RoboCup world championsnhip 2021

Golden Brains Team

Golden Brains Team Description Paper (TDP)

RoboCup world championsnhip 2021

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Date:	2021 June 22

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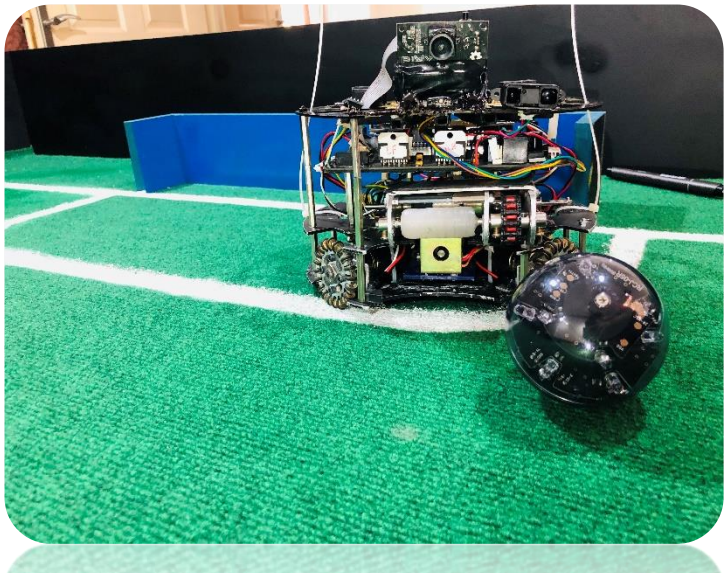
Golden Brains Team

1.Abstraction

This report tries to convey all the robot information + programs of this team to the reader.

In the structure of the main body of the robot, a combination of fiberglass and 3 mm aluminum has been used. Sharp (GP2Y0A21) is used to measure the distance to the wall, and Gyroscope (GY-25) is used for orientation on the field. Another challenge is to identify the gate and its empty points, for which we have used Pixy cmucam5. There are several options available for ball detection and we have chosen TSOP 1138. Arduino Due is responsible for processing the information and receives all the information and processes the output we want.

To keep the ball in front of the robot, we must use a dribbler and use a shooter (kick by solenoid) to throw the ball towards the goal.



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2.Introduction

Golden Brains Team has been created by junior robotic students of Technorobiran Robotic Institute, in May 2018. the members of this team were prepared to participate in the competition in 2018 after the necessary training, but due to the Corona pandemic, the first official competition of this team was held in 2021.We have participated in Internal competitions like Iran- Open AND junior cup. Our goal is to learn from experiences that we gain from participating in this competition.

3.Robot

3.1. Hardware:

3.1.1. Locomotion System

3.1.1.1. Body

These are not final information, especially regarding weight. Our attempt to reduce weight is continuing. We know lighter weight may result in a decrease in resistance of the robot against the opponent robot but it can increase velocity. The first chassis, where the motors are fixed and should bear the weight, is made of aluminum. Aluminum besides its light weight is a tight one. location of photocell-boards is embedded here. We implement our body designs using CNC.

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Dimensions	Width: 21.5 cm; Height 20cm
Max velocity	2 m/s
Ball coverage	18%

Table1: Major Physical Information

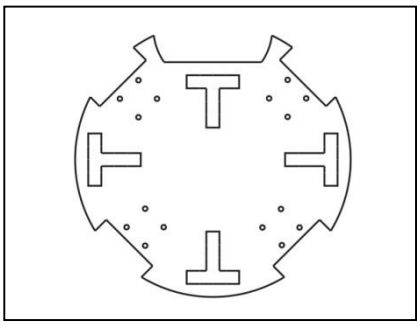


Image1: Schematic Model of the chassis (Designed by Corel Draw X9)

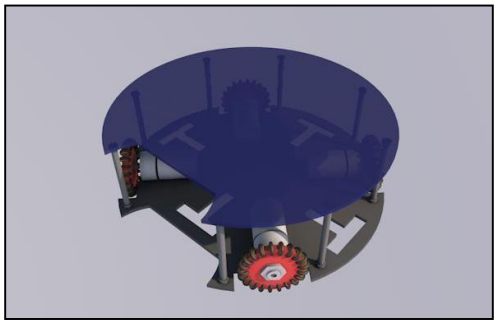


Image2: 3d Model of 1st and 2nd chassis (Designed by Cinema4D R16)

3.1.1.2. Motor & Wheels

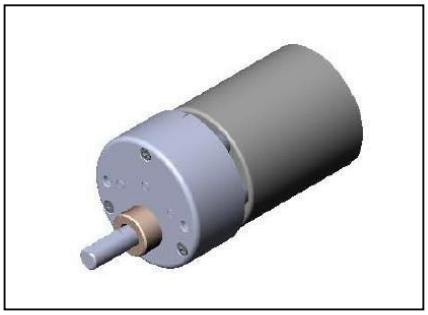


Image3: 3d Model of motor

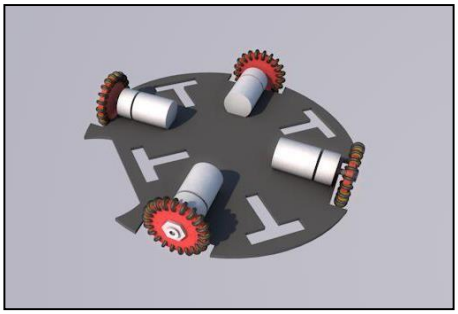
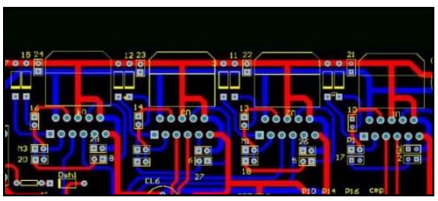


Image4: 3d Model of the motor set

3.1.1.3. Circuits

The maximum output voltage of Arduino Due is 5V. Therefore, the main reason why we need motor driver is to provide higher voltage to operate motors. The reason for choosing L6203 (Image5) as the motor driver is that it can bear voltage up to 48v and currency up to 5A.



3.1.2Goal Detection

We use “PIXY cmucam5” for detect color of the GOAL and positioning. This module has ARM-NXP microcontroller itself and we connect to it via SPI protocol. Position and dimensions of detected object is the output of this module. The dimensions of detected Goal color show the distance of the robot to the Goal. Output of this module can connect to microcontroller via different protocols like UART, Serial, SPI, I2C and etc.

The Image processor of this module gets 1280×800px live image from the camera and uses its inside processor (NXP LPC4330) to detect the defined objects. The input voltage should be 5~10V. More Voltage can make it Ruined. It also has 264Kb memories to save the details of defined objects and some other settings. [2]

Lenz type	Standard M12
Consumption rate	140 MAH
Output protocols	UART, Serial, SPI, I2C, …

Table4: CMUCAM5 Information

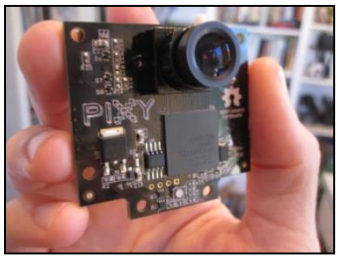


Image7: CMUCAM5 Module

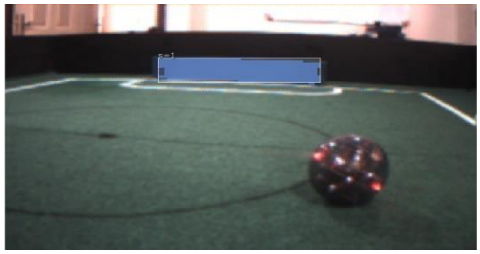


Image8: Detecting goal

In image processing with cmucam5, we After several tests, we realized that the best place to correctly detect the gates is to place the camera in front of the robot placed the camera at the front of the robot to detect goal.

3.1.3. Finding the ball

We used TSOP1138 sensors to detect the ball and receive infrared light sent from the racing ball (40 KHZ frequency we place them in the middle floor in a circular shape at an angle of 22.5 degrees the output of this sensor is analog voltage, therefore, should be connected to the microcontroller via the ADC to convert its analog voltage to digital Due to the limited ADC base in the Arduino Due, it is necessary to use a multiplexer IC.

3.1.4 Goal and Direction Detection

GY-25

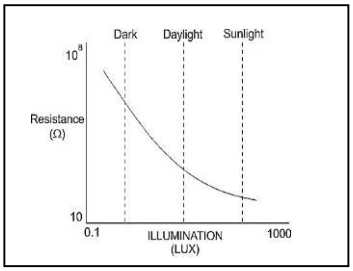
To navigate the robot, we use the GY-25, which is based on 6050 mpu. This gyroscope communicates with our processor through I2C and serial channels. The output numbers (yaw) of this module are from 0 to 180 and 0 to -180 by default.

3.1.5. Out Line Detection

LDR sensor

Photocell sensor (LDR) is used to distinguish the white line around the playground. It is indeed a dependent resistor that changes by the light that is reflected on it. There is an inverse relationship between light intensity and Resistance of this component (figure3). The resistance is decreased when light falls on it and that is increased in the dark. Therefore, it distinguishes the white color of the lines from green color of the background.

The robot's position, the robot's role and the position of the ball and also the current moving direction, make algorithms of this part complicated [3].



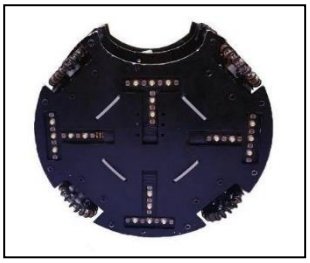
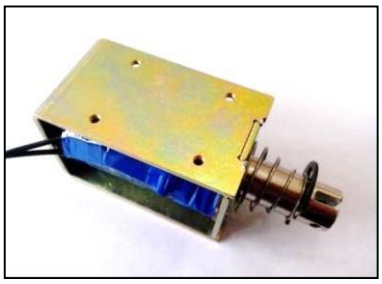
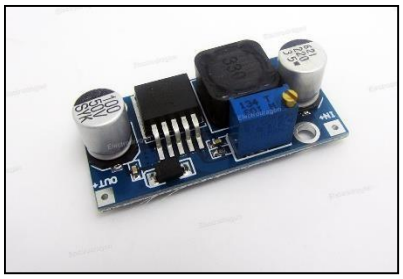


Figure3: Resistance vs. illumination of LDR **Image11:** A view of how boards are placed on a robot

3.1.6. kicking system

Having a kicking system will increase the rate of scores. Sometimes its interruptions or consumed energy raise the question whether it is the best option to use. This kicker system is a leverage one and its mechanical part contains a solenoid, a shaft and a spring (Image13). When the electrical energy reaches the coil of the solenoid, it creates a magnetic field around it that pulls in the shaft. Xl6009 DC adjustable power supply (Image14) is used to provide the solenoid required voltage.





3.1.7Spin Back

To keep the ball in control for longer and reducing the chance of losing the ball, we designed a spin back (Dribbler) system (Image17). Mechanism of the spin-back system can be designed in different ways. The most common and simple one is which uses a bar in front of the robot as a roller that prevents the ball from going out of the crater (Image18).

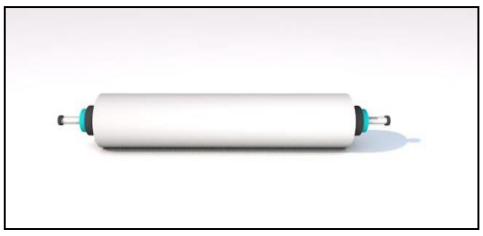


Image17: 3d Model of a Spin back

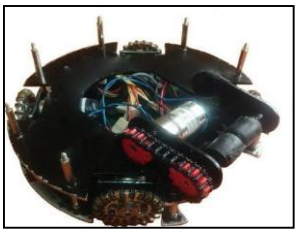


Image18: Spin back testing model

3.2. Software:

The software is based on our robot processor (Arduino due) which we use Arduino IDE for programming to Arduino. Various algorithms have been used to program the robot, such as detecting out, attacking the opponent's goal, the goalkeeper, and these algorithms have been written using the data that the components give us.

3.3. Result:

In general, one of the important points for us is the stability of the robot, and we have tried to observe this important point. The trend of the competition rules in the past years has been such that we do not use CMP 03 because this part is sensitive to robot noise. We have done a lot of research for alternative parts, which resulted in two parts, GY-25 and MPU 6050. Our choice was GY-25 because 6050 MPU creates problems for the robot in certain situations.

4.Future Works

Golden Brains team members decide to use new components and processors in the future. Sharps are currently used on the robot, but Sharps have a limit that we will have to change in the future. The VL53L0X laser module overcomes all these limitations and has a good viewing distance. In Big Field, where the distance between the walls is very large, this module can meet our needs. Team members are looking for a new programming challenge so that in the not-too-distant future the team will compete with a processor other than the Arduino and AVR. The time limit does not allow us to test and use these modules, but we tried our best to use the best possible in these competitions.

5.Refrences

1.https://www.dropbox.com/sh/u95djny96cncwik/AACAA9yqjCpW6-l9I9fUYLB5a?dl=0

2.https://www.dropbox.com/sh/sddf695v3imf80a/AACsKjVd-IzWx0pURkEZ3Dd0a?dl=0