

Localization

Our robot does localization by estimate change in position over time. But to do that, first, we need to set the initial position of the robot. To determine the initial position of the robot, we create a set of the possible position that has been defined previously as described in [1]. But according to the proposed rules for Robocup 2020, there will be no positioning for either striker or goalkeeper, thus we need to modify the method to determine the initial position of the robot. as shown in figure 1, we have 4 possible positions for the robot's initial position instead of 6 possible positions as stated in [1].

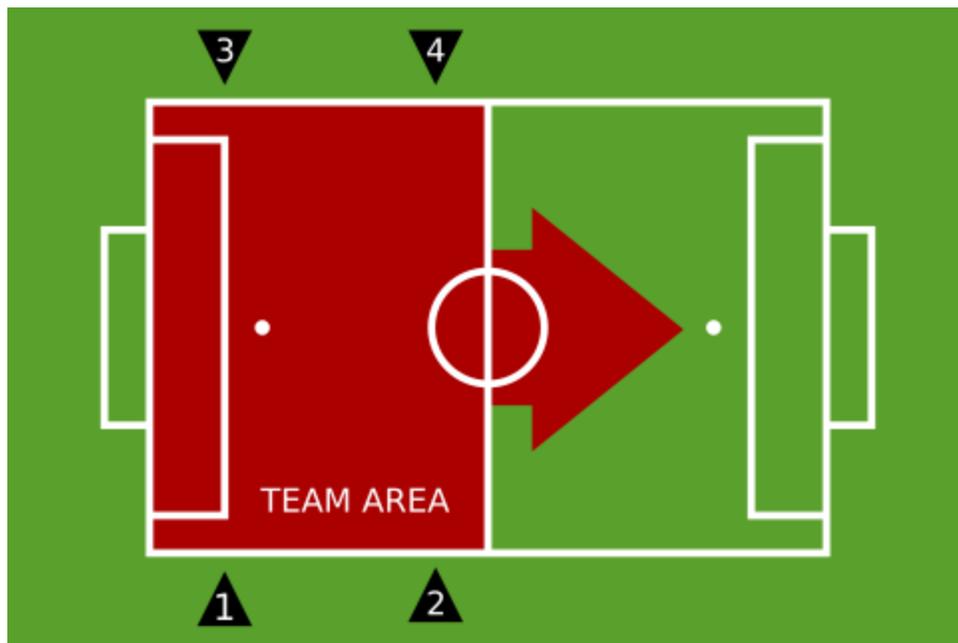


Figure 1. Predefined initial positions of the robot.

After the robot knows its initial position in the field, then the robot estimates its position based on the estimation of its step as stated in [1]. But using this method has a weakness because a small error in estimation could lead to a larger error. To solve that problem, we proposed two approaches to get a better estimation of the robot position. The first approach involves a forward kinematic calculation of the robot's foot end position to gain a more accurate position of the robot step. The forward kinematic itself will be calculated from the servo read position instead of the target position that has been processed in the program.

The second approach involves the usage of particle filters using features of the field such as the junction of field lines and the goal post. Different from the previous localization method, this method uses the perception of the robot instead of the kinematic calculation to determine the position of the robot. As described in the vision section, this year we will implement the usage of Convolution Neural Network (CNN) and Mobilenet V1 architecture to detect features of the field such as line junctions and goalposts. Using particle filters method and the robot possible

positions relative to those features, we could obtain the most possible position of the robot in the field. But this method has a weakness that requires a heavy computational power and could not be done in real-time. That is why we need to do fusion between the first method that could be done in real-time and the second method that has a more accurate result. Our solution to do that implement a closed-loop system for the kinematic method with the perception method as the feedback to minimize the errors of the robot position.

1. Muhtadin , Muhammad Reza Arrazi , Sulaiman Ali , Tommy Pratama , Dhany Satrio Wicaksono , Ahmad Hernando Pradanatta Putra , I Made Pande Ari , Alfi Maulana , Oktaviansyah Purwo Bramastyo , Syifaul Qolby Asshakina , Muhammad Attamimi , Muhammad Arifin , Mauridhi Hery Purnomo , Djoko Purwanto, “Ichiro Robots Winning RoboCup 2018 Humanoid TeenSize Soccer Competitions”. (2018).