

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/384443774>

Project Carrom Bot: An autonomous precision sorting robot prototype

Technical Report · February 2020

DOI: 10.13140/RG.2.2.15504.42249/2

CITATIONS

0

READS

32

4 authors:



Sabit Hasnat Mahee

Bangladesh University of Engineering and Technology

2 PUBLICATIONS 0 CITATIONS

SEE PROFILE



Md. Azmal Bin Adil

Bangladesh University of Engineering and Technology

3 PUBLICATIONS 0 CITATIONS

SEE PROFILE



Imran Ahmed

Bangladesh University of Engineering and Technology

1 PUBLICATION 0 CITATIONS

SEE PROFILE



Nafis Nahian

Bangladesh University of Engineering and Technology

1 PUBLICATION 0 CITATIONS

SEE PROFILE



Bangladesh University of Engineering and Technology

Course: ME 366 (JUNE 2022)

Electro-Mechanical System Design and Practice



PROJECT CARROM BOT

An Arduino Based Mechanical robotic arm mounted on a cart with slot for carrom pieces

Group Members:

1. 1910091-Sabit Hasnat Mahee
2. 1910085-MD. Azmal Bin Adil
3. 1910089-Imran Ahmed
4. 1910088-Nafis Nahian

Table of Contents

Abstract.....	1
Acknowledgements	1
Introduction	1
Methodology.....	2
Structure Design	2
Components Used	2
Mechanism.....	3
Software Programming.....	3
Results.....	3
Discussion	3

Abstract

As part of our academic curriculum, we undertook a project focused on the design and development of an electro-mechanical system. Our chosen project was a four-degrees-of-freedom robotic arm with a suction mechanism, designed to sort carrom pucks. The primary objective was to create a fully automated robotic system capable of sorting objects in any pattern based on pre-programmed instructions. The system incorporated various electronic components such as an Arduino UNO, motor drivers, stepper motor, servo motor, vacuum pump, and suction tip. We used Arduino IDE as the software platform for this project. This bot can be applied to tasks involving sorting or pattern formation.

Acknowledgements

We would like to express our sincere gratitude to everyone who contributed to the success of this project.

First and foremost, we are deeply grateful to our course teachers for their invaluable guidance, insightful suggestions, and continuous support throughout the development of this project. Their expertise and encouragement have been crucial in helping us navigate challenges and refine our work.

We would also like to extend our thanks to the Department of Mechanical Engineering at BUET for providing us with the resources and infrastructure necessary to complete this project. We appreciate the assistance from our faculty members, whose feedback helped us improve our understanding of key concepts.

Introduction

In today's rapidly evolving world of automation and robotics, electro-mechanical systems play a crucial role in various industries. Our project, undertaken as part of the junior year academic curriculum, focuses on the design and development of a four-degrees-of-freedom robotic arm equipped with a suction mechanism. This robotic system is designed to sort carrom pucks into various predefined patterns, offering a real-world application of sorting and pattern formation through automation.

The primary objective of this project is to create a fully automated robotic arm capable of performing sorting tasks autonomously. By utilizing advanced control mechanisms and pre-programmed instructions, the robotic arm will be able to precisely pick, place, and organize carrom pucks. This system integrates a variety of

electronic components, including an Arduino UNO as the microcontroller, motor drivers, stepper motors, servo motors, and a vacuum pump with a suction tip to effectively handle the objects.

The development of this project involves both hardware assembly and software programming, with the control logic being developed on the Arduino IDE platform. The versatile nature of the robotic arm allows it to be applied to a wide range of sorting and pattern-making tasks, beyond the sorting of carrom pucks. Applications in industrial automation, logistics, and warehouse management are just a few areas where such systems can improve efficiency and accuracy in organizing objects.

This project explores core concepts in robotics, automation, and control systems, aiming to demonstrate how these technologies can be used to solve practical problems in real-world scenarios.

Methodology

The project is based on multiple stage of software and hardware development.

Structure Design

The Cobot model is primarily designed on SolidWorks and then modified further as the project continues. It has two sections- 1) moving car base and 2) 4DOF arm. The arm sections are made of polymer using 3D printing of the model, and the car body is made from wood for light and rigid structure. It has 4 plastic wheels with rubber grip.

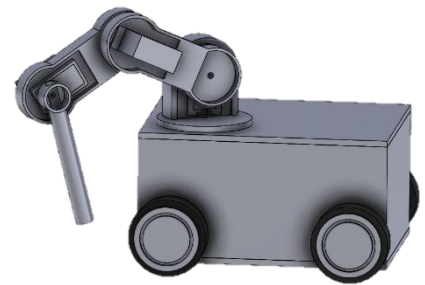


Figure: CAD model

Components Used

- Arduino Uno
- MG996R Servo Motor
- Nema-17 Stepper Motor
- 12V DC Vacuum Pump
- L298n Motor Driver
- DRV8825 Motor Driver
- 85mm Wheels
- Suction Cup

Mechanism

The arm sections of robot move using 4 servo motor which are controlled by preprogrammed Arduino Uno microcontroller. The arm set up allows us a 4 DOF (degree of freedom) movement. Two of the four wheels driven by Nema-17 Stepper motor controlled by DRV8825 motor driver and the other two wheels are idle. A 12V DC motor runs the vacuum system which is controlled by L298n Motor driver. Vulcanized rubber tip is used for durability.

Software Programming

All motor movement is initially programmed in Arduino IDE and loaded to the Arduino UNO attached to the bot. Total task is executed in a single run and so every step of the robot is preprogrammed. For every carrom puck, the position of 4 servo motor is unique.

Results

The robot runs accurately and places all the carrom pucks accordingly. The project is demonstrated to faculty members and other audience during a project exhibition organized by the Department of Mechanical Engineering at Bangladesh University of Engineering and Technology. To watch the demonstration video [Click Here](#).

A video tutorial of the suction mechanism used in the project is also made. To watch "How to make suction probe" [Click Here](#).

Discussion

Developing a robot for such precise a job from scratch was indeed a difficult task. The first challenge we faced was coordinating the servo motors, stepper motors, and the dc motor present in the vacuum pump. As the motors run at different power ratings and use different types of drivers, power leakage caused unwanted starting and stopping of the motors. Upon solving this vary problem we faced gear slippage in the servo motors which persisted till the end of the project. Due to this reason, picking and placing of pucks had to be calibrated frequently.

As this robot was employed to create a known pattern instructions regarding the exact locations of sorting the pucks were given directly. For further advancement machine learning can be introduced in this. As a result, the robot will be able to read any pattern it is shown and recreate that on its own.