Mechanical and Electrical Description with Software Architecture

1 Mechanical Structure

We developed a new generation of robot platform. As the upgrade of the last generation with 3 Omni wheels, this new generation can be more quickly move and more stable. We designed the external frame of robot can be adapt to the competition impact with size 45 cm x 45 cm x 80cm and weight around 25 kg.

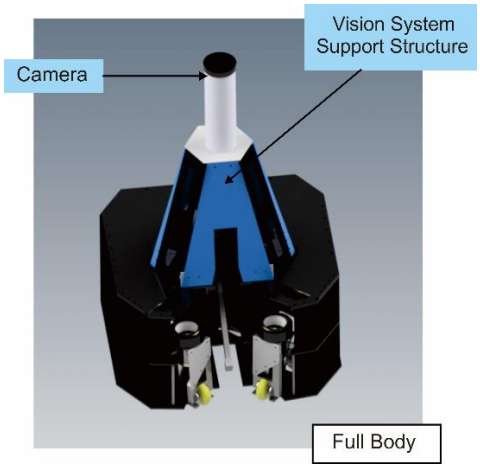

Fig.1. IRIS Robot

1.1 The Shooting System

The shooting system in this robot used brushless dc motor attached to gearbox to generate higher impulsive power. Then the power transmitted to shooting rod and the momentum generated by rotational force of the rod will strike the ball. After the shooting is finished, the proximity sensor will detect the rod and make it stay in certain position.

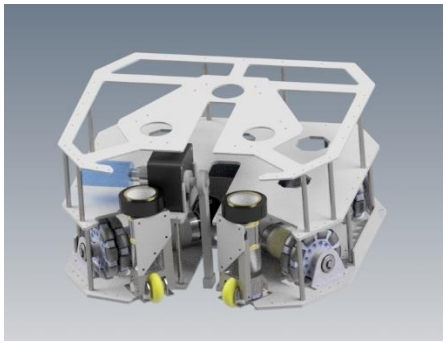

Fig. 2. The Ball Shooting System

1.2 Frame

In our omnidirectional wheeled robot, we use custom-designed omnidirectional wheel, with the four omnidirectional wheels are arranged like **Fig. 3.** on the base frame.

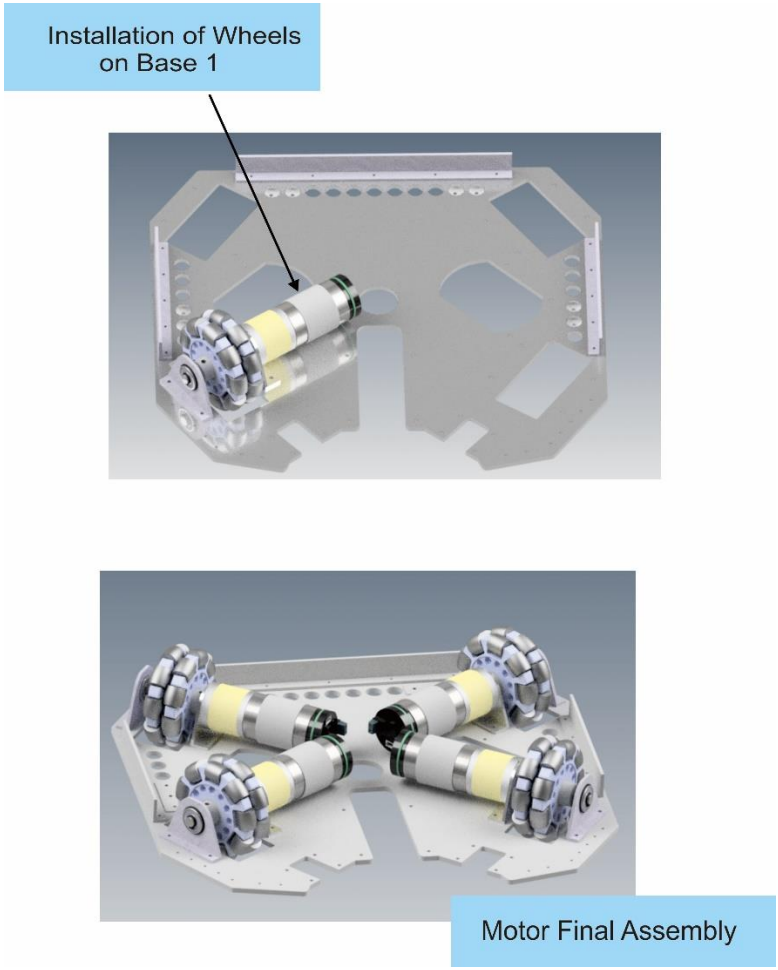

Fig. 3. The Omnidirectional wheel and frame

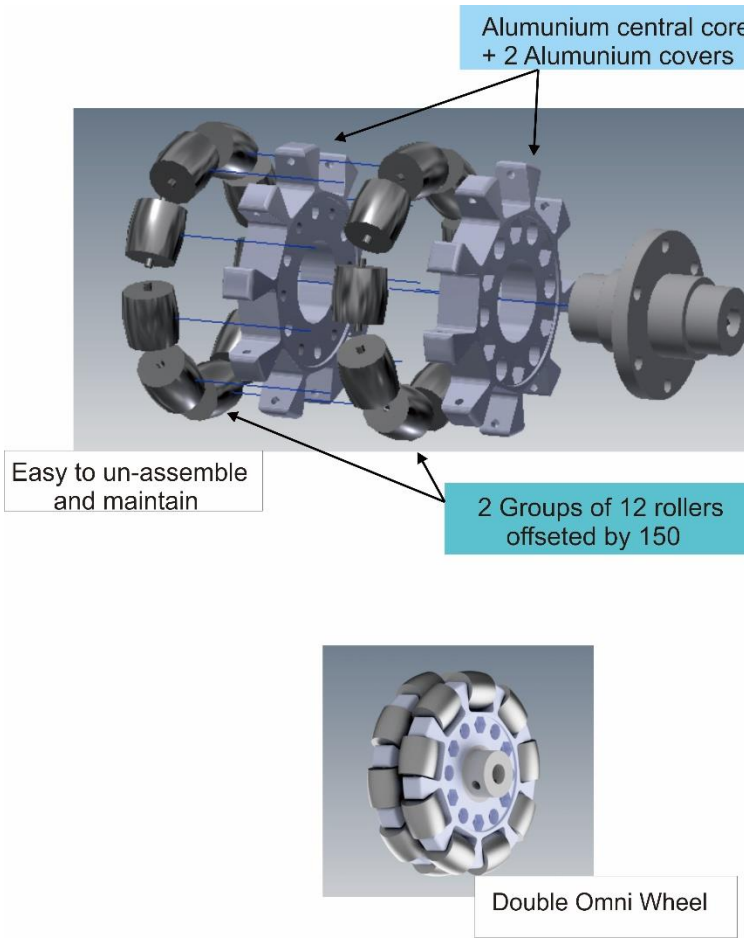

Fig. 4. Double Omni Wheel

1.3 The Shooting System

The shooting system in this robot used brushless dc motor attached to gearbox to generate higher impulsive power. Then the power transmitted to shooting rod and the momentum generated by rotational force of the rod will strike the ball. After the shooting is finished, the proximity sensor will detect the rod and make it stay in certain position.

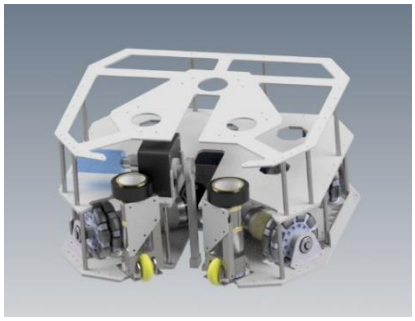

Fig. 5. The Ball Shooting System

1.4 The Ball Handling System

The ball handling system, which is designed for dribbling the ball. We use highly – torque DC motor for dribbling. There are two symmetrical assemblies and DC motor with a specific angle. The wheels are driven by the DC motor in desired direction. This mechanism used closed-loop control system with the ball distance as the feedback signal, which is measured by proximity sensor in the dribbling mechanism. When the ball approach the robot, the motor will rotate in higher speed than when it in standby condition. With this simple system it works well.

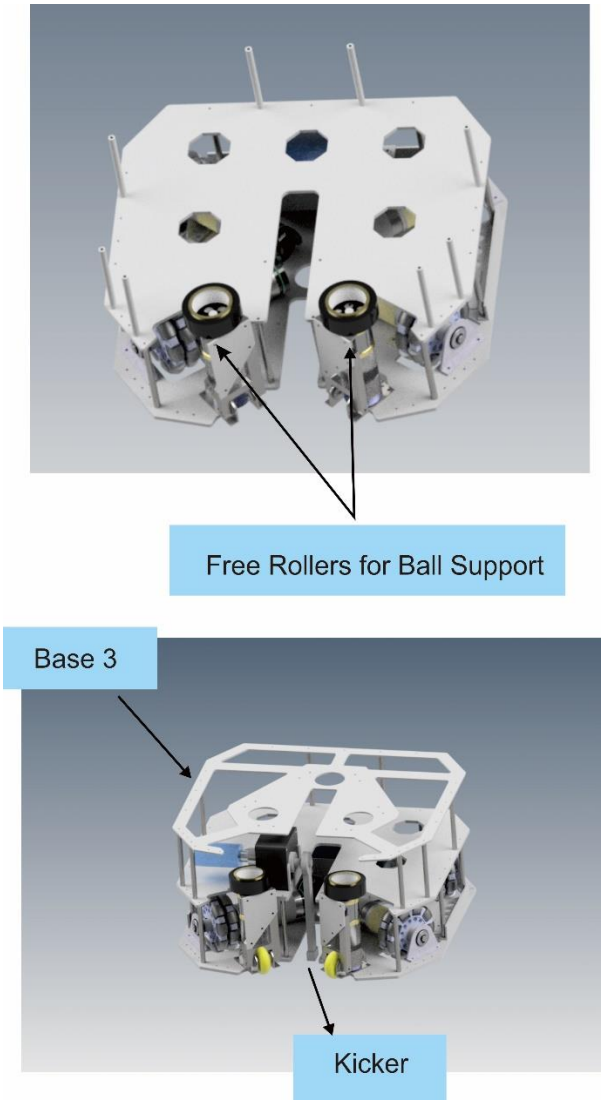

Fig. 6. The Ball Handling System

2 Electrical Structure

One of the most important parts of the robot is the sensor and the electronic circuit. There is low-level sensors system that is used such as the motor velocity sensor, Inertial measurement, Odometry sensor. There are also some other sensors that indicate the distance and line of objects around the robot. The concept of the motor velocity sensor is a simple PWM that uses the PID method to determine the ideal speed of the rotor spin, depending the robot is on a high-speed manoeuvre or in a goal-sighting situation that needs stability. IMU that stands for Inertial Measurement Unit is used to determine the robot angle based on the field with a triple-axis gyroscope and triple-axis accelerometer. To determine it's the position, the robot uses the electro-mechanical encoder to get the coordinates in the field. Other electronics components such as Electronics Speed Control is used in the kicking mechanism and a proximity sensor to determine an object around the robot. All sensors are connected to the microcontroller and have a serial connection with the main processor.

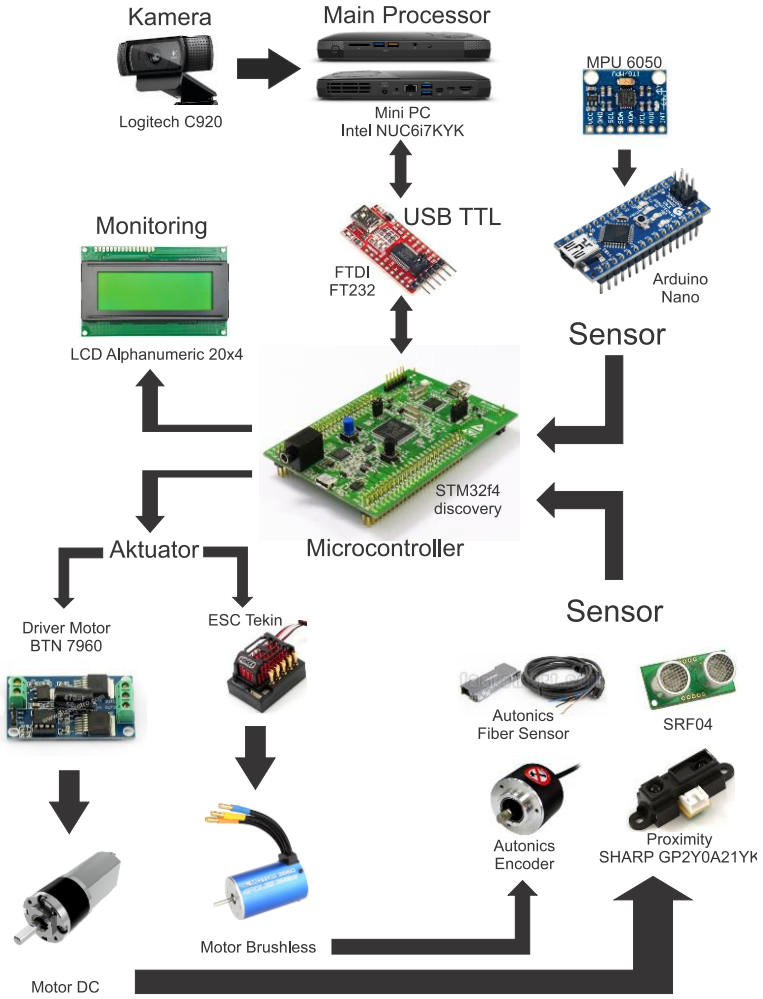

Fig. 7. Sensing-Actuating System

3 Software Structure

As the name suggests, the main system is handling all the important control in the robot. All robot has their own main system on them. IRIS use Intel NUC mini PC for the main system. The strategy and decision making are all handled by this part. The main system decides the strategy based on the information given by the omnidirectional camera, and the sensor data that was sent by the controller as well as the role of the robot. The wireless communication is used to communicate with the base station. The base station gives the information about command from the referee box, and the position of all the ally robot. Thus, will ensure the robot to act with coordination in mind.

Our main strategy consists of 3 algorithms, positioning, ball chasing, and scoring. The positioning algorithm only used in the first part of every game. This algorithm used to position the robot based on the game that it played (kickoff position, free kick position, etc). The ball chasing algorithm uses to instruct the robot to grab the ball. The way the robot chase the ball will change based on the obstacle between the robot and the ball. The robot will use obstacle avoidance function to pass through it. The scoring algorithm is called when the robot grabs the ball. This will calculate the best position to shoot to the goal.