A SURVEY ON AUTOMATED BUS SYSTEM USING LINE FOLLOWER

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***Abstract*—This topic is an attempt to automate bus using the concept of line follower. The resultant system doesn't require a driver for controlling the bus. The bus uses image processing to detect bus stops and moves after pre alloted time. It uses sound waves to detect obstruction and stops if it finds an obstruction nearby. Driverless buses are poised to decongest personal traffic,shrink our eco footprint and reduce the frequency of collisions by about 90% . Since it avoid the involvement of a driver, it reduces fare. Presently, there is no such system for public transportation. Everyone is behind automating cars but still the frequency of traffic and accidents are not reduced as intended. But, automating a public transport will help in this.**

***Index Terms*—Automated using Line follower , comparator**

I. Introduction

Generally, line follower robot is mobile robot that is designed to detect and follow the line. The path or track is usually predetermined by user and the robot needs to complete the path or track until the finish line. The path or track is basically physical white line on the floor or as complex path marking schemes for example embedded line, magnetic markers and laser guide markers. The basic operations of line follower robot are as follow: 1. The line follower robot will sense or detect the line position with optical sensors and the optical sensors are usually placed at the front end of the robot. 2. The robot will have steering mechanism in order for the robot to move straight, turn left or turn right. 3. The speed of the robot will be controlled according to the lane condition. It means that for curvy lane, the speed of the robot is decrease in order to obtain smooth turn. There are number of micro controllers, motors and sensor in the market with varying specification. Therefore in this chapter we choose the most suitable micro controller, motor and sensor to be used for our project.

II. BACKGROUND

A line following robot is an autonomous robot which is capable of following a black line drawn on the floor. It can sense a line and maneuver the robot to stay on black line, while constantly correcting wrong moves using open loop system. Programmer has to 'teach' the robot how to follow the black line.

III. LITERATURE SURVEY

This section presents related literature concerning line follower and enhancement techniques. Several research for line follower robots are broadly classified here.

A. Line Follower Robot from CPP Robotic Club

This following robot has been by a lot of people around the world, in this chapter we shows an example of line following robot that had been done by others. This line following robot will easily leave its track from the black line drawn on the floor because it is an open loop system. This problem will make the motion of the robot to be unsmooth. Although line follower robot can follow the black line its motion still need to be improved. As a result, applying digital PID algorithm control is a closed loop systems can smoothing the tracking motion. It is because PID control is a closed loop systems that will feedback and correct the error occurred with fast response.

B. Design and Development of Autonomous Line Tracking Robot Using MMicro controller(UTEM)

Problem statement: The design and development of an autonomous line tracking robot is a very complicated task. There are many aspects that should be considered such as mechanical system, electrical circuit and microprocessor programming. All these aspects need to be fully integrated between each other. So that, the autonomous robot can be perfectly functional to achieve the tasks provided. In order to make sure this autonomous robot system fully integrate, the challenges are to decide and choose the best device should be implemented in this autonomous robot system. Furthermore, there are many types of micro controller, sensor device and driven motor in the market. Each of them has difference specifications, capability and functions. The biggest obstacle is to program the micro controller based on the information gathered from the robot's line sensors. Basically each sensor provides the information to controller based on the signal that they got and the controller will decide what to do base on the programming loaded. For line sensor case, its information based on the rate of reflected light that have been detected by detector. In different environment or brightness of area, the rate of light detected by detector is fully different. So, the strong programming languages knowledge are needed to synchronize environment changes with the execute program in the micro controller.

Objectives: The main aim of this project is to design and develop an autonomous line tracking robot using micro controller. This is achieved through these objectives:

1. To design and develop a suitable mechanical structure of an autonomous mobile robot.

2. To develop electronics hardware that is able to integrate sensor and electrical motor with the micro controller.
3. To develop a complete program for the micro controller to achieve the required task of line tracking.

Scopes:

In order to design and development an autonomous line tracking robot using micro controller, project scopes need to be defined for assist and guide the development of the project. The main scopes for this project are:

1. Data collection: Collect necessary data through literature review on existing autonomous line tracking robots, micro controller, line sensor, driven motor and circuit design.

2. Design electronics and mechanical system: Create a circuit diagram for electronics part and design robot structure.

3. Integration: Build a complete set of autonomous robot by integrate the mechanical structure and electronics device.

4. Programming and Testing Build the complete set of program for micro controller unit and run the testing for the complete autonomous robot.

C. Line following Robotic Vehicle using Micro controller

The project is designed to develop a robotic vehicle that follows a specific path. This project uses a micro controller of 8051 family for its operation. A pair of photo sensors comprising IR transmitter and photo diode is interfaced to the controller to detect the specified path for its movement.

Line follower robot is a useful robot that is used in ware houses, industries, and stores etc, where it follows a dedicated path. This proposed system of a line following robot fulfils the desired functionality and demonstrates the working of it. It uses a pair of photo sensors, comprising of one IR transmitter and a photo diode in each. It guides the robot to follow a specified path by giving appropriate signal to the micro controller. Two DC motors are used interfaced to the micro controller through a motor driver IC. Input signals given to the micro controller from the sensors and then the controller takes the appropriate action according to the program written in it and drives motors as desired.

Further the project can be enhanced by adding more advanced sensors to it. This will add more features to the existing project. For example, we can use ultrasonic sensors for detect any obstacle in front of the robot and to take appropriate action.

IV. STRUCTURE

This robot can be divided into several parts:

1 Sensors
2 ADC (Analog to Digital Converter) and sensor circuit
3 Processor
4 river
5 Actuators (Motors and wheels)
6 Chassis and body structure
7 Power Supply (5V / 12V DC)

The electrical circuit of some line follower robots can compare the analog signal received form sensors and then transmit the result to the processor in digit '0' or '1' and some of them send the analog signal to the processor directly. Anyway, the analog signal must be converted to the digital form and then the processor can process it according to that digit.

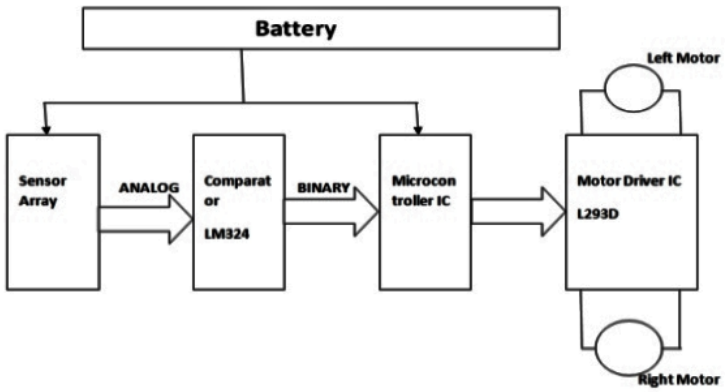

Fig. 1. block diagram

The microcontroller and other devices get power supply from AC to Dc adapter through 7805, 5 volts regulator. The adapter output voltage will be 12V DC none regulated. The 7805/7812 voltage regulators are used to convert 12 V to 5V/12V DC.

A. The Sensors

The robot uses IR sensors to sense the line, IR sensors consist of two diodes that one of them sends ray and another one must receive it. If the receiver receives the reflection ray, it means that the robot is on white and if it cannot receive it, so the robot is on black.

IR reflectance sensors contain a matched infrared transmitter and infrared receiver pair. These devices work by measuring the amount of light that is reflected into the receiver. Because the receiver also responds to ambient light, the device works best when well shielded from ambient light, and when the distance between the sensor and the reflective surface is small (less than 5mm). IR reflectance sensors are often used to detect white and black surfaces. White surfaces generally reflect well, but while black surfaces reflect poorly. Instead of IR diode we can use a sensor package that consist a diode and a transistor.

B. The ADC and sensor circuits

The Sensors Received signal must be converted to the digital form, an ADC can convert it. A good ADC is IC LM324 that can support four sensors. We must use two LM324 to support eight sensors. The resistance of the sensor decreases when IR light falls on it. A good sensor will have near zero resistance in presence of light and a very large resistance in absence of light.

The resistance of the sensor decreases when IR light falls on it. A good sensor will have near zero resistance in presence of

light and a very large resistance in absence of light. We have used this property of the sensor to form a potential divider. A good sensor circuit should give maximum change for no-light and bright-light conditions. This is especially important if you plan to use an ADC in place of the comparator.

C. The Processor

We have used the Atmel's AVR microcontroller "At Mega 16" in our project. Because Atmel's AVR microcontrollers have a RISC core running single cycle instructions and a well-defined I/O structure that limits the needs for external components. Internal oscillators, timers, UART, SPI, pull-up resistors, pulse width modulation, ADC, analog comparator and watch-dog timers are some of the features you will find in AVR devices.

AVR instructions are turned to decrease the size of the program whether the code is written in C or Assembly. With on-chip in-system programmable Flash and EEPROM, the AVR is a perfect choice in order to optimize cost. [5, 3]

One of the best AVR is "At Mega 16" which has four ports for I/O and 16 MIPS speed in 16 MHz. The microcontroller power is 5V and it is better to use the 7805 regulator.

D. The Driver

We must use a driver IC for controlling the motors. The microcontroller sends a signal to the driver that acts as a switch. If the signal received by the driver is high, it will rotate the motor or else it won't do so. Note that the microcontroller only sends a signal to a switch which gives the voltage required by the motor to rotate.

One of good driver for our project is L298 which can be used to control two motors. The L298 motor driver has four inputs to control the motion of the motors and two enable inputs which are used for switching the motors on and off. Many Circuits use L293D for motor control, we chose L298 as it has current capacity 2A per channel 45V compared to 0.6A 36V of a L293D.

L293D's package is not suitable for attaching a good heat sink; practically you can't use it above 16V without cooling it. On the other hand, L298 works happily at 16V without a heat sink, although it is always better to use one.

The microcontroller sends instructions to the driver after processing the data coming from sensors part. The driver gives voltage to the motors according to the inputs. Actually the diver gives positive voltage to one of the motor pins and gives negative voltage to another one which there is five states:

1. Both of the motors are turn on and rotate forward simultaneously. (Move Forward)

2. The right motor is turn on and the left motor is turn off. (Move Left)

3. The left motor is turn on and the right motor is turn off. (Move Right)

4. The right motor rotates forward and the left motor rotates backward. (Move Left Fast)

5. The left motor is rotate forward and the right motor rotates backward. (Move Right Fast)

• Usually two states are not practical in this kind of line follower robots:

1. Both of the motors are turn off.

2. Both of them rotate backward.

E. The Actuators (Motors and wheels)

The movement system is an important part of a robot. And its objective is how to move robot from one point to another one. This system has some details shown us how we should use motors and wheels. We use motors to convert electrical energy to the mechanical energy. There are a lot of kinds of motors and we must choice the best one that we need. Our choice is depended on the robot function, power and precision. Undoubtedly, one of the agents of success of our robot is to choose good motors.

Motor gearbox is one of the best motors for line follower robots. Because it has some gears and axle and its speed doesn't change in towards the top of a hill or in downhill. In this project, two gearboxes 6V 800RPM have been used and we understood that we must use high speeder motor for our project, for example a 12V 1200RPM or 12V 2000RPM motor. Of course, the wheel's radius has effects on the speed.

Usually there are two movement systems for robots: 1. Wheel 2. Tank system

It is better to use wheels for line follower robots. We can use three wheels which two wheels joint to the motors and these are installed rear the robot and one wheel is free and installed front of the robot.

I designed my Robot, which use two motors control rear wheels and two front wheels.

F. The Chassis and Body

There are some good materials for designing robots such as wood, plastic, aluminum and brass alloys. We must ability for choosing one of them. There are some agents that we can use them to choose a good body, ability to perforate, incision, flexibility and etc.

In the designed robot, aluminum has been used for chassis because of its lightweight and being strong enough for our project.

To decrease weight you can install all components on the circuit fiber. For example, you can install motors under the fiber and install battery on the fiber but sometimes it is impossible. In a robot, appearance is not important. The performance is more important than other things.

V. CONCLUSION

In this paper, the existing methods for line follower were introduced and the common problems in these methods were summarized. Earlier methods are some times very complex,Here im using line follower in a simple way and also we can reduce the cost . So iam using this method to impliment in bus system , In its current form bus is enough capable. It can follow any curve and cycle.The designed bus has infrared sensors on the bottom for detect line. Microcontroller ATMega16 and driver L298 were used to control direction and speed

of motors. The robot is controlled by the microcontroller. In performs change the motor direction by giving signal to driver IC according to receives signals from sensors.This system also detect any obstruction or any vehicles that comes in front of bus. This can be achieved using sonar technology. We will be using ultrasonic sensor to detect obstructions. In this proposed system also detects bus stop signs using image processing and moves after pre allotted time.

REFERENCES

[1] Papadimitratos P, La Fortelle A, Evenssen K, Brignolo R, Cosenza S. Vehicular communication systems: Enabling technologies applications and future outlook on intelligent transportation. IEEE Communications Magazine 2009; 47: 84-95.

[2] Critchlow AJ. Introduction to Robotics. New York: Macmillan; 1985.

[3] Ozdemir Y, Sezgin A, Yüksel T. Çizgi izleyen gezgin bir robotun incelenmesi ve gerçeklenmesi. In:Proceeding of the 6th Symposium on Automation 2007; 21-24.

[4] Iren K. Improvement of industrial path following robot [dissertation]. Ankara: Hacettepe University; 2013.

[5] Akash S, Kabi B, Karthick MS. Implementing a line tracing robot as an effective sensor and closed loop system. In: International Journal of Recent Trends in Engineering 2009; 2:104-107.

[6] Mansour SF. Corporation robots [dissertation]. Malaysia: University Tun Hussein Onn; 2011.

[7] Bacha AR. Line detection and lane following for an autonomous mobile robot [dissertation]. Virginia: Virginia Polytechnic Institute and State University; 2005.

[8] Kelkar ND. A fuzzy controller for three dimensional line following of an unmanned autonomous mobile robot [dissertation]. India: Government College of Engineering; 1997.

[9] Ibrahim D, Alshanableh T. An undergraduate fuzzy logic control lab using a line following robot. J Computer Applied Engineering Education 2009; 19:639-646.

[10] Dufour P, Gudiksen O. Intelligent line following for vision enabled mobile robots [dissertation]. Lyngby:Technical University of Denmark; 2008.

[11] Arıcı M, Kara T. Eksik tahrikli robot manipülatörün durum geri beslemeli kontrolü. In: Proceeding of National Automatic Control Meeting 2013; 900-906.

[12] Duran IU, Demir O, Yavuz C. Dht11 sıcaklık ve nem sensörü ile bilgisayar destekli ölçüm ve kontrol devresinin imalatı ve deneysel olarak incelenmesi. In: Proceeding of Project Base Mechatronics Education Workshop 2012.

[13] Lee EK, Yoo YM, Park CG, Kim M, Gerla M. Installation and evaluation of RFID readers on moving vehicles. In: Proceedings of the sixth ACM international workshop on VehiculAr InterNETworking. Beijing: ACM; 2009: 99-108.

[14] Schneegans S, Vorst P, Zell A. Using RFID snapshots for mobile robot self-localization. In: Proceedings of the 3rd European Conference on Mobile Robots 19-21 September 2007; Freiburg, Germany; 2007: 241-246.

[15] Yamano K, Tanaka K, Hirayama M, Kondo E, Kimuro Y, Matsumoto M. Self-localization of mobile robots with RFID system by using support vector machine In: Intelligent Robots and Systems IROS 2004. Proceedings. 2004 IEEE/RSJ International Conference on. IEEE; 2004:3756-3761.