

# Global System Description

This year, our team uses Webots [1] to simulate a soccer match using multiple robot instance. Our reason to do this because developing robot behavior and team play would be hard to be done when using a real robot as we need to tune all the robot walking and vision systems to match the current field of the match. To do that, we proposed a new software system based on the ROS node as shown in figure 1.

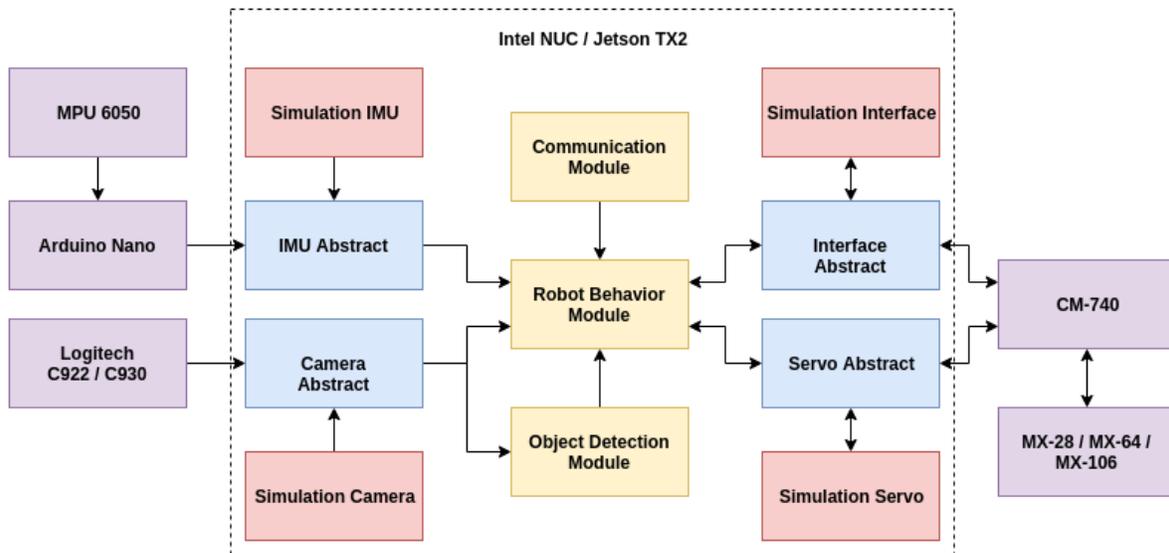


Figure 1. Diagram of the robot system

In this system, all the processes could be rooted back to the robot behavior module where all the decisions of the robot will be processed there. The four abstract modules, IMU, camera, interface, and servo, are used as an abstraction module to connect the robot behavior with simulation or the real robot hardware.

The communication module is used to communicate with other robots using the UDP network as described in the behavior section and our 2019 winning paper [2]. The communication module is not created as an abstraction module because the communication hardware (UDP communication) is in the main controller hardware and we use the same implementation for team communication in both simulation and real robot.

As described in the vision section, this year we implement a DNN object detection to detect the ball and field features. Because the object detection process requires a heavy computational power, we separate that process as a different module to prevent it from slowing down the main behavior module. Also with treating object detection as a separate module, it would be easy to change a different implementation of object detection like from DNN to LBP or vice versa.

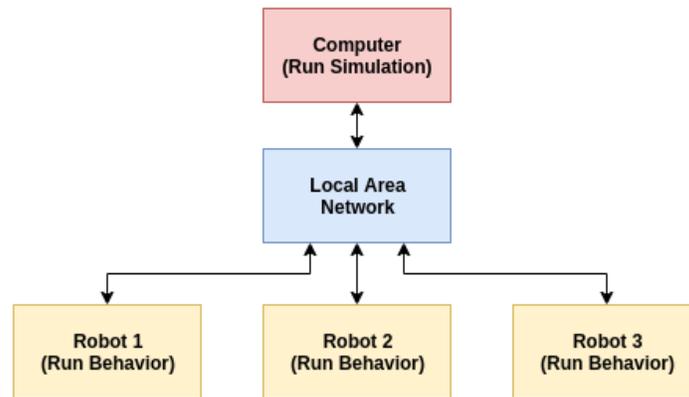


figure 2. Diagram of the multi-robot system

With the robot system as described previously, we could implement a multi-robot system that enables multiple robot behaviors to be run without using the real robot hardware as shown in figure 2. In this system, a high-speed computer will be used to run a robot simulation that includes IMU, camera, interface, and servo simulation modules while the other computers are the robot's main controllers that only run robot behavior module. The computer and all the robot's main controllers are connected using ROS communication via a local area network. With this system, the robot behavior process would be working as closely as to how it would be working when using real robot hardware. Also, with this system, the robot teamplay behavior could be developed without the need to prepare the hardware of all the robots.

1. Michel, O. Webots: Professional Mobile Robot Simulation, International Journal of Advanced Robotic Systems, Vol. 1, Num. 1, pages 39-42, (2004).
2. 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).