

Robotics Educational and Research Platform



NAIRI-STEM
science - technology - engineering - math



Overview

The Robotics Educational and Research Platform has been designed as a platform for practical hands-on works and as an open platform for robotics algorithms design and development. The mobile robot is based on a four-wheeled mobile platform equipped with microelectromechanical sensors (MEMS) with 10 degrees of freedom, a manipulator with 2 degrees of freedom, a color camera on controlled servomotors, an ultrasonic and infrared distance sensors. The platform has been developed using National Instruments Virtual Instrumentation and reconfigurable powerful NI myRIO hardware platform. The platform can be controlled and configured over the Wi-Fi connection from a personal computer with MS Windows operating system, as well as from mobile device based on Android operating system. Both research groups and high schools or university students can benefit from using this platform.

Open Source Software

The lab delivery package includes special open source software framework that allows users to control the robot platform, as well as perform measurements using sensors installed on the mobile robot. The software is fully open source which allows users to use the program for their own projects significantly reducing the time and resources.

Features

- Simultaneous and independent control of motors using NI myRIO controller
- Control of a manipulator with 2 degrees of freedom
- Control of camera view direction using servomotors
- Implementation of measurements and data acquisition from the following sensors:
 1. Ultrasonic distance sensor
 2. Infrared distance sensor
 3. Digital compass
 4. Barometer
 5. Accelerometer
 6. Gyroscope

Hands-on Works

1. Control of Robot Wheels:
 - 1.1. Getting Started with the Robotics Platform.
 - 1.2. Dependency of Current on Slope Angle.
 - 1.3. Simultaneous Control of Motors by PWM Signal.
2. Manipulator Control.
3. Ultrasonic Sensor:
 - 3.1. Ultrasonic Distance Meter.
 - 3.2. Ultrasonic Sensor Based Radar.
4. Infrared Distance Sensor:
 - 4.1. Output Characteristics of Infrared Sensor.
 - 4.2. Distance and Error Determination.
5. Tracking Objects Using Digital Camera.
6. Digital Accelerometer and Barometer.
7. Digital Compass and Gyroscope.
8. Sensors Calibration:
 - 8.1. Magnetometer Based Digital Compass.
 - 8.2. Accelerometer.
9. Obstacle Avoidance.

