Final Project Proposal

Year: 2023 Semester: Fall Project Name: Air-Hockey Playing Robot

Creation Date: August 24, 2023 Last Modified: August 24, 2023

Team Members (#1 is Team Leader):

Member 1: Abigale Haluska Email: ahaluska@purdue.edu

Member 2: John Morton Email: morton67@purdue.edu

Member 3: Joey Collins Email: colli384@purdue.edu

Member 4: Cameron McCutcheon Email: mccutchc@purdue.edu

1.0 Project Description:

The Air-Hockey Robot is a project dedicated to providing an at-home activity for air-hockey enthusiasts and hobbyists. This robot is designed to provide a reliable and versatile opponent to practice and play with. This project will involve the creation of a robotic apparatus that can attach to any functioning air hockey table. The attachment will consist of a computer vision system that can track an active puck and predict the trajectory of the puck while in motion. The predicted trajectory will then be used as input to the robot’s motor system, which will adjust a paddle in the X and Y directions. The adjustment of this paddle will mimic the presence of another human player, so that the puck can be blocked and hit as in a typical game of air-hockey.

2.0 Team Member Expertise and Team Roles and Responsibilities:

2.1 Team Member Expertise:

2.1.1 Team Member: Abby Haluska is a fourth-year computer engineering student with experience in design thinking, prototyping, and entrepreneurship. Abby’s area of expertise focuses on project design and software development. Through two internships with Milwaukee Tool, one as a design research intern and the other as a firmware engineer intern on the IoT team, she has become accustomed to designing for the end user. She also has experience with pitch competitions on and off of campus. Her experience as a firmware engineer intern leads her to be the most comfortable with C, python, and embedded systems.

2.1.2 Team Member: John Morton is a senior in computer engineering with an interest in low level programing, firmware, and optimization. He spent this past summer in an internship for ECS Solutions where he did data visualization and some work on SQL development. He prioritizes efficiency and integrates this desire when working on other projects.

2.1.3 Team Member: Joey Collins is a senior in computer engineering. His areas of interest include embedded systems, network programming, and software development. He spent his most recent summer at Scientia LLC working on an embedded system for the Marine Corps with the purpose of receiving and processing incoming video, and streaming it out to several locations. He will leverage this experience to write functional and understandable code. He has some knowledge of artificial intelligence that should be useful throughout the development of the project.

2.1.4 Team Member: Cameron McCutcheon is a senior in electrical engineering. His areas of interest include electromechanical motion, game design, and 3D printing. This past summer, he spent his time working in the ASIC design department of Keysight technologies working on test-and-measurement technologies for 5 and 6G systems. Electromechanical motion specifically will be heavily leveraged to create the actual motion systems with the stepper motor driver system.

2.2 Team Roles and Responsibilities:

| Role | Team Member |
| --- | --- |
| Team Leader | Abby Haluska |
| Systems Engineer | John Morton |
| Hardware Engineer | Cameron McCutcheon |
| Software Engineer | Joey Collins |

3.0 Homework Assignment Responsibilities

| *Design Component Report* | | *Professional Component Report* | |
| --- | --- | --- | --- |
| A3-Software Overview | Joey | A9-Legal Analysis | Cameron |
| A4-Electrical Overview | Cameron | A10-Reliability and Safety Analysis | Joey |
| A6-Mechanical Overview | John | A11-Ethical/Environmental Analysis | John |
| A8-Software Formalization | Abby | A12-User Manual | Abby |

4.0 Estimated Budget

See the estimated project budget below:

| **Item** | **Estimated Cost** |
| --- | --- |
| ***Mechanical:The physical apparatus and robot itself*** | |
| Motors | $150 |
| Cable Spool Wheels | $50 |
| Mechanical components(nuts, bolts, screws, bearings, etc.) | $50 |
| ***Electrical: Hardware and firmware components*** | |
| Microcontroller | $75 |
| Project Circuit Board | $50 |
| Camera Module and Microcontroller | $100 |
| Power Supply | $30 |
| Electrical components (transistors, capacitors, switches, etc.) | $50 |
| ***Other: Miscellaneous components*** | |
| Air Hockey Table (used) | $150 |
| Filament/3D Prints | $25 |
| Shipping | $75 |
| **Total ($)** | 805 |

Due to the scope of this project, the estimated budget exceeds the budget provided by the ECE477 course. With this in mind, our team plans to split the remaining cost via personal investments. Additionally, we plan to enter an on-campus pitch competition to further support this project.

5.0 Project Specific Design Requirements

The following statements cover the proposed project specific design requirements for this project:

1. [hardware] An ability to interface a motor controller module with a microcontroller via a serialized asynchronous bus.
2. [hardware] An ability to establish communication and send data between a microcontroller and power PC.
3. [hardware] An ability to interface an LCD screen with a microcontroller via an SPI connection.
4. [hardware] An ability to keep score using sensor data.
5. [software] An ability to estimate the position and trajectory of a puck in motion using computer vision.

6.0 Sources Cited:

No external resources were referenced in the making of this proposal.