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Delineation using instinctive road markers

G.Prema
AP,Dept of ECE
Mepco Schlenk Engineering College
Sivakasi

A.Jenif Pooja
Department of ECE
Mepco Schlenk Engineering College
Sivakasi

K.Santhiya Mona
Department of ECE
Mepco Schlenk Engineering College
Sivakasi

Abstract:

Road surface marking is a kind of device mainly used on the road surface to dispatchguidance and information to drivers and pedestrians . They are mounted along with paved marking equipmentandareoperated manually.It involves more cost, time and manpower. Henceforth, to optimize it road markers can be automated. The white lines which are delineated on the roads plays an important role to minimize confusion and uncertainty about their meaning and efforts exist to standardize such markings across borders. Solid white lines running in the middle of the road indicate that the vehicle must not change lanes and should stay in the lane it is already in. There are various other meanings for each marking of different colors. The road markers are made instinctive in the proposed method by programming in arduino. Since the white lines are marked especially on the centre of the roads, the robot will navigate according to the white lines on the border of the roads and the marker holder which is extended from the robot will start marking the straight white lines on the middle of the roads. This road markers will be an one time investment that reduces the manpower, cost and time.

Keywords:arduino, marker holder.

I. INTRODUCTION

An embedded system is a microprocessor-based computer hardware system integrated with software. It is designed to perform a dedicated function either as an independent system or as a part of a large system. A road marker is a kind of device that is used on the surface of the road to convey official information. Paint is used because of its low cost. These are usually done manually that usually takes more time and a lot of manpower gets used. This instinctive road marker is a gadget that helps us to reduce the challenges experienced by the conventional one.

II.PROPOSED METHOD

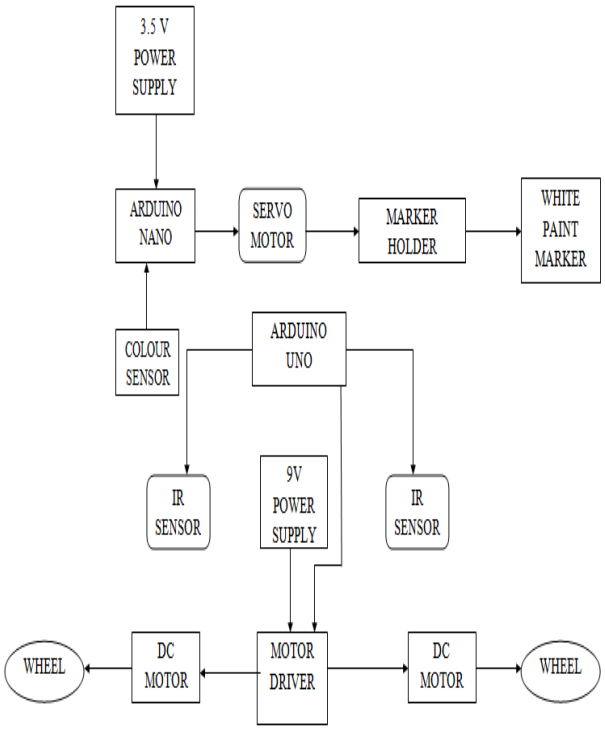

Fig.1 Proposed method

The framework of the proposed method is shown in Fig. 1. The major components of instinctive road markers include

- Arduino Uno
- Motor Driver (L298n)

- Arduino Nano
- Lipo Battery
- Servo Mg995
- Infrared Sensor
- Marker Holder
- White Paint Marker
- Dc Motor
- Wheels
- Colour Sensor

Arduino Uno

Arduino Uno board is the most widely used and documented board of the Arduino family. It has 14 digital I/O pins. 6 analog pins are also present depicted in Fig. 2. Here out of 14 digital I/O pins, 6 can be used as PWM pins. The Arduino software (IDE) is used for writing programs and through USB pin the code can be dumped on the board.

Fig. 2Arduino Uno

Motor Driver (L298N)

L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors**.** It can control up to 4 DC motors, or 2 DC motors with directional and speed control and is shown in Fig. 3.

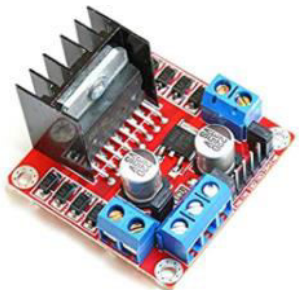

Fig. 3Motor Driver (L298N)

Arduino Nano

Arduino Nanoisa small and breadboard friendly as shown in Fig. 4. It is similar to UNO as they can share same programs. But this is very small as compared to UNO. It needs mini USB cable for dumping the programs. There are three ways to power the board. One is with the help of USB Jack, another one is with the help of Vin pin and third is with the help of +5V pin.

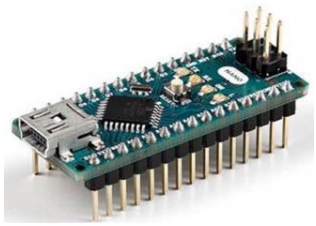

Fig. 4 Arduino Nano

Lipo Battery

Lipo Batteryis also known as lithium polymer battery or lithium-ion polymer battery. It These batteries provide higher energy than other lithium batteries. Lipo batteries are used in applications where weight is a major feature such as mobile phones and aircraft, etc.

Fig. 5. Litho battery

Servo MG995

Servo MG995is a digital servo motor used to receive and process PWM signals faster and better. It is shown in Fig. 6. It will provide good torque and holding power. Here this motor is used for operating the extendable hand.

Fig. 6 Servo MG995

Infrared Sensor

IR sensor is an electronic device. It emits the light to sense the object of the surroundings. It can also measure the heat of an object as well as detects the motion. Here the IR sensor which is shown in Fig.7 used to detect the white color, so that the bot follows the white lines and moves where exactly the lines should be delineated.

Fig. 7 Infrared Sensor

Marker Holder

Marker Holderis used to hold the marker.This holder is attached with the servo motor which is programmed in such a way that it moves up for 15 seconds and down for 15 seconds.

White Paint Marker

The white paint marker is used for delineating lines on the road. It is attached to the marker holder. The marker used in the proposed method is shown in Fig.8.So when the holder moves down , it starts

delineating lines on the road. When it moves down, it leaves a gap thus resulting in dotted lines on the road.

Fig. 8 White paint marker

DC Motor

The 300 RPM DC motor is used for the proposed method and is shown in Fig. 9. This is because of its low

density, light weight and low inertia. Because of its inherent lubricity, it has the ability to operate without any lubrication. The operating voltage is about 3-12V. It has low coefficient of friction.

Fig. 9 DC Motor

Wheels

The wheels used are light weighted and is shown in Fig. 10. This is selected in such a way that it fits appropriate with the shaft of the DC motor.

Fig. 10 Wheels

Colour Sensor

The colour sensor is mainly used to sense the colour of the object. The proposed method uses 8x8 array of photodiodes as shown in Fig. 11. The output of the photodiodes is converted into square wave with the help of current to frequencyconverter.

Fig. 11 Colour Sensor

Here, the colour sensor is used for detecting the already delineated white lines on the road. So if already white lines are present then no markings will be marked by the paint marker. Yet it delineates on the black surface of the road. In the colour sensor, there are four pinsS_0, S_1, S_2 and S_3. Out of which two pins S_2 and S_3 are used for picking the colour channel and other two pins S_0 and S_1 are used for determining the base frequency (f_0) of the output, which can be well defined with the help of the table shown in Table 1.

Table. 1: Pins Vs Base frequency

S_0	S_1	f_0	S_2	S_3	Photodiode type
L	L	Power down	L	L	Red
L	H	2%	L	H	Blue
H	L	20%	H	L	No filter
H	H	100%	H	H	Green

III. EXPERIMENTAL RESULTS

3.1. Robot Navigation

The bot is a line follower robot that follows the white lines whose complete framework is shown in Fig.12.When robot is placed on the fixed path, it follows the path by detecting the white line. IR sensors are the crucial part of this robot. The IR sensor differentiates the black and white color separately. This is done because of the two components present in the IR sensor which are

an LED and a receiver. The LED emits the IR radiation when the sensor is powered. If the object is black in color then the light will be absorbed and when the object is white in color then the light gets reflected. Henceforth, IR sensor detects and differentiates the black and the white colors as shown in Fig 13 and Fig. 14. In this prototype the IR sensors are used to differentiate the white border lines from the black roads as shown in Fig. 15, which are delineated as the reference lines for the robot.

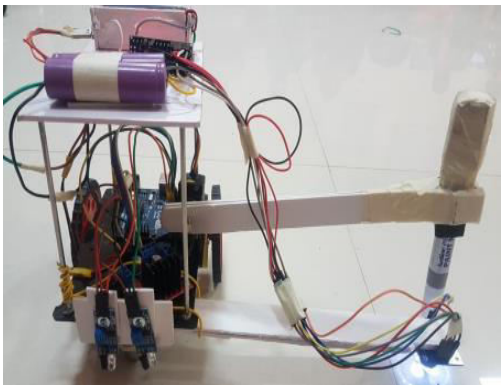

Fig. 12 The complete robot

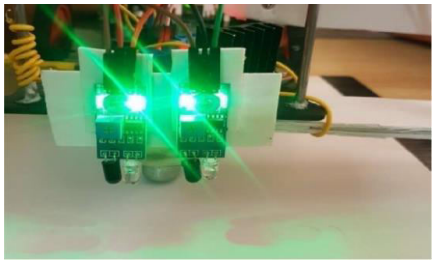

Fig. 13 IR sensor sensing the white color

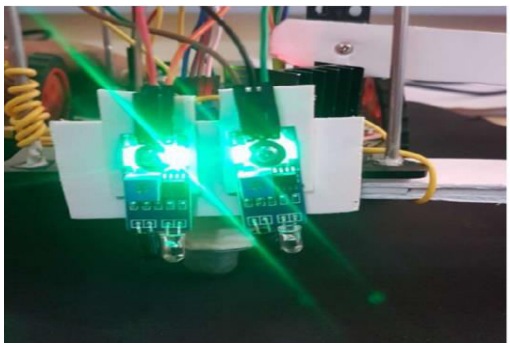

Fig. 14 IR sensor sensing the black color

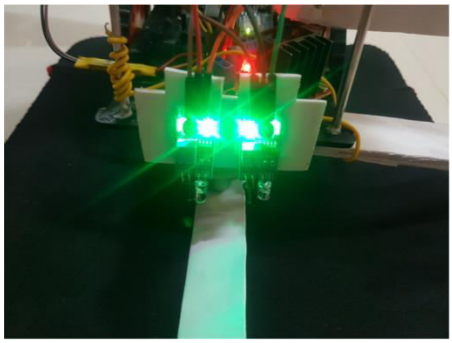

Fig. 15 IR sensor differentiating the white color

The robot moves in the forward direction when the two sensors are on the line of path. If the left sensor moves away from the line, robot moves towards right and vice versa. Here the line follower robot will follow the white lines which are drawn on the border of the roads. So the robot moves along the border of the roads, the marker holder that is extended from the robot is used to draw white lines on the middle of the roads.

3.2. Delinaeting Mechanism

The delineatingmechanism is controlled by servo motor. It is programmed with the help of arduino nano, since this is very small as compared to arduino uno. Delineating is done by integrating the marker holder with the servo motor. When the servo motor is operated, the marker holder will move up to 15 steps so that no line is drawn on the road. After 15 steps the holder will move down. Henceforth, bot moves and draw lines on middle of the road. The color sensor is also a part of the delineating mechanism which is connected to the Arduino NANO and interfaced with the board in order to delineate in the required area. Thus, when the color sensor senses the black color the delineating part starts working and when it detects the white color the servo motor stops working.

3.3. INTEGRATION OF MECHANISMS

The mechanism of robot navigation is integrated with the delineating mechanism. This will result in a complete

prototype. The prototype will be an automated one that delineates the white dotted lines on the road. The line follower robot will follow the white lines on the border of the road and the delineating mechanism will draw the white lines.

3.4 CODING PART

The whole coding part is done using the Arduino IDE software. This is the common software where the programs can be written and dumped in the Arduino boards such as Arduino UNO and Arduino NANO for satisfying the purpose. In the Arduino UNO, the program for following the white color line has been dumped.In the Arduino NANO which is programmed for the delineating part, the coding is written for the moving of servo motor in the clockwise and the anticlockwise direction. The coding for the color sensor is also written in the same board.

IV. CONCLUSION

A completely automated system is designed to its utmost efficiency. The navigation is optimized for delineating lines on the roads. Thus reducing the manpower cost and time. This prototype is capable of delineating lines even in curved roads. This prototype is light weighted. The robot is self-operating and micro controlled.

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