TEAM ASHVA -2018

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ABOUT THE ROBOT-HARDWARE

Chassis

We have converted a high speed digital proportional RC Racing Car into a Robot Chassis. The Car was 2.4 Ghz radio controlled with dimensions: 24x35 cm with a wheel diameter of 7cm. We have installed two rods with adjustable heights to mount our cameras.

Motor

A 1000 rpm brushed motor has been used to control the wheels and a Servo motor has been used to control the steering mechanism of the front wheels.

Motor Driver-RKI Motor Driver.

To add Raw power and for simple connections for our project we have used this 6V - 24V compatible 20A capable DC motor driver. It is ideal for application where the motor requires up to 20 Amperes of current during startup and during normal operations. It is also compatible with motors that run at 6V - 24V.
It comes with a simple TTL/ CMOS based interface that can connect directly to the IOs of an MCU. It has a breaking feature that can guarantee immediate halt on the shaft of motors in most high power applications and also includes protection circuitry to avoid any electrical fluctuations affecting the normal operation of an MCU.

Intel NUC-
Mini PC

To make onboard processing possible we have used a Mini PC by Intel with specifications as follows :-

Item Weight
1.21 Kg

Memory Storage Capacity
32000 MB

Dimensions
11.5 x 11.1 x 5.1 cm

Voltage
1.2 Volts

Wattage
65 Watts

Wireless Type
802.11B, 802.11G, 802.11n

Battery

- We have used 50000 mAh Power bank with Lihium Ion Batteries to give power to our Mini PC. The Specifications of our Power Bank have been given as follows :-

Voltage
20 V

Output
5A

Item Weight
1.26 Kg

Dimensions
20.6 x 13.5 x 3.3cm

Batteries:
8 Lithium ion batteries

- We have also used another set of Lithium Ion Batteries of 12V/4A to give power to our Motor Driver, Arduino and Bluetooth Module.

Bluetooth Module

To make Pit Stopping Possible we have used a HC-05 Bluetooth Module.

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module,designed for transparent wireless serial

connection setup.The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.

ARDUINO - MICROCONTROLLER

An Arduino-UNO microcontroller has been used to control the servo motor and also for making pit stopping possible.

About the Robot - Software

MAIN CODE

Most of our Robot has been programmed using Python. Our program in Python is based on OpenCV ie Open Source Computer Vision Library.

OpenCV-Python is a library of Python bindings designed to solve computer vision problems.
Python is a general purpose programming language started by A Dutch Coder that became very popular very quickly, mainly because of its simplicity and code readability.
It enables the programmer to express ideas in fewer lines of code without reducing readability.

Compared to languages like C/C++, Python is slower. That said, Python can be easily extended with C/C++, which allows us to write computationally intensive code in C/C++ and create Python wrappers that can be used as Python modules. This gives us two advantages: first, the code is as fast as the original C/C++ code (since it is the actual C++ code working in background) and second, it easier to code in Python than C/C++. OpenCV-Python is a Python wrapper for the original OpenCV C++ implementation.

The Program in python makes great use of image processing to provide a path for the robot to run. The Robot uses two web cameras attached on the tops of height adjustable rods to provide real time images to the mini pc.

The images obtained from one of the two cameras is first converted to grey scale, then blurred and finally converted into canny.

The Canny Image obtained detects the lines in front of it and and then the mid-point between the line obtained through canny and its mirror image is calculated.
After Calculating the mid-point the robot then autonomously follows the mid-point until the finish line.

The images obtained from the other camera is then

colour mastered by the use of HSV Colour Master for red light and magenta line detection.

RESEARCH

To improve our python algorithm further we put our brains together and came out with the concept of PID i.e. Proportional Integral Derivative , this constituted to the research and development part of the robot. After implementing this concept we were able to obtain perfect results. This helped us in perfectly controlling the steering mechanism of the robot, thereby allowing us to take sharp turns.

PID consists of three basic coefficients, proportional , integral and derivative which are varied accordingly for optimal use.

Apart from helping us take sharp turns this concept also helped us in obtaining maximum speeds.