IRIS TEAM

Mechanical and Electrical Description with Software Architecture

1 Mechanical Structure

The wheeled based soccer robot in our team are based on the four omni-directional wheels as this is an upgrade on our previous 3 omni-directional wheels based robot. The 4 wheeled robot upgrade can have better acceleration on straight line on the field and also can carry more payload including the new stainless steel cover of the robot. The new 4 wheeled robot has the size of 45 cm x 45 cm x 80cm dimensions and has the weight of 23.20 kg.

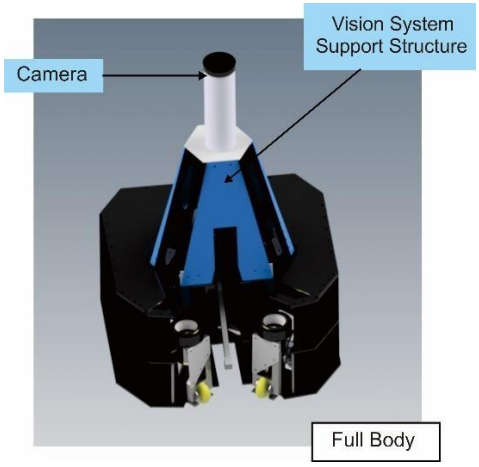

Fig.1. IRIS Robot

1.1 The Shooting System

The ball shooting mechanism uses the 2000KV brushless DC motor which then attached to planetary gearbox 19.5K to generate higher impulsive of power. The rotating 14.5 cm shooting rod will hit the ball as the gearbox rotate. After the shooting sequence is complete, the shooting rod will rotate back into upper position so that the shooting mechanism will be ready for the next kicing sequence.

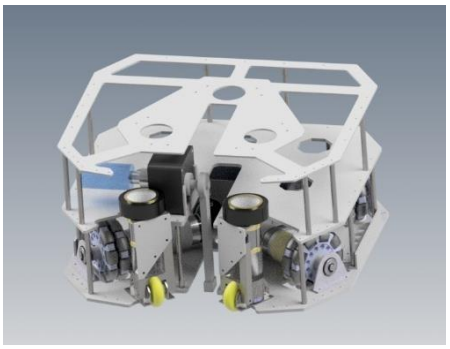

Fig.2. Ball shooting system

1.2 Main Frame

The four omnidirectional wheeled robot uses the 5mm alumunium base consisting of multiple layers. The first layer will be the housing of the DC brushed motor as shown in the **Fig. 3** below :

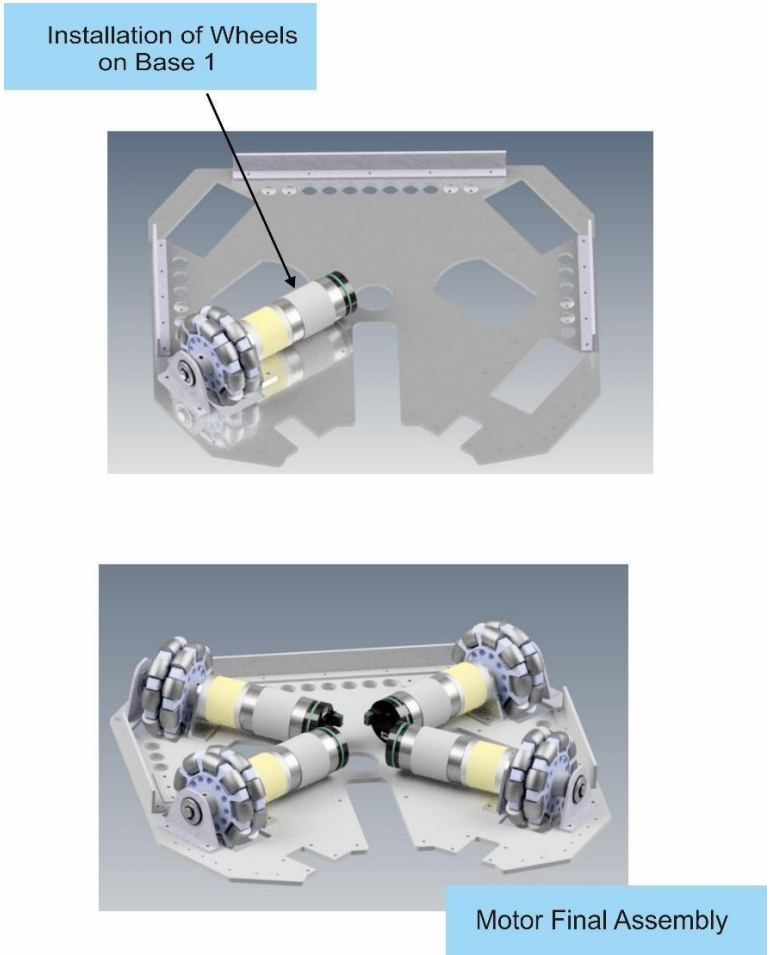

Fig. 3. The Omnidirectional wheel and frame

The omniwheels consist of multiple layer of alumunium cover and also rubber wheel. The two alumunium then connected with the rubber wheel via an alumunium connecting rod as shown in the **Fig. 4** below :

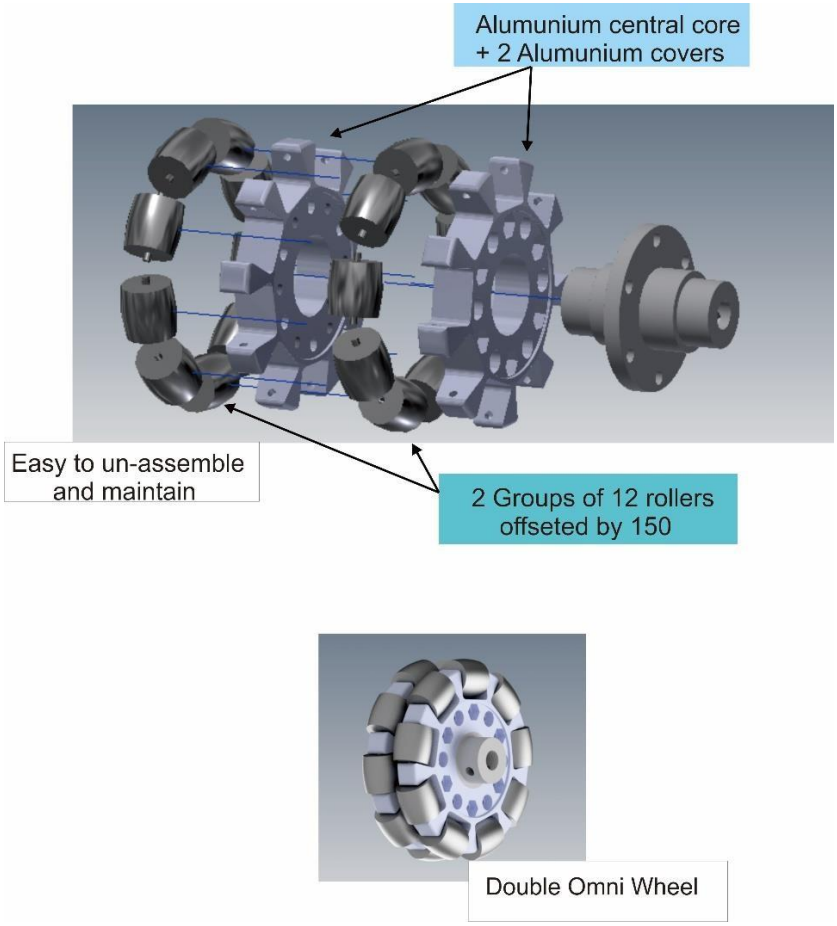

Fig. 4. Double Omni Wheel

1.3 The Ball Handling System

Two high torque Brushed DC motors are used in the ball handling system which is designed for dribbling the ball in multiple direction. With the specific angle of the two motors, the distance sensor is used as the feedback signal in this closed-loop control system. In order to complete the control system, the two brushed DC motors use an 7 PPR hall-efect sensor as an velocity control feedback of the dribbling mechanism, hence the dribbling mechanism will have more power to handle the ball.

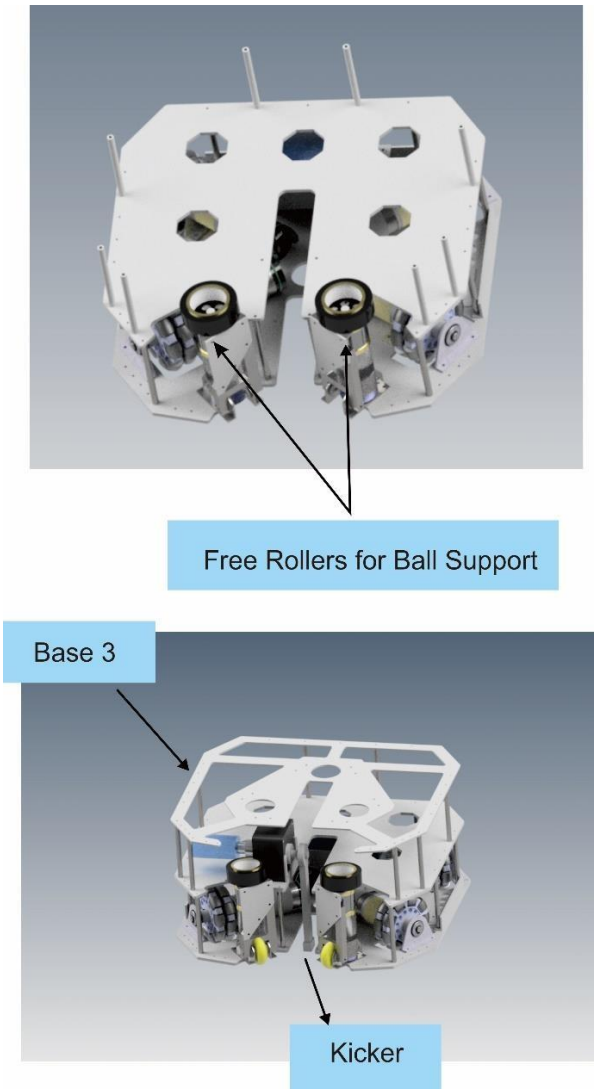

Fig. 6. The Ball Handling System

2 Electrical Structure

The electrical systems of the 4 wheeled robot are powered by 6 cell of Lithium-ion Battery that has the power of 5000mAh. There are two level of electrical system as the first level is the sensors. The sensors also divided into two section of low-level sensors system such as 6Axis-IMU, Proximity sensor, and also 200PPR-Odometry sensor, Fiber Optic sensor, and also the Camera as an High-level sensor. Controller is the next level of the electrical system which is devided into two main parts, the microcontroller as the low-level controller which control low-level sensors and to send the command sequence into the actuator of the entire robot system. There are 3 microcontroller boards used in the robot, and one of the controller acting as the master which control the main low-level sensors, while the last two controllers acting as the slave controller. Each master-slave controller use the serial-TTL communication protocol in order to communicate with each other. The high level controller is the Mini PC which act as the main processor which control the camera and the robot movement algorithm. Another important controller is the Electronic Speed Controller (ESC) who act as the controller of the kicking system. The electrical system schematic is shown in the **Fig. 7** below.

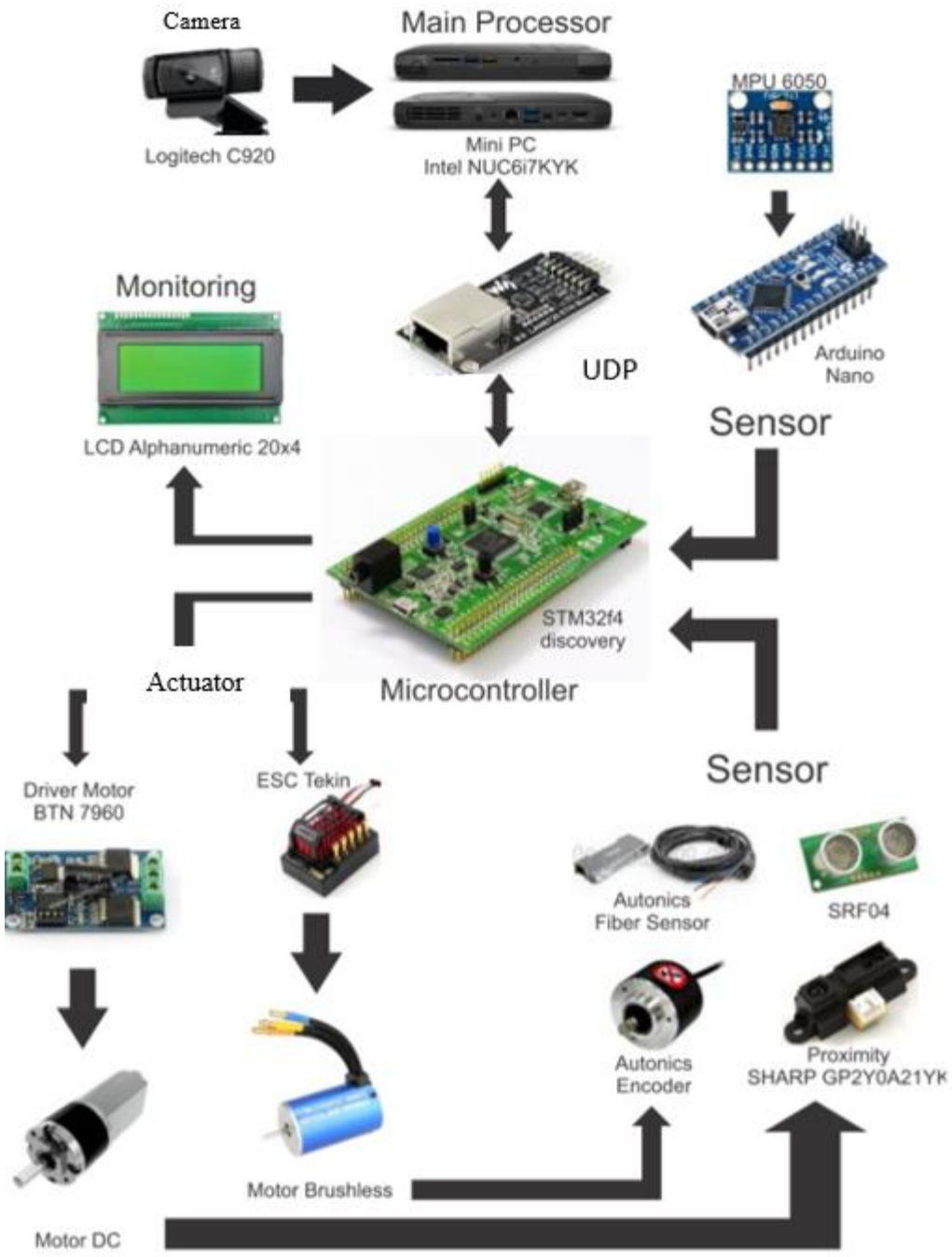

Fig. 7. Electrical System Diagram

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. Below is the flowchart of the software structure

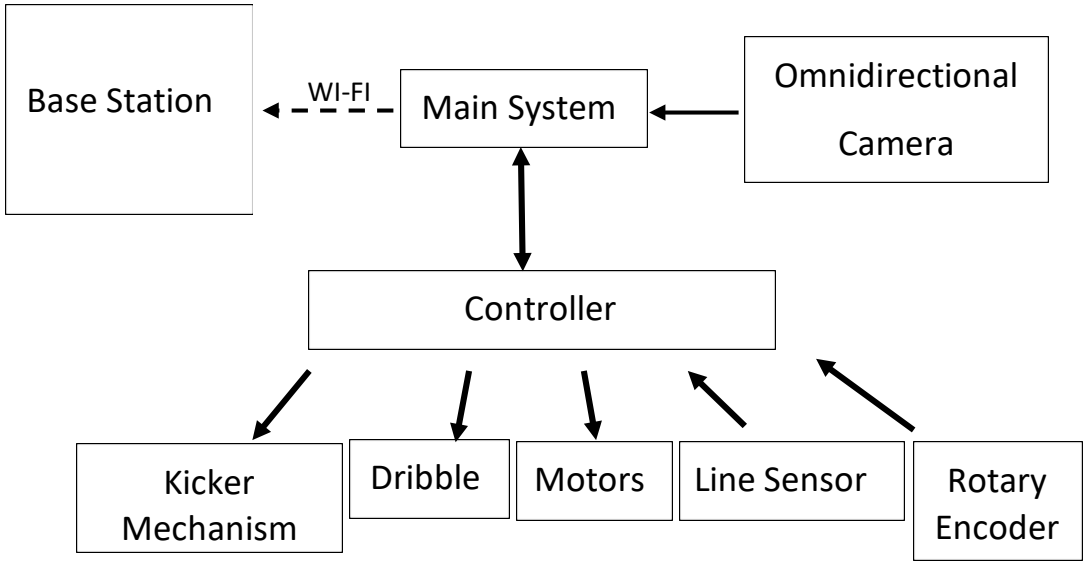

Fig. 8 Software Structure