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

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

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

**1.0 Project Description:**

/\* TODO(b/0001): I just pasted some whatever text we should all expand on this design \*/

**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.

Keep in mind that this is a high-level overview, and the specific details will depend on the components you choose and the complexity of your design. Additionally, safety should be a top priority, especially when working on a robot that interacts with physical objects.

**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

***ECE 47700 requires each student to write one design component report and one professional component report. In the table below, each team member must select the ONE design component report and the ONE professional report that they are responsible to complete. Note that while these are project reports, they must be written by the individual student assigned and be turned in by that student. If the assignments students must complete must be changed for some legitimate reason, please contact course staff.***

*Design Component Report*

*Professional Component Report*

**A3-Software Overview**

**A4-Electrical Overview**

**A6-Mechanical Overview**

**A8-Software Formalization: Carlos**

**A9-Legal Analysis**

**A10-Reliability and Safety Analysis**

**A11-Ethical/Environmental Analysis: Max**

**A12-User Manual**

4.0 Estimated Budget

***In this section, develop a first-cut estimation of the budget of your project, separated into categories. For each category, include a description of the category as well as a conservative estimated cost. Include a total estimated cost at the end of the estimated budget. See the example Final Project Proposal for more details.***

1. Motors = $1,000
   1. The total is of a 3x quantity of 40Nm Hub Motors
2. Board, Micros = $210
   1. Requires a Jetson ($150) + STM32 ($30)
   2. Board + Components ($30)
3. ESC + Power Supply = $200
   1. DC-DC Converter & Inverter for Motor ($150)
   2. Components for supplying subcircuits at 5V, 3.3V ($50)
4. 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)

1. Electromagnetic requirements to produce specific levels of:
   1. Speed
   2. Torque
2. Power delivery requirements:
3. Computer Vision input validation and testing for:
   1. Minimum latency
   2. Correct punch angle prediction
4. Testing dodging logic for:
   1. Mapping punch inputs to correct dodge choices consistently.
5. Design Hardware for embedding components:
   1. Cameras
   2. Sensors
   3. Boards

***ECE 47700 requires teams to develop a set of 5 Project Specific Requirements (PSDRs). These five PSDRs are the engineering requirements of the project in which the team will focus their engineering design efforts to meet the minimum ECE design criteria for the School and ABET. A team must successfully achieve at least three of these PSDRs in preliminary testing on the final project hardware in order to meet ABET requirements and pass the course. Please note that there are specific course policies that must be observed when selecting project specific design requirements and when demonstrating their achievement. More information on these course policies can be found in the “PSDR Policy” document, available on Brightspace.***

***List here and later on your team webpage, a first draft of the 5 PSDRs you plan to use for your project. Read the PSDR Policy document and see the Example PSDRs (previously called PSSCs) from previous semesters that are posted on Brightspace. These five PSDRs may be modified as necessary based on your prototyping results during the first five weeks of the course after which they will be “locked down” and your team will need course instructor permission to change.***

6.0 Sources Cited:

***Throughout this and other papers, use of the IEEE citation style should be used. Use of embedded hyperlinks for all web-based sources is required. A reference to the IEEE citation style format is provided here.***