members in addressing significant issues.

3.0 Homework Assignment Responsibilities

*Design Component Report*

**A3-Software Overview: Carlos Cotera**

**A4-Electrical Overview: Ayman Motada**

**A6-Mechanical Overview: Yusuf Jarada**

**A8-Software Formalization: Maximilian Drach**

*Professional Component Report*

**A9-Legal Analysis: Maximilian Drach**

**A10-Reliability and Safety Analysis: Yusuf Jarada**

**A11-Ethical/Environmental Analysis: Carlos Cotera**

**A12-User Manual: Ayman Motada**

1. Estimated Budget
2. Motors = $1,000
   1. The total is of a 3x quantity of 40Nm Hub Motors
3. Board, Micros = $210
   1. Requires a Jetson ($150) + STM32 ($30)
   2. Board + Components ($30)
4. ESC + Power Supply = $200
   1. DC-DC Converter & Inverter for Motor ($150)
   2. Components for supplying subcircuits at 5V, 3.3V ($50)
5. Mechanical Components = $100
   1. Ball and Socket Joint ($20)
   2. Shaft ($10)
   3. Belts ($50)
   4. Screws, Nuts, ETC. ($20)

5.0 Project Specific Design Requirements (PSDR)

Definitions:

* Punch - Strong enough force applied by a bare hand to create mild contusion on an average 21-year-old healthy male.
* Environment (Area) – The effective area in space, which the dodging system was design to monitor.
* System – The electrical makeup of the robot which involve the specified components.

1. An ability to track a punch and robot in the environment space.
2. An ability to create a set of coordinates that place the robots outside a punch trajectory path.
3. An ability to translate a set of coordinates into motor specific torque values to control the proper robot path.
4. An ability to supply a constant 5V and 3.3V to the microcontrollers and peripherals of the logic system at varying current demands.
5. An ability to communicate motor command data between both microcontrollers.

6.0 Sources Cited: