EE 324
Control Systems Lab
Experiment 2
Line Follower on Spark V using PID algorithm

Tuesday Batch I
Group 6

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AIM :-

1. Design and implement an embedded (PID) feedback controller using ATMEGA16 platform on the SPARK -V bot.
2. Implement the PID for line-following on a black track and ensure that the timing is below 30 seconds.

The logic behind the PID algorithm:-

We took input from the sensors attached to the LF bot. We defined our error as the reading of the left sensor minus the reading of the right sensor. Depending on the readings and their differences we determined whether the bot was on the track and moving correctly or whether it had to turn right/left. Once that was determined, we used the calculated error to decide the velocity of both the wheels. We incorporated for sharp left/right turns and soft left/right turns. Thus, we could control the turning velocity of the bot and ensure that the bot stayed on the black line.

Values used in the system were:

1. Kp = 1
2. Ki = 0.001
3. Kd = 0.15

Using these parameters, we achieved a timing of 28 seconds on the track.

The problems faced were:-

1. Choosing a good error function :-
   (a) We weren't sure about what to take as our error function since we were unable to make it dependent on the reading of the center sensor.
   (b) Finally, we went forward with error as the reading of the left sensor minus the reading of the right sensor.
2. Choosing the PID Parameters:-
   We were getting a good performance on track just with P controller before incorporating any I or D.
3. All readings low:-
   (a) We were not using the fact that we could make the bot move backward too.
   (b) And hence deciding what to do when the reading on all sensors is low seemed difficult.
   (c) We concluded it was essential to move backwards to get back to the line and then implemented it.
4. Charging the bot:-
   We often wasted a lot of time charging our bot since the bots were not fully charged before we went to the lab
5. Calibration of the bot:-
   (a) Every lab session we went, we were given a different bot. And hence we had to recalibrate the bot every time.
   (b) Many bots were not easily recalibrated as the range of all three

sensors were not equal.
(c) Also, in some cases, our threshold was set for the bot used in the previous lab and hence we had to tweak our code again.

6. Special cases:-
   (a) We faced a major problem in making the bot go comfortably through the “+”(cross) sign.
   (b) We had not hardcoded the special case, hence sometimes the bot would take turns instead of going straight.
   (c) We then used a memory of some sort (previous error values) to take care of this special case.
7. Timing:-
   (a) We could easily make our bot complete the track within 35 seconds, but to make it complete under 30 seconds was difficult.
   (b) We had to change the velocities of soft and hard turns to get done.