ROS based Autonomous control of a Humanoid Robot

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Abstract. This paper demonstrates how to control a Bioloid humanoid robot using a BeagleBone Black (BBB) and Robot Operating System (ROS). ROS works as a development framework in synchrony with the BBB and integrates the robotic functions as a whole. Individual AX-12A Dynamixel servo motors and sensors are used to control the robot movement, so that it walks with reasonable balance and gait (cf. Figure 1 and a demonstration video in [1]).

The two-legged robot is constructed using 12 servos, resulting in 12 degree of freedom (DOF). USB2Dynamixel connector is used to operate the Dynamixel actuators through the Wi-Fi interface of the BBB [2]. Position of the Dynamixel AX-12A servos is obtained using inbuilt encoders. A Gyro sensor is mounted around the centre of the robot, which supports in balancing the robot. One infrared (IR) sensor mounted on the robot's chest is used to detect obstacles. Additional libraries are added from ROS, thereby enabling the BBB to work with a Wi-Fi adaptor and a USB camera. When the robot is moving forward, if the IR sensors detect presence of an obstacle, then further movement of the robot is stopped. Additionally, an alarm is raised by flickering of the LEDs mounted on the BBB. The gyro sensor also sends data to the BBB, and these sensor parameters are updated once in every 500 milliseconds. This dynamic model is used as a building block to actuate the motors mounted on the leg, thereby resulting in a swing-stance period of the legs for further movement [3].

This study has the potential to enhance the capability of the Bioloid humanoid robot. The inbuilt RoboPlus software of the Robotis Bioloid robot is meant for easy programming, but it has limited universal applicability. Therefore, in the work presented here, this software has been replaced by ROS, along with a python script for a universal acceptability towards autonomous control of the Bioloid humanoid robot.

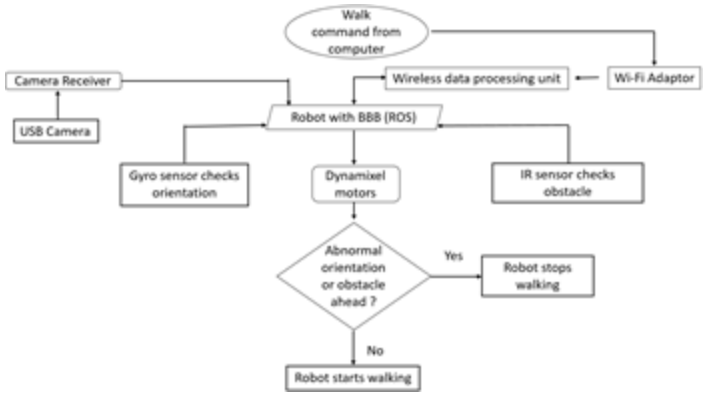

Figure 1: Functional components of the robot

1. https://www.youtube.com/watch?v=9N0LkQyjW7U&feature=youtu.be
2. *ROBOTIS e-Manual v1.25.00 , v1.27.00*, ROBOTIS 12-06-2015
3. Z.Yang *Dynamic control of walking leg joints: A building block model perspective*, ICNC 2011: 459-463