Walking

Designing a suitable walking algorithm is still a challenge for us. Reflecting on previous competition experience at the RoboCup 2019, Sydney, our robot has a lack of stability when walking. In a match, physical contact with the opposing robot or with teammate robots is unavoidable and even often happens. The stability of the robot in maintaining its position when walking is one of the keys to win the game. We use an open-loop system where the actuator will actuate the leg of the robot based on the specified trajectory. With this method, our robots are easily disturbed due to the disturbance and an altered environment. Although we use gyroscope and accelerometer sensors as optimization, this method does not help much in stabilizing the robot when walking. Therefore we developed a load cell sensor that is placed on each robot foot cleat. This load cell sensor serves as feedback to maintain the stability of the robot when walking or kicking the ball. Our robot uses a 40kg load cell sensor that is processed by the stm32f103c8t6 microcontroller via the hx711 module as a converter of resistance quantities into voltage quantities. Then the data is sent to CM740 via each servo using TTL serial communication.

In controlling the robot walking, we also need to adjust some parameters in our walking algorithm. To get the value of this parameter we use trial and error methods. This method requires accuracy in the knowledge of the parameters in the robot algorithm and also only applies to limited environments. This is also a problem we faced in the past competition. This method consumes a lot of time and requires a lot of experiments that cause hardware damage. Therefore, we are currently developing robot simulations. We use the webots simulator. This simulation aims to reduce to simplify the tuning process and also to minimize hardware damage to the robot. This simulation also can be used to test teamplay algorithms and robot behavior. Further explanation about our simulation can be found in the software description.

We also implemented forward kinematics in our walking algorithms. This method has an important role in distance calculation. Another problem that we faced in the previous competition is the ability to approach the ball as fast as possible. In the last competition, we used the pan and tilt angle values of the robot's head, compile the robot's pan and tilt values according to the conditions we have specified to approach and kick the ball. However, this method has the disadvantage that it takes too much time, and often the robot makes repetitive movements that cause a longer time to go to the next step. To solve this problem, now we use the forward kinematics method to determine the position relative to the camera and then the robot can determine the relative position of the ball to the foot to help the robot for making a fast decision.

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