

## DEVELOPMENT AND EXECUTION OF AN ARDUINO MOBILE ROBOT WITH LINE FOLLOWING CAPABILITY USING MATLAB SIMULINK TOOLBOX

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**Abstract** - The fundamental issue of line devotee robot is the way to make the versatile robot follows an ideal way (which is a line drawn on the floor) easily and precisely in briefest time. In this paper, the plan and execution of a complicated line supporter mission is introduced by utilizing Matlab Simulink tool kit. The movement of versatile robot on the complicated way is mimicked by utilizing the Robot Test system which is programed in Matlab to plan and test the exhibition of the proposed line adherent calculation and the planned PID regulator. Because of the intricacy of choice the boundaries of PID regulator, the Molecule Multitude Enhancement (PSO) calculation are utilized to choose and tune the boundaries of planned PID regulator. Five Infrared Beam (IR) sensors are utilized to gather the data about the area of portable robot concerning the ideal way (dark line). Contingent upon the gathered data, the directing point of the versatile robot will be controlled to keep up with the robot on the ideal way by controlling the speed of actuators (two DC engines). The acquired recreation results show that, the movement of versatile robot is as yet stable even the mind boggling move is performed. The Arduino Mobile Robot (AMR) is used to design the robot system's hardware. The Simulink Backing Bundle for Arduino and control framework tool stash are utilized to program the AMR. The pragmatic outcomes show that the exhibitions of genuine portable robot are the very same of the exhibitions of reenacted versatile robot.

**Keywords:** Arduino Versatile Robot, Line devotee, Infrared Beam (IR) sensors, Molecule Multitude Optimization(PSO) calculation, PID regulator.

### 1. INTRODUCTION

These days, the specialists have put forth huge attempt in the field of line supporter robot since it is utilized in numerous applications, for example, clinical help, transportation, instructive, promoting, and modern applications. The line devotee versatile robot is one of the kinds of the independent robot that can play out a particular wanted mission without human intercession. The tasks of the line adherent robot can be close as follow: the robot utilized the IR sensors, which are mounted at front

closures of the robot, to catch the line position that is drawn on the floor. Contingent upon the IR sensors perusing, the control framework will convey the order messages to the actuators (DC engines) to administer the guiding point of the portable robot to follow the line without a hitch and precisely in most limited time. As a result, the line's sensing process requires high robustness and resolution.

In reference [1], the creators planned a line supporter robot for

public vehicle to take care of the issues of number of travelers in Turkey. The line follower mobile robot is controlled by the web server to follow the desired trajectory, and the PID controller is used to carry out this mission [2]. The IR sensor to gather the information and it to the microcontroller, then the microcontroller produce the appropriate signs to activate the engines to and keep up with the robot follow the ideal way [3-5].

The central concern in the plan of the line supporter versatile robot is the plan the appropriate regulator to oversee the guiding point of the robot to keep it on the craving way. The PID control conspire is utilized effectively in numerous modern applications in most recent fifty years. Over the other controller types, the PID controller is used most frequently in industrial applications for the following reasons: its construction is basic, strength in extensive variety of activity, and only three boundaries ought to be acclimated to configuration its design. The PID regulator framework has three boundaries that ought to be tuned to upgrade the exhibition of the controlled plant. The undertaking of changing the boundaries of PID regulator is very troublesome and there are numerous strategy to play out this assignment. The Ziegler-Nichols tuning technique is a heuristic strategy for tuning a PID regulator. John G. Ziegler and Nathaniel B. Nichols developed it [8]. Sadly, this traditional strategy doesn't return an ideal boundaries for the PID regulator, so that by utilizing this technique to plan the regulator, the presentation of controlled framework is as yet deficient. A few other traditional techniques are utilized to tune the boundaries of PID regulator, for example, Cohen-Coon strategy, rule-based strategy and model-based strategy. Every one of those strategies enjoys its benefits and disadvantages.

The disadvantages of those strategies are they use just for first request models including huge cycle deferrals and they require experienced people in modern applications.

In the new ten years, the specialists zeroed in on creating and proposing the streamlining techniques to acquire the ideal boundaries for PID regulator to improve the exhibitions of the controlled framework. New methods for successfully tuning the PID parameters are provided by the emergence of intelligence and optimization algorithms like the genetic algorithm (GA), the Particle Swarm Optimization (PSO) method, and the Ant Colony Optimization (ACO) method.

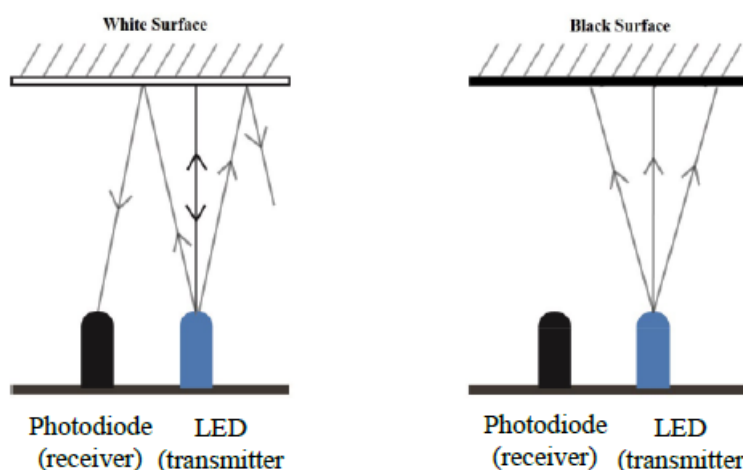
In this paper, the line devotee calculation is proposed and the PID regulator is intended for the versatile robot. The PID controller's ideal parameters were determined using the PSO algorithm. Line follower mobile robots are, without a doubt, quite pricey. Thus, an exact regulator ought to be appropriately planned and its execution ought to be completely concentrated prior to purchasing an actual robot. Accordingly, numerous reproduction programs are intended to assist the analysts with assessing the presentation of planned controlled framework. Because of these factors, using a simulator program can be advantageous because it can save time and money. Subsequently, in this review, the Robot Test system and Simulink bundle are utilized to mimic the following of the controlled portable robot for the ideal way that is drawn on the floor. The acquired recreation results demonstrated that the presentation of the planned PID regulator is extremely precise. Then, at that point, the Arduino Portable

Robot (AMR) is carried out and programmed to follow the ideal direction. Five Infrared Beam (IR) sensors are utilized to gather the data about the area of portable robot concerning the ideal way (dark line). Contingent upon the gathered data, the directing point of the versatile robot will be controlled to keep up with the robot on the ideal way by controlling the speed of actuators (two DC engines). The arduino and control framework tool compartments (PID regulator Blocks), which are built in Matlab, are utilized to program the AMR. The pragmatic outcomes show that the exhibitions of genuine portable robot are the very same of the exhibitions of reenacted versatile robot.

## 2. LINE FOLLOWER MOBILE ROBOT

An autonomous robot known as the Line Follower Mobile Robot (LFMR) is capable of capturing the desired floor path. The LFMR is utilized numerous

application, for example, military application, medical clinic administrations application, conveyance administrations framework, transportation frameworks and visual impairment helping frameworks. The LFMR utilizes a few optical sensors (like IR sensors) that are fixed toward the front of the robot to distinguish the presence of the defined boundary. The activity standard of the IR sensor relies upon the Planck's radiation regulation. The color of the indecent surfaces determines the proportions of light that are reflected, absorbed, and scattered. At the point when the light beam falls on the dark surface, the surface will retain all the force of the light and no light will reflect back. On the other hand, if a light ray hits a white surface, it will reflect all of the light back. For hued surfaces, some measure of the light ingests and the rest reflects back. Figure (1) shows the activity rule of IR sensor.



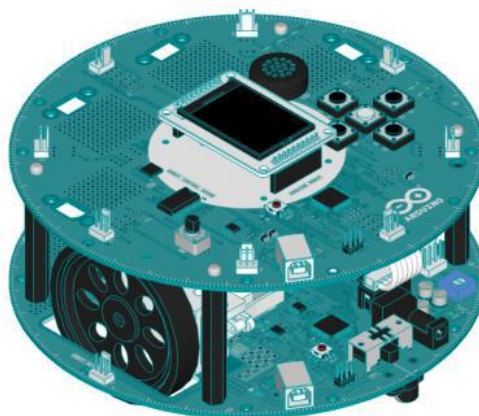
**Fig. 1 The operation principle of IR**

The IR sensor utilizes this standard to perceive the dark line that is drawn on the white surface. There are two main parts to the IR sensor: Driven

(transmitter) and photodiode (beneficiary). The Drove sends the light to distinguish the variety on a superficial level under the robot.

Assuming huge measure of the light get once again to the photodiode that is mean the white surface is identified. However, the black line is detected if only a small amount of light returns to the photodiode. The appropriate control signals that are used to steer the LFMR and keep it on the desired path will be generated by the data that is collected from the IR sensors and sent to the microcontroller. To balance out the following movement, the PID regulator is utilized. In this work, the Arduino

Versatile Robot (AMR) is utilized. Figure (2) shows the out perspective on AMR. The AMR accompanies an alternate sorts of sensors, for example, a computerized compass and five story sensors and a two potentiometers. Additionally, it has two DC motors with integrated motor drives. The Simulink Bundle for Arduino Equipment that is introduced with Matlab Simulink is utilized to control this multitude of sensors and actuators.



**Fig. 2 The out view of AMR**

### 3. CONCLUSION

The line adherent calculation is proposed for portable robot to drive it on the perplexing way. The test system is utilized to test the adequacy of the proposed calculation. The mobile robot's oscillation on a sharp bend will not be affected by the robust PID controller. The PSO calculation is utilized to choose the ideal boundaries of PID regulator. The Arduino Portable Robot is utilized for executing the reasonable framework. Simulink Backing Bundle for Arduino Equipment is introduced to Matlab program for programming the AMR. The pragmatic and reproduction results are demonstrate that the propose line devotee calculation and

planned PID regulator prevail to drive the versatile robot on the mind boggling way.

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