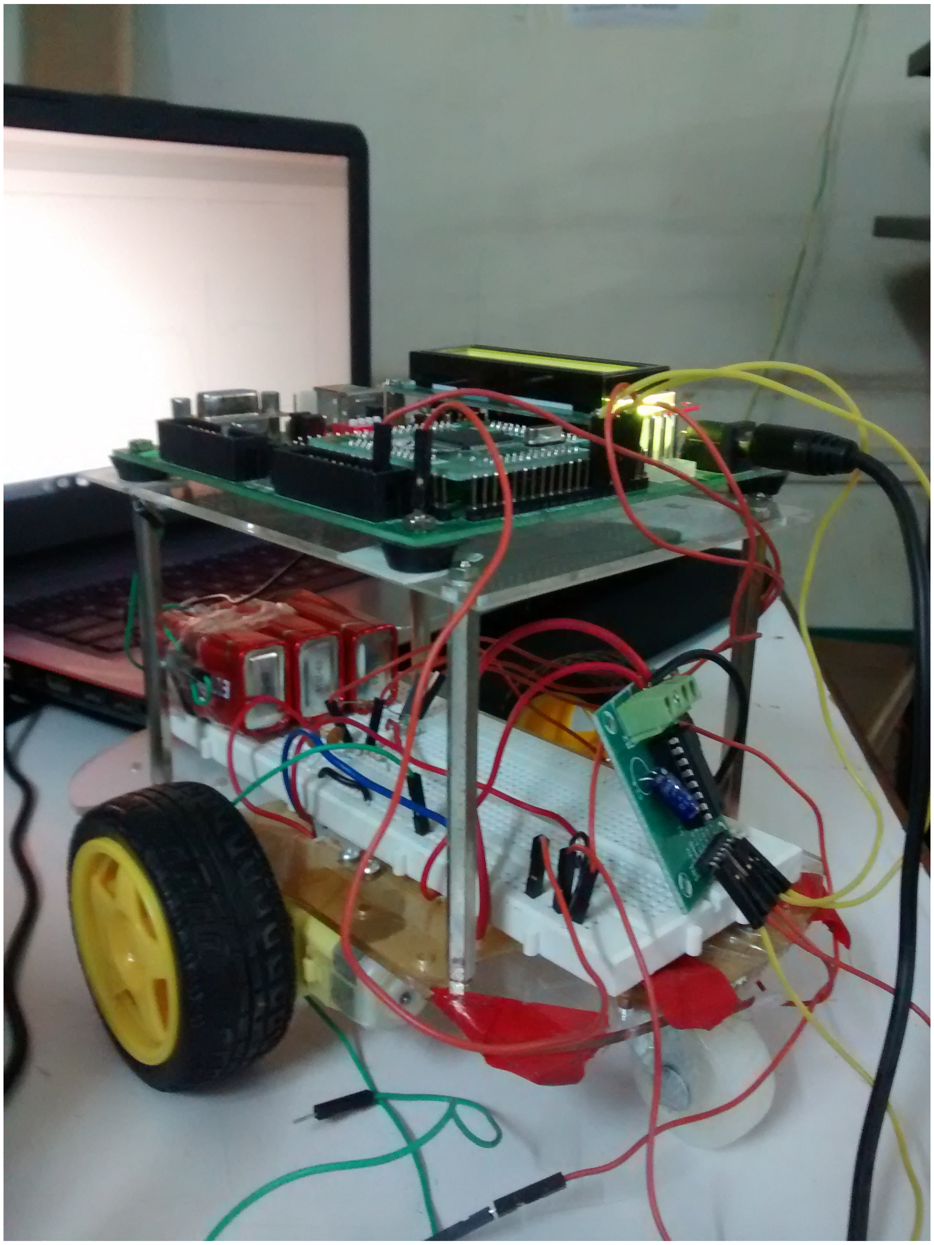
Project Report

AMC Mini Project : PID Speed Control of a Robotic Car



Team Abelian

Aashirwad N. B. 01FB14EEE004
Dhruva Anand 01FB14EEE031
Sai Prasad R. M. 01FB14EEE0075

Contributions of Team Members

Team Member	Work Carried Out	Contribution
Aashirwad	Software Design and Interfacing, Hardware Design and Planning	HIGH
Dhruva	Hardware Design and Assembly, Software Planning	HIGH
Sai Prasad	Interfacing XBEE, Hardware Design and Assembly,	HIGH

Introduction:

PID (Proportional - Integral – Derivative) Control is a closed loop control mechanism in which the actuating signal is a combination of the error (the difference between the desired and actual outputs) and its temporal integral and derivative. The usefulness of PID control lies in its ability to achieve the desired output even when the system is subject to disturbance and loading. Another benefit is that the transfer function of the system to be controlled need not be known exactly beforehand.

The actuating signal is given by

$$d(t)=k_p e(t)+k_i\int_0^t e(\tau)d\tau+k_d\frac{de(t)}{dt}$$

k_p, k_i, and k_d are parameters used to scale the P, I, and D terms.
e(t) is the value of the error at time t

In the case of DC motor speed control, the actuating signal is used to set the duty cycle of the motor.

Motivation

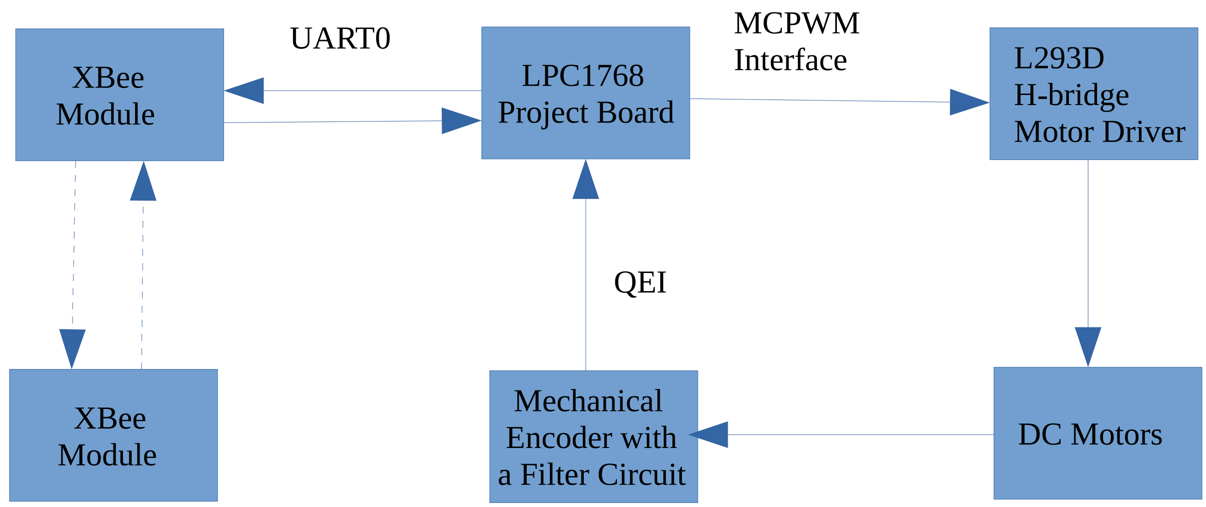
To implement a fairly simple idea which would not be focused on a single application but would be applicable in many situations.

To learn about the typical interfaces involved in motor control.

Objectives

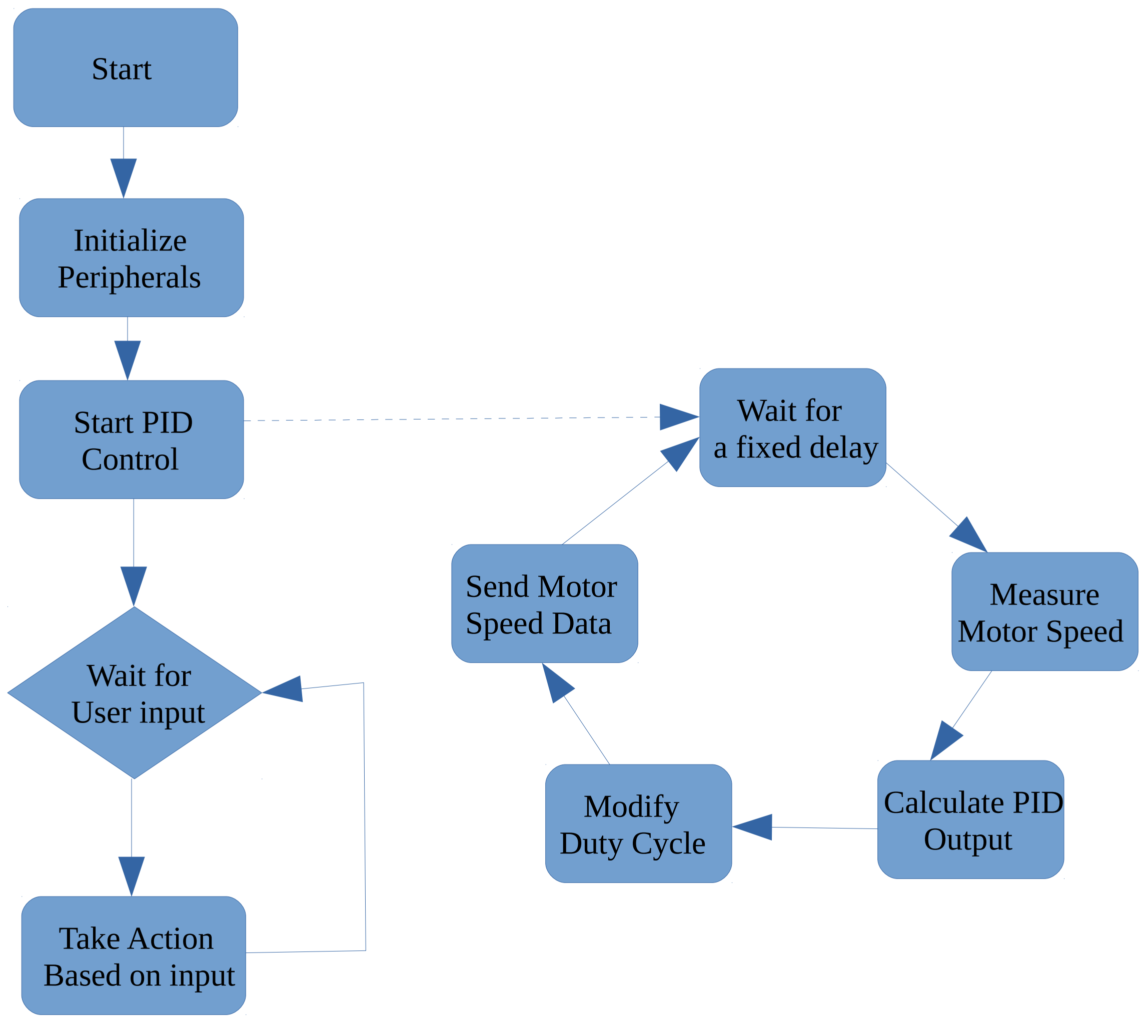
Control the speed of the robotic car with a reasonable amount of accuracy.
Observe variations in speed and the response of the PID algorithm to disturbances.

Hardware Architecture



The encoder used is a quadrature encoder with a PPR of 20

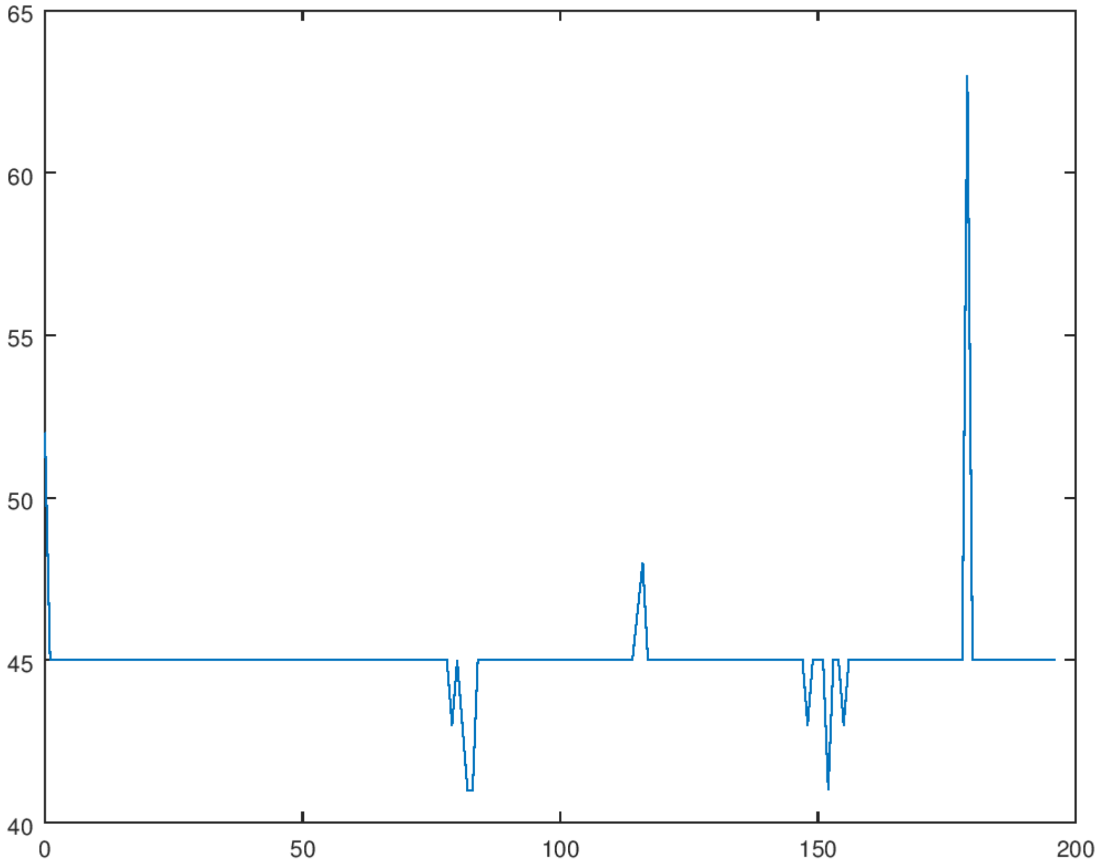
Software Architecture



k_p = 20
k_i = 500
k_d = 3

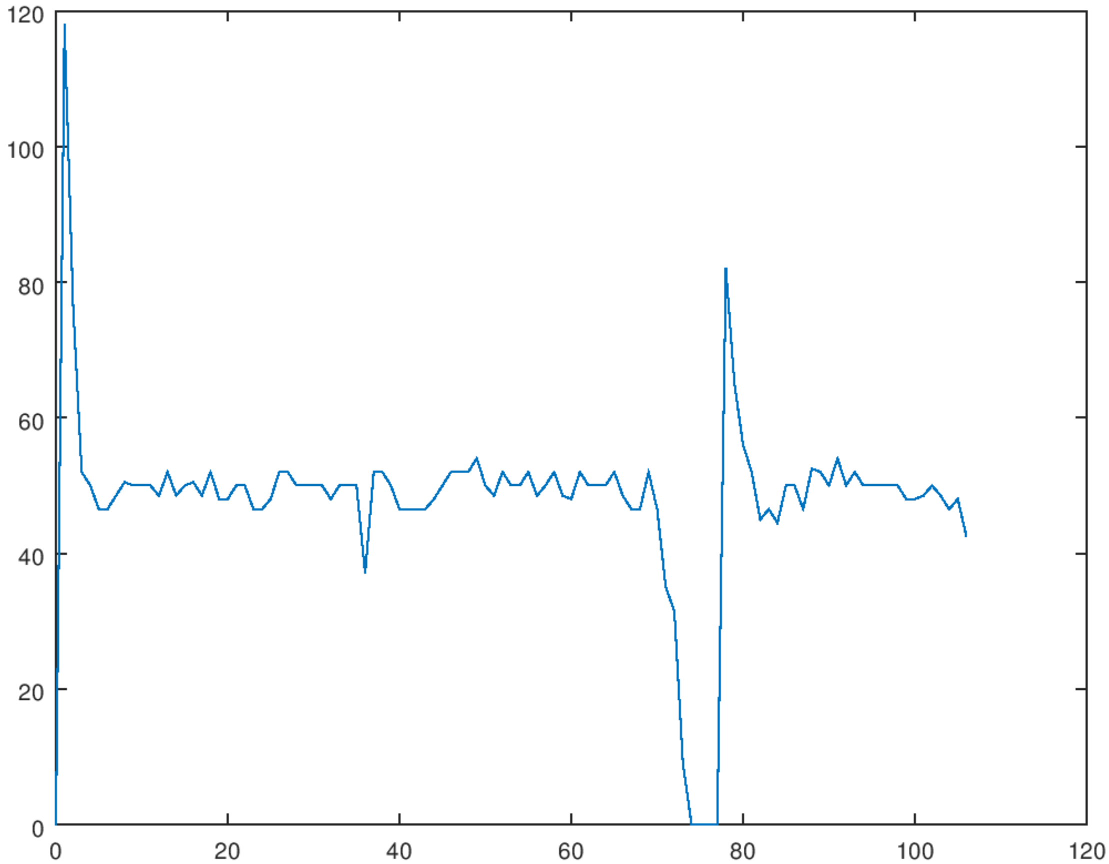
Simulated Output for a reference speed of 45

The



spikes in the plot are due to the addition of virtual disturbances.
The speed settles at 45 after a few seconds.

Actual Observed Output



(Reference speed = 50 rpm)

Conclusion

Fairly reasonable speed control (+/- 5 rpm accuracy) of the motor was achieved when only one motor's speed was measured with a 20 PPR encoder and used in the PID algorithm.

It was noticed that the settling time increased when k_i increased. k_d did not seem to have much of an effect on the performance although the output became unstable for large values of k_d.

The response could be improved if both the motor speeds were recorded and a more accurate encoder were used.