

Implementation of algorithms in a ros-based embedded system for the manipulation of autonomous devices

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Abstract

This project addresses the idea of the integration of an embedded system with middleware resulting in the programming and control of a mobile device, allowing the automation of the same. This project mainly tries to increase the fields of robotics within the automation of existing devices. These applications, which are intended to achieve with automation, are only methods of helping people by removing the burden of performing these jobs, so it was decided to carry out this project. General Objective: Implement algorithms in an embedded system based on ROS for the manipulation of autonomous devices. Specific objectives: Develop ROS-based algorithms to establish a tracking path for the control of an autonomous device, Implement algorithms in an embedded system for device control, To show the operation of the algorithms made in ROS in an autonomous device with a predetermined route, Methodology: The methodology used in this project is the "waterfall" type, because it is a traditional model that, as its name suggests, is a linear and sequential process: in a very detailed way there is a starting point that would lead us to an end point in different stages: Conception, Analysis, Design, Construction, Testing, Implementation and Maintenance.

Introduction

Among the latest advances that are currently being made in the field of robotics, one of the most striking and that are gradually being implemented more in everyday life is that of autonomous vehicles.

This project addresses the task of integrating ROS (Robot Operating System) with the general purpose platform Arduino UNO.

ROS constitutes as a middleware since it is a software that assists the particular applications designed in this project as well as any general purpose application designed on it, to interact or communicate with each other and the hardware used. It works as a distributed software abstraction layer.

The main mission that was intended to be achieved with the integration is, by means of a distributed system, to perform the programming and control of a mobile robot through the design of applications that provide the system with different features and functionalities.

Materials and methods

Embedded systems

Embedded systems are modules or boards created with the purpose of being controlled by microprocessors or microcontrollers, taken to a completely systematized end and without carrying so many tasks, they are, better said, systems that fulfill a specific task.






Arduino UNO The Arduino UNO is an electronic board based on an ATmega328 microcontroller. It has 14 digital input/output pins (4 of which can be used for PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a female USB connector, a power supply jack, an ICSF connector and a reset button.	
Bluetooth module Bluetooth is an industry specification for Wireless Personal Area Networks (WPAN) that enables voice and data transmission between different devices via a radio frequency link. Devices that incorporate this protocol can communicate with each other when they are within range. Bluetooth devices can act as Masters or Slaves.	
ROS The definition of ROS, according to its official website is as follows: "ROS (Robot Operating System) provides libraries and tools to help software developers create robot applications. ROS provides hardware abstraction, device drivers, libraries, visualization tools, message communication, package management and more. ROS is licensed under the Open Source, BSD license."	
ROS Kinetic ROS version with specific libraries and tools for the control of remote control devices (drones, remote controlled vehicles, etc.). It is compatible with Ubuntu Wily, Xenial.	
Ubuntu 16.04 Open source operating system based on a Linux distribution. Mainly used on personal computers, focused on ease of use and improved user experience. ROS is compatible with the following Ubuntu versions: Wily, Xenial.	

Table 1

Results

1. First phase Arduino UNO and drive module

For the realization of the traction module we used a special assemblable body for electronic projects. It has 4 direct current motors operating at 5V. The L298N module was added in a strategic position to have a fast and comfortable access to its terminals.



Figure 1

The L298N module receives signals through its four inputs, using the code developed in the Arduino IDE. Afterwards, the module was connected directly, since the outputs of the Arduino UNO are digital. This module detects when an input is "High" or "Low", activating its outputs with their respective configuration, in this case four PINs were used to control the module: PIN 4 and PIN 5.

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