

Speed Modulated Bot via Color Signals

EMBEDDED SYSTEMS PROJECT REPORT



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CONTENTS

1. [Introduction](#)
2. [Problem Statement](#)
3. [Requirements](#)
4. [Software Structure and Implementation](#)
5. [Testing](#)
6. A. [Challenges and Their Solutions](#)
 B. [Design Constraints](#)
7. [Bugs](#)
8. [Future Work](#)
9. [References](#)

1. Introduction

This project aims at development of an automated Firebird V bot programmed to move on white line path whose path selection on junctions and the corresponding speed is decided on the basis of the colored banner signals.

2. Problem Statement

To develop an automated Firebird V Speed modulated bot using colored banners. Our **Goals** were:

- ✓ PID line follower which stops at junction
- ✓ Color detection
- ✓ Variation of speed using PWM
- ✓ Controlled Rotation

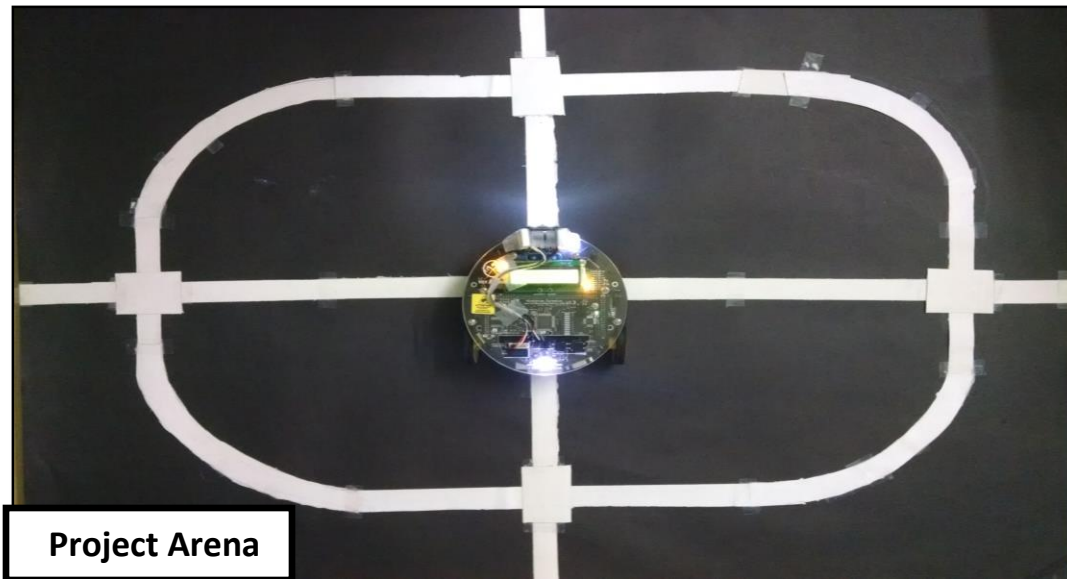
3. Requirements

A) Hardware Requirements

1. Firebird Bot
2. Colour Sensor

B) Software Requirements

1. Atmel Studio: To program instruction onto a given bot



4. Software Structure and Implementation

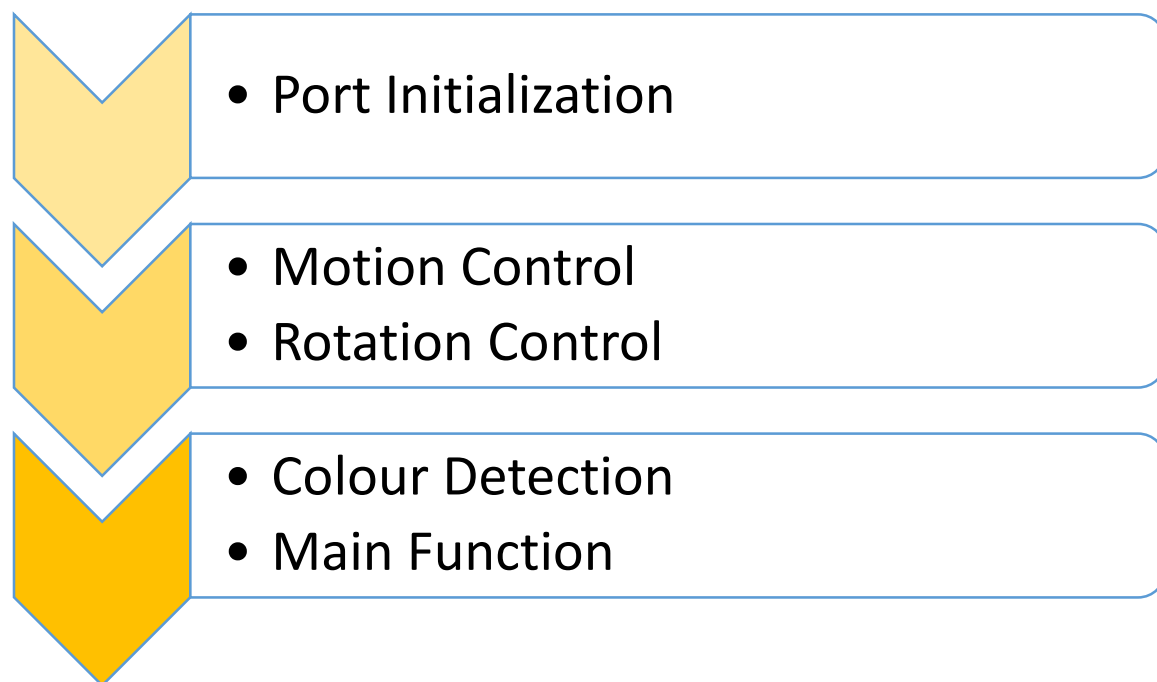


Fig : Software Hierarchy

The bot has to be calibrated for black colour when it is turned on and put on track. This is because the bot requires a threshold value for black colour. It follows the line till it encounters a junction where all white line sensors sense white colour. Here it stops momentarily and waits for colour input (through banners). On the basis of colours it decides its course of action. Red makes it search for alternate path, black toggles speed and blue is to make it continue on the same path without change in direction.

5. Testing

The entire program was developed module wise. First a simple Line follower whose performance was then improved using PID. A test track was set up with enough straight and curved paths so as to determine the appropriate speed of the bot for turns along with coefficients for error, integral and differential. Then using position encoder the bot is made to move a fixed distance. This is fairly easy to test. A track is taken with the fixed distance marked on it. The bot is made to traverse the distance. Debugging is done in cases where it overshoots. Color sensing and turning were developed as the last module in our project. Color sensing was tested by comparing values of different pulses when objects of different colors are kept close to the sensors. Rotation was tested along with color sensing by using position encoders again.



6.

A. Challenges and Their Solutions

- 1) The white line code had to be adjusted many times, especially the co-efficient of error, integral and differential and choosing a proper speed of the bot during turns. If the speed was more than required then it would overshoot the turn, if co-efficient were not suitable then the amount of rotations at turns would be undesirable too.
- 2) We hoped to use the servo motor attached with colour sensors to scan around the bot for coloured banners, but the servo motor rotates in only one direction hence gets entangled with the wiring. We tried overcoming it by rotation of the entire bot instead.
- 3) The colour sensor gives inappropriate pulse measurements for green (blue value is more than green). Hence we had to reduce the number of colour inputs although this does not reduce the functionality, it reduce the sample space of test.

B. Design Constraints

1. The color sensor can detect a signal only up to a distance of 2-4 cm.
2. Line following path should be white line on black background.
3. The color used for the banner should be red, black or blue!!!

7. Bugs

1. The bot may get rerouted from its original path while moving on the line.
2. The color sensor might not detect the color signal.

8. Future Work

Our project may be used as a template for further works on automated cars. For instance:

- Integrating it with a smartphone interface to get the location of user and destination and choosing a path by itself.
- It can be used for transportation over fixed routes like goods hauling or public transport.

9. References

- Firebird V Hardware and Software Manuals
- <http://www.tifr.res.in/~cccf/index.php/interns/77-general/127-how-to-write-a-structured-project-report>
- <http://www.tinyurl.com/robottutorials>
- <http://www.eyantra.org/projects>

Youtube Video Links to our project:

- https://youtu.be/X127enR_vak
- <https://youtu.be/ZYe5OLtI0pQ>

GitHub link to our Project

- <https://github.com/Adityajain97/Speed-Modulated-Bot/tree/94aa6808317f5c6a520e63f13d3b7ca640051426>