Barelang63 Mechanical and Electrical Description 2023

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Abstract. To participate in RoboCup Medium Size League(MSL) 2023, Barelang63 builds a new generation of robots MSL robots. Our mechanical system is described in this paper regarding the electrical system, mechanical systems, and structures used in robots. The system and structure range from kicker mechanism, dribbling mechanism, and vision system.

1. Mechanical Structure

We developed the latest robot design shown in Fig. 1. We made a layered frame design for the layout of the ball handle system in the first layer and the electrical system in the second layer. The size of the robot is 48 x 47 x 75 cm with a weight of about 35 kg. for our robot frame made of stronger aluminum sheets.

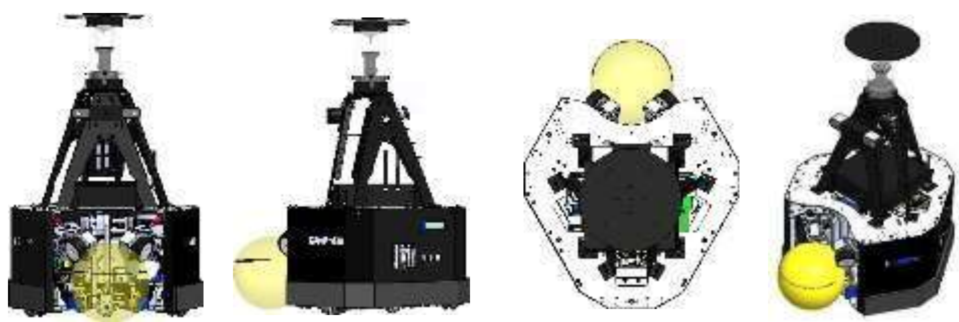

Fig. 1. Barelang63 Striker Robot

We developed the latest goalkeeper design as shown in Fig. 2. We made a layered design where the first layer contains the driving motors, dribble system, and kicker system. The second layer contains the electrical system. The weight of the robot is around 35kg. For robots, we build with raw materials and ISO standards.

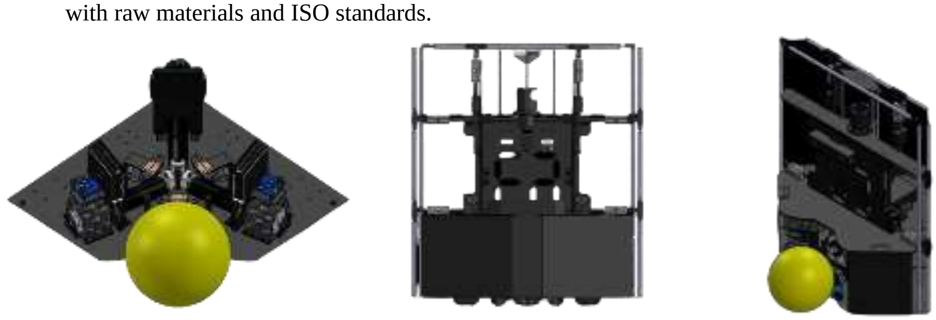

Fig. 2. Barelang63 Goalkeeper Robot

1.1 Frame

In our omnidirectional wheeled robot, we use the omnidirectional wheel, with three-layer omnidirectional wheels can be seen in Fig 3. The whole body of the robot is made of a sandwich structure aluminum sheet and uses an aluminum round bar with a thickness of 12.7mm so it can withstand pressure and can make the robot stronger.

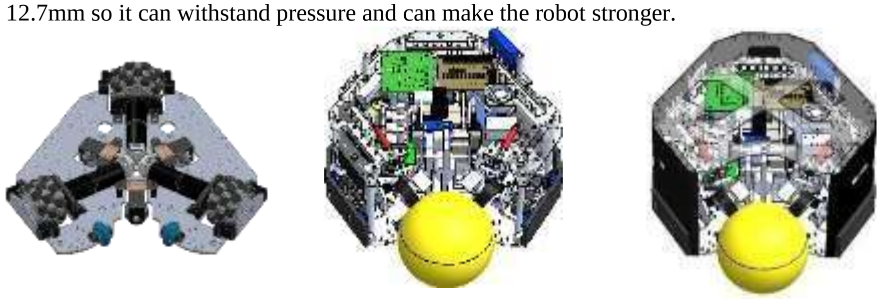

Fig. 3. Sandwich Structure

1.2 Ball Handler

- Kicker Mechanism

The Barelang63 robot uses a solenoid plunger mechanism for the kick system dan for the robot keeper only uses a lob shot to throw the ball as far as possible. The plunger material we use is iron and aluminum to give a strong structure and we added some useful bearings for the smooth return of the plunger the kick mechanism design is shown in Fig. 4

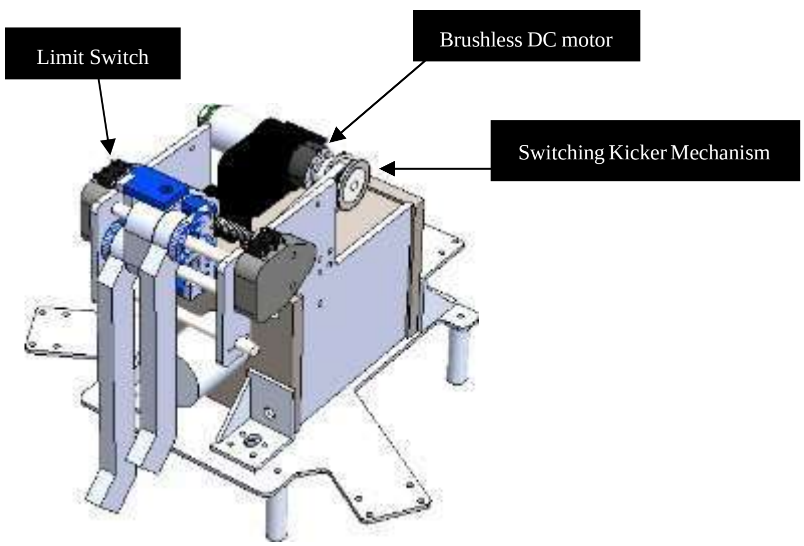

Fig. 4. Kicker Mechanism

- Dribble Mechanism

In the dribble system, we use a PG28 DC motor shown in Fig. 5. The main material used for this dribbler system is aluminum which gives it a strong structure. We have also adjusted the dribble angle so that it is relatively facing the front of the robot to allow the dribble to rotate around the front area of the robot.

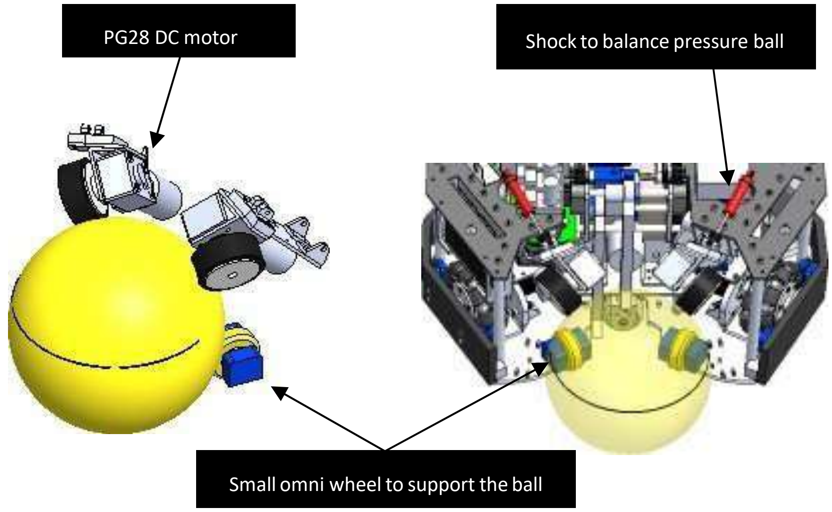

Fig. 5. Dribble Mechanism

1.3 Vision System

In the vision system, we have made a design using an aluminum structure as camera support, for the camera protector we use an acrylic tube to protect the camera and mirror from ball kicks. In the previous design, we used stainless steel as a camera protector, and it created a blind spot on the vision system that could interfere with the previous vision structure we used aluminum hollow which is very thin and not very sturdy to be used for the vision system structure, for the vision system structure design, shown in Fig. 6.

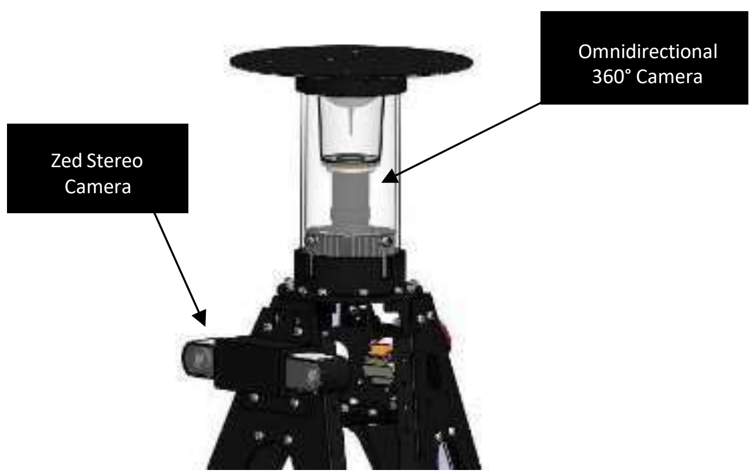

Fig. 6. Vision System Structure

2. Electrical

This year our robot changed from a mechanical as well to an electrical aspect. Especially in the electrical system, last year our robot used an inverter (DC to AC) to activate the PC by changing the input from a 24VDC battery to a voltage of 220 VAC, then the inverter was replaced with a buck converter (DC to DC) changing the input from a 24VDC battery to 19.5 VDC according to the input for the PC / laptop used in the robot as shown in Fig.1 below. In addition, in this paper, we also explain the electrical system on the Arduino Mega2560 and STM32F407 Discovery, as well as the electrical system on the Barelang63 robot kicker. this robot uses 3 lipo batteries, namely 2 uses 6-cell lipo batteries (24 VDC) which are for supply to PC/laptop, Maxon Motor as well as PG28 DC motor. One uses a 3-cell lipo battery (12 VDC) which is for the kicker system in our robot.

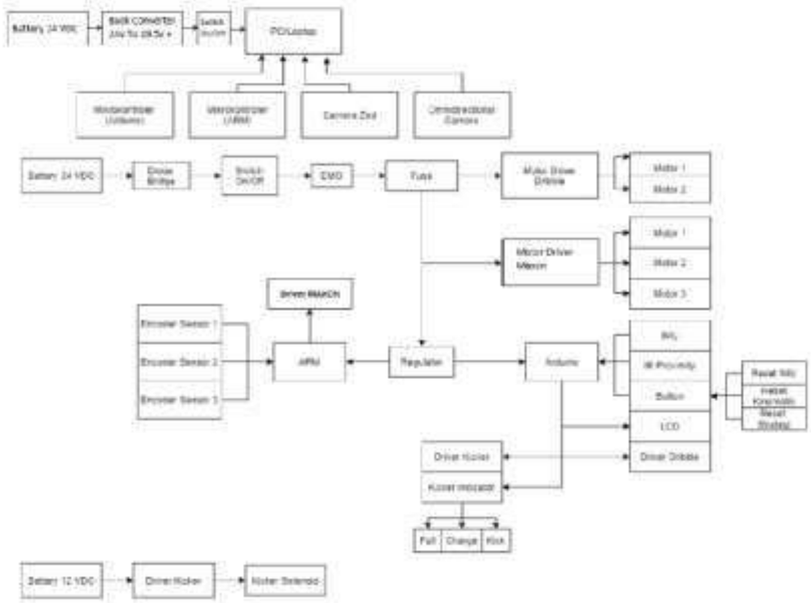

Fig. 7. Hardware Diagram

1.1 Electrical Structure

For the electrical system used in the Barelang63 robot, we use two 6 Cell Lippo batteries. to be able to activate the PC, the 24vdc battery needs to be converted using a buck converter so that the output from the buck converter can be seen, therefore a watt meter is used, after that setting the buck converter to 19.5 volts according to the needs of the PC. The electrical system is divided into three main parts, namely actuators, sensors, and controllers, the actuators used in the robot are 3 maxon brushed DC motors for robotic propulsion, two PG28 DC motors for dribbling control, and one PG28 DC motor for the lever system. The sensor used is a proximity infrared sensor which functions to detect the ball there is also an IMU GY 25 sensor where this sensor is used to determine the angle of the robot from 0 - 360 degrees, and there is also an autonics encoder sensor 1024 - PPR which functions to get the position of the coordinates robot.

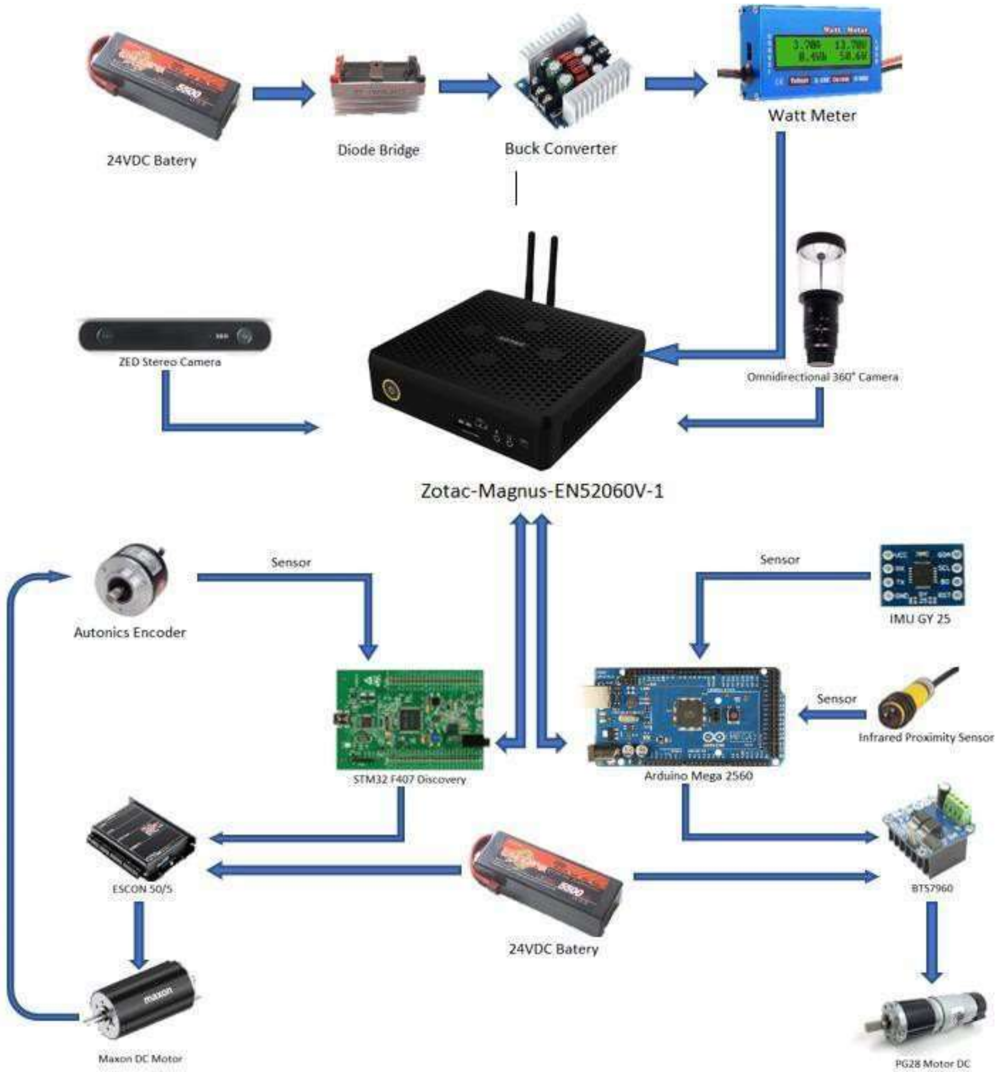

Fig. 8. System electrical structure

1.2 System Kicking

To be able to kick like a human, our robot uses a solenoid mechanism, namely by applying a high voltage to the solenoid so that it can produce a large magnetic field. To produce this high voltage, it can be seen in Fig. 9 below which to control a strong system, the slow kick on our robot is to use an Arduino Mega 2560, on this micro, it is also used to adjust the BTS7960 driver, where this driver is to activate the ZVS BOOSTER (step-up) from 12vdc to 450vdc, after the ZVS BOOSTER is active it will go to the next stage, namely to IGBT after the ZVS BOOSTER was active, the resulting voltage will be stored in the capacitor, if the capacitor is fully charged it is ready to be used to be able to use the voltage stored in the capacitor In this case, we use the IGBT as a high- voltage electronic switch where the voltage will be used in the solenoid to generate an electromagnetic field so that the robot can kick.

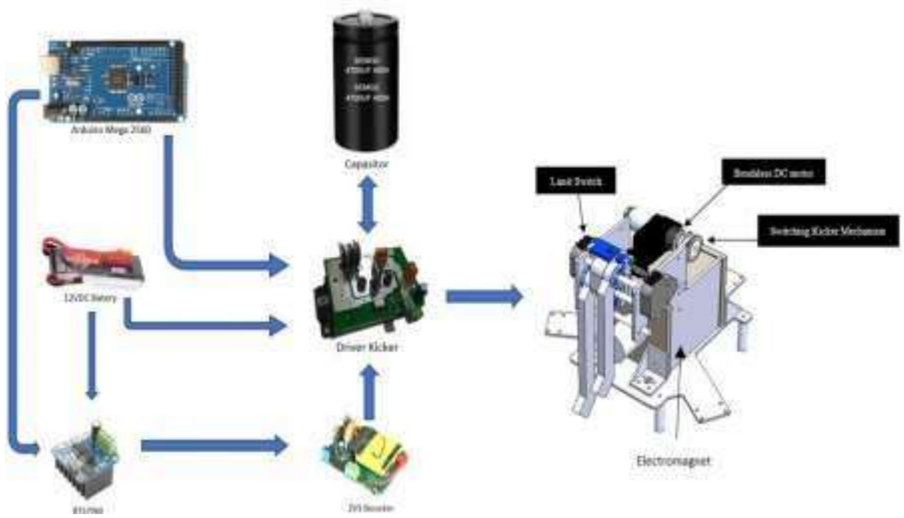

Fig. 9. System kicker structure