

# CARROM PLAYING BOT

Team name:

Here for Beer!!!

Team Members:

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Project introduction:

This project aims at building a carrom playing bot which tracks the position of pockets and the coin and then decides the angle, position and speed of the striker and then makes the shot. (Considering standard carrom board of 29"X29")

Details:

## Module 1 : Newtonian mechanics and algorithm

1. To make an algorithm for the simple case of one striker and one piece which takes their positions as inputs and gives the optimum position of striker, speed and angle of shot using Newton's laws of motion for head on and oblique collision.
2. Initially we will divide the striking strip(length~44cm) in 22(can be changed) equidistant parts virtually, which will serve as allowed positions for striker placement.
3. After getting the coordinates of coin and holes, we will check if head on collision is possible
4. Else we will go for oblique collision with least collision parameter,(ref. D 1).
5. Once position of striker is determined, next we will determine the speed and angle(module 3) with which striker is to released

## Module 2: Data Acquisition

1. Capturing the image of the board using a camera placed centrally above the board.
2. Comparing it with the reference blank board image saved initially.

3. Determining the type and coordinates of the position of each piece using image processing using various filters based on frequency ,size and intensity.

### **Module 3: Data Processing**

1. To determine the angle and speed of the shot.
2. Microprocessor will find theoretical value of speed of striker by considering parameters like distance between coin and hole(l2),distance between striker and coin(l1), cut angle(phi).We get these from image processing.
3. Other parameters like coefficient of friction, coefficient of restitution, mass and radius of coin and striker will be determined experimentally and stored initially.
4. Now the quantised speed which is closest to the theoretical speed will be chosen.
5. Angle at which striker will be released can be determined just by image processing.

### **Module 4: Mechanical and Electrical components**

1. To build a mechanical arm to hit the striker from the desired location.
2. To build a spring or rubber mechanism which will impart the striker the desired momentum (which is given by the module 3).

Explanation -

- We are thinking of making arm which will slide on the edge of carrom horizontally. We will bring it to the desired position by horizontal movement on the slider. (see reference a)
- The angle of the shot decided by the programming will be achieved by using stepper motor. To hit the striker we will be using either a simple spring mechanism or rubber mechanism on the arm. (whichever is better.) (see reference b)
- We will place the striker back at original position of striking mechanism manually for the next move. We may think for further modifications later.

### **Plan of action:**

Week 1:

1. The basic algorithm is developed on paper. The problem is solved on paper.
2. Two team members start learning image processing(preferably on Open CV), while the other work on making the mechanical components.(The component which will move and hit the striker)

Week 2:

1. Controls and functions of raspberry pi will be learnt.
2. Electrical connections will be decided.
3. Work on Mechanical arrangement will be continued.

Week 3:

1. Basic code is developed and debugging starts.
2. All the mechanical components should be ready.
3. Integration of the modules starts.

Week 4:

1. Finish integrating the modules and testing starts.
2. If everything works as per expectation for one piece and time permits, we will modify the the algorithm for more pieces.

Week 5:

1. We will keep last week as buffer and do thorough testing and improvisation.

## Components:

1. Carrom Board and pieces.
2. Webcam.
3. Raspberry pi.
4. Linear actuator for striking mechanism.
5. Sliding mechanism for horizontal motion.
6. Stepper motor for rotation of actuator.

## Cost estimate:

- 1)Raspberry pi~3500Rs
- 2)Mechanical arrangement~1000-1500 Rs
- \*3)Webcam~500 Rs
- \*4)Carrom board~500-800 Rs
- 5)Stepper motor~600 Rs

Total:7500 Rs(accounting some other minor expenses)

## Things that will be learnt:

1. Image processing.
2. Implementation of a mechanical actuator and arm.
3. Integration of various components/modules.
4. Using a micro-controller.(probably Raspberry Pi and using open cv to code)
5. Making algorithms and developing complex codes.

## References:

- a. Striker hitting mechanism
  - 1.Using spring  
<https://www.youtube.com/watch?v=uHD-O9Fsa4Q&index=14&list=PL2r12rruQ-o-vWIF1wlnSrUHLilB0Cp2Q>
  2. using rubber band  
<https://www.youtube.com/watch?v=9vSnqgWyU1M>
- b. Horizontal Motion of track
  1. <https://www.youtube.com/watch?v=hGCxUjjvIBk>
  2. <https://www.youtube.com/watch?v=C15yPENQ074>
- c. Actual carrom playing robot  
<https://www.youtube.com/watch?v=jHkRSSSksBA&index=7&list=PL2r12rruQ-o-vWIF1wlnSrUHLilB0Cp2Q&spfreload=5>
- d. Reference images
  1. <http://images.tutorvista.com/content/work-energy-power/oblique-collision.jpg> (oblique collision)
  2. [http://aventuriersdujeu49.free.fr/fabrique\\_carrom\\_2/bv000010.jpg](http://aventuriersdujeu49.free.fr/fabrique_carrom_2/bv000010.jpg) (carrom dim.)