[Arab Academy for Science and Technology – Al Alamein]

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[Fundamentals of Robotics - Rb310]

**PROJECT PROPOSAL**

TurtleBot2 Ball Manipulation using ROS

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1. Summary

This project proposal outlines the development of an autonomous robot system for the annual DEBI Robotics Challenge. The primary objective is to create a robot capable of detecting, tracking, and manipulating balls within a predefined playground. The anticipated end result is a fully functional robot that is capable of competing in the DEBI Robotics Challenge, showcasing autonomous ball handling and manipulation.

* Identification and Purpose:
  + Autonomous ball handling and manipulation for the annual DEBI Robotics Challenge.
* Purpose of the Proposal:
  + Seeking approval and support for the development of the project.
* Anticipated Budget:
  + The total anticipated budget for the project is 400 as turtlebot2 robot and the 3d printing material are both provided by the lab of AAST or available from previous projects.
* Additional Information:
  + The project aims to contribute to the advancement of robotics and promote student involvement in competitive robotics challenges in the campus.

1. Introduction

This project introduces an autonomous robotic system designed for the DEBI Robotics Challenge 2023. The robot will be equipped with ROS1 Noetic Ninjemys, operating on the TurtleBot 2 platform, to navigate a predefined playground, detect and track colored balls, and autonomously manipulate them across the red line.

1. Needs/Problems

The needs and problems addressed by this project include:

* Duration of Needs/Problems:
  + The DEBI Robotics Challenge requires a solution for the autonomous movement and manipulation of balls within a competitive environment.
* Previous Attempts:
  + No previous attempts have been made to address this specific challenge, making it a novel and exciting project.
* Impact of the Problem:
  + The successful implementation of the project will demonstrate advancements in autonomous robotics and contribute to the field.

1. Goals/Objectives

The goals and objectives of the project are as follows:

1. Specific & Measurable Goal 1:
   * Develop a robust ball detection and tracking algorithm.
2. Specific & Measurable Goal 2:
   * Implement autonomous navigation and movement control.
3. Specific & Measurable Goal 3:
   * Integrate ball manipulation mechanisms for pushing balls across the red line.

1. Procedures/Scope of Work

The project will involve the following procedures and scope of work:

* Ball Detection and Tracking:
  + Implement computer vision algorithms for accurate ball detection and tracking.
* Autonomous Navigation:
  + Develop algorithms for autonomous navigation within the predefined playground.
* Ball Manipulation:
  + Integrate control mechanisms for pushing the detected ball across the red line.
* Optional: Manipulator Arms (Pending Approval):
  + Develop and integrate manipulator arms for finer ball control (subject to approval).

1. Timetable

Provide detailed information on the expected timetable for the project. Break the project into phases and provide a schedule for each phase.

|  |  |  |
| --- | --- | --- |
|  | **Description of Work** | **Start and End Dates** |
| **Phase One** | Set up TurtleBot 2 with ROS1 Melodic Environment. | 1 week |
| **Phase Two** | Implement ROS framework and initialization | 1 week |
| **Phase Three** | Implement ball detection and tracking algorithms | 2 weeks |
| **Phase Four** | Integrate ROS for communication and control | 2 weeks |
| **Phase Five** | Develop autonomous navigation and movement control. | 3 weeks |

Budget

State the proposed costs and budget of the project. Also include information on all parts and equipment used in the project.

|  |  |
| --- | --- |
| **Description of Work** | **Price** |
| Get Appropriate Ball | 100 EGP |
| 3D Printing of Arms | (Prev. Available) |
| Acquire tape or suitable materials for simulating the red line | 100 EGP per unit |
| designated playground | 200 EGP |
| **Total** | **$ 400 EGP** |

Next Steps

* Approval and Support:
  + Await approval and support for the project.
* Project Kickoff:
  + Initiate the project and begin the implementation phase.

The project's codebase will be hosted on GitHub to ensure open access and facilitate collaboration among researchers, students, and robotics enthusiasts. This platform will serve as a central hub for sharing, reviewing, and contributing to the project's source code.

[The GitHub repository](https://github.com/ffathy-tdx/TurtleBot2-Ball-Manipulation-ROS) will be regularly updated to include the latest developments, improvements, and documentation, making it a valuable resource for future students interested in similar projects.

1. Appendix

(Ros Wiki, n.d.)

(Turtlebot, n.d.)

(Debi Rules, n.d.)

(Github Refrence, n.d.)