

Automatic Robot System In Industries Using Rf Module

Alpana Lingayat, Dinesh Rotake

¹Department of Electronics And Telecommunication G H Raisoni College of Engg. & Tech. for Women
Nagpur, India

²Department of Electronics And Telecommunication G H Raisoni College of Engg. & Tech. for Women
Nagpur, India

Abstract: Most of the problem relating to the labourer (numbers, work capacity efficiency etc) in the industries can be overcome by using Robots. We have studied the automatic Robot system to transport goods within industries. Our model use a pair of Robots (A & B) which are given commands by RF module following them these commands they travel along the shortest possible path on 4*4 grids system. While crossing the junction Robot A will get precedence over Robot B and thus collision avoided. Hence the automatic system is quiet useful in industries as it save time, man power and is more efficient.

Keywords: RF module, Shortest path, precedence, commands, collision avoidance.

I. Introduction

Managing industries is a herculian task, the toughest part being labourer administration. Considering the tedious job allotted to these labours, it becomes difficult for them to be up to the mark in terms of their efficacy. Using Robots for transferring goods within industries can reduce the work load of these labourers.

As compared to labours Robots can work with precision and without any physical or mental fatigue. As more goods could be carried per Robot in lesser time production costs decrease and efficacy increase.

Robot navigate through the grid drawn on the floor of the godown to reach the racks where goods to be unloaded and stored. Possibility of collision always exists when more than Robot is used. To avoid this possibility Robots will be prioritizes so that the one with higher priority will get precedence.

II. Related work

The line follower Robot is an autonomous machine that follows a predefined path(either black line on white surface or white line on black surface). LED-LDR sensors are installed under the Robot through which Robot senses black or white line and data is transmitted to the processor by processor bus. The microcontroller processes according to the predefined commands, and sends them to the motor drivers [1].

Another study uses 32 phototransistors to instead of the LED LDR sensors. The sensor sends analog signals to the microcontroller and motor drivers work on digital signal. The motor works according to the output of the phototransistor. The phototransistor senses the white line and ground than converts it into electric signal. An AD sampler is used to convert the analog signal to digital signal which is used as an input for the optimization of algorithm [3].

When obstacles are in the path at places known by the Robot, it finds shortest distance path from source to destination using camera by avoiding these obstacles [2].

Traversing in a known obstacle arena is intelligence, whereas traversing in an unknown obstacle arena is a challenge. In micro mouse competition, micro mouse has to reach its destination from the starting point of the maze without manual interference. The main objective of micro mouse is to minimize the cost and to reach its destination in minimum time. The arena has undefined walls/obstacles and the micro mouse has to reach the destination avoiding collision. To avoid unknown obstacles of the path, a new concept of ET-floodfill is used [4].

III. Proposed system

The aim of our study is to navigate Robot A and B to their destination utilizing less time, less power and shortest possible path taking care that they do not collide with each other.

Our proposed system utilizes, Robot A will have higher priority than Robot B. Starting point for both the Robots will be the same because goods will be loaded from the same place, but their destination can be different.

The RF module will provide destination co-ordinates so that they can find the shortest path to the end point.

Robots will pick the objects and move towards their respective targets, if by chance both of them are about to cross the same node rob A (higher priority) will cross initially followed by rob this will avoid collision

B. Algorithm

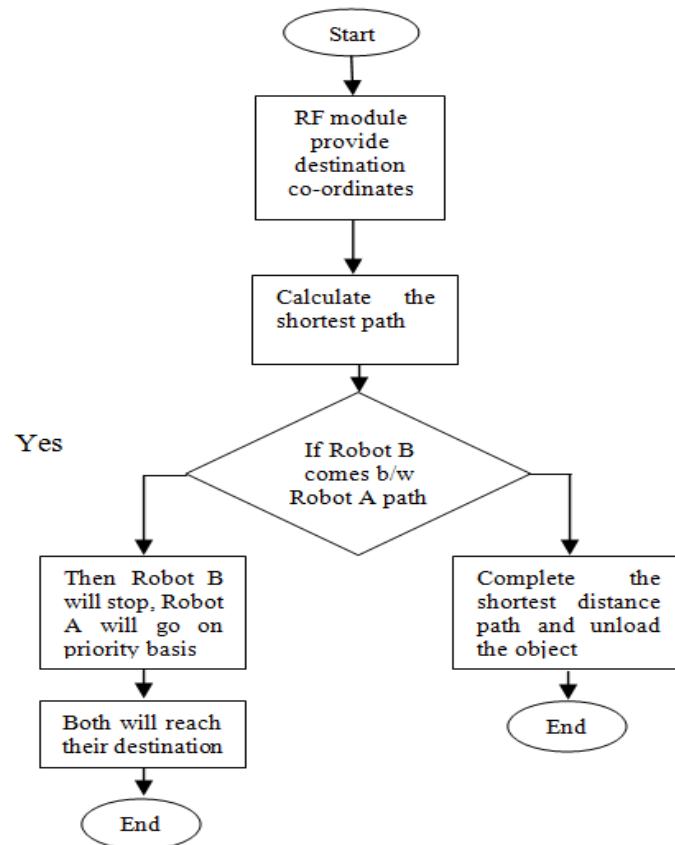


Figure 1 The Flow diagram for robotic path.

Proposed Robot will perform the following functions:

- 1) Line follower.
- 2) Grid traversing.
- 3) Object picking.
- 4) Collision avoidance.
- 5) Destination co-ordinates through RF module.

A. Line follower

Line follower is an autonomous Robot which follows black line on white surface. Robot must be able to detect particular line and keep following it.

Line follower Robot which follows black line on white surface and take right or left turn whenever junction occurs. Two sensors are used to detect the line.

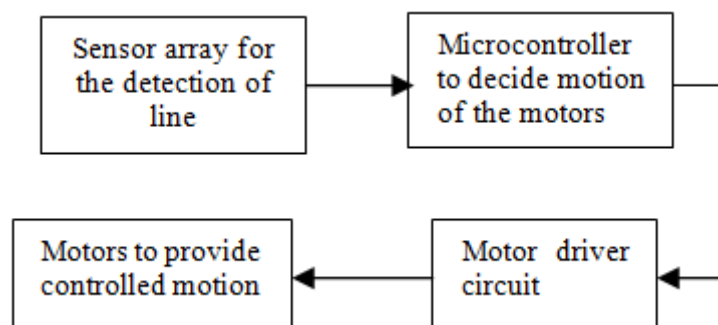


Figure 2 Block diagram of line following Robot.

An array of sensors is used for line detection. Based on the status of sensors microcontroller decides the position of the line and gives direction to the motors required to follow the line. Motor driver circuit is used to turn ON/OFF the RIGHT/LEFT motors of the Robot to provide desired motion.

Left sensor	Right sensor	Motion of the ROBOT
0	0	Forward
0	1	Right Turn
1	0	Left Turn
1	1	Stop

Table 1 Motion of the sensor according to the output of the Robot.

B. Grid traversing

The grid is mapped according to Cartesian co-ordinate system with dimension $m*n$. two additional sensors are used for detecting junctions.



Figure 3 co-ordinate assigned to the junctions.

C. Object picking

An L shaped arrangement of the dc motor helps lifting object at an angle of 45.this motor in turn controlled by microcontroller.

D. Collision avoidance.

A fifth sensor is used with the purpose of avoiding collision at junctions. This sensor functions by detecting the presence of other robot while crossing junctions.

E. Destination co-ordinates through RF module

Robots will receive their respective x and y destination co-ordinates by a remote controller, so that they can reach their destination to the place object.

Robot can be divided into different parts such as:

- 1) Sensors
- 2) RF module
- 3) Microcontroller board
- 4) Motor driver
- 5) Body

1) Sensor

Sensors are required to detect position of the line to be followed with respect to the robot's position. Most widely used sensors for the line follower robot are Photosensors. They are based on the basic observation that "the white surface reflects the light and the black surface absorbs it".

Sensor circuit contains emitter, detector and comparator assembly. IR(Infrared) or Visible light is emitted from the emmitter.IR light is mostly preferred to avoid interference from the visible light which is generally around the Robot. However IR is also present in the atmosphere but its intensity is much less than that of visible light, so IR light can give more reliable output. For better accuracy of the sensors, they must be covered properly to isolate from the surrounding.

This emitted light strikes the surface and gets reflected back. If the surface is white, more intensity of light gets reflected and for black surface very less intensity of light is reflected.

Photo detector is used to detect the intensity of light reflected. The corresponding analog voltage is induced based on the intensity of reflected light. This voltage is compared with the fixed reference voltage in comparator circuit and hence it is converted into logic0 or logic1 which can be used by the controller. The comparator circuit may be designed in two ways:

- Case 1: Black area = logic1
 White area = logic0
- Case 2: Black area = logic0
 White area = logic1

Our Robot is designed using IR sensors, and case 1 is used.

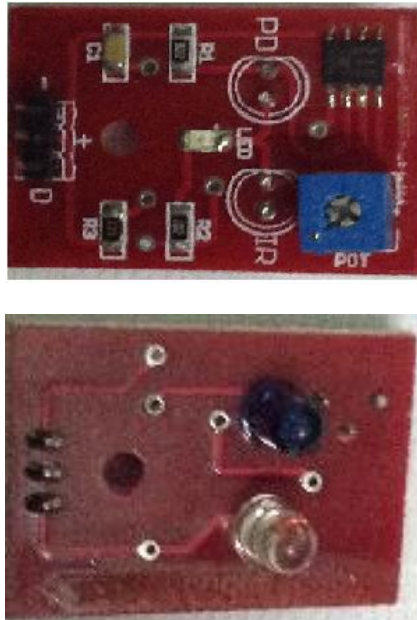


Figure 4 IR sensors.

2) RF Module

Radio Frequency module (RF module) is an electronic device used to transmit and/or receive wireless signals between two devices. For many applications RF communication is used because it does not require line-of-sight. RF communication is the combination of receiver and transmitter. The RF module is invented for 2400-2485.5 MHz ISM (industrial, scientific and medical) and short range frequency band.

Various technologies exist for wireless data transmission e.g. Bluetooth, Zig bee Module and Wi-Fi module. Amongst them

RF module is the cheaper and will work quite well for small scale projects. RF module can also be used in garage door opener, wireless alarm system, industrial remote control, wireless home automation system, smart sensor application, wireless game controller and wireless audio controller.

It is sometimes used to replace the older IR communication as it does not require line-of-sight operation. The CC2500 RF module can transmit and receive frequency of 2.5GHz which is a low cost and low power consuming wireless module. It has configurable data rate up to 500 K Baud. It can transmit/receive 64 byte of data on first come first out basis and can be controlled by using microcontroller.



Figure 5 F module.

3) Microcontroller Board

- 40 pin Atmel ATmega16 microcontroller with external clock system 16 MHz, 4 PWM channels, on chip analog comparator and external & internal interrupt sources.
- Motor driving IC (L293D).
- 7805 voltage regulating IC.
- ATmega16 can be programmed by using embedded C language in WINAVR compiler.

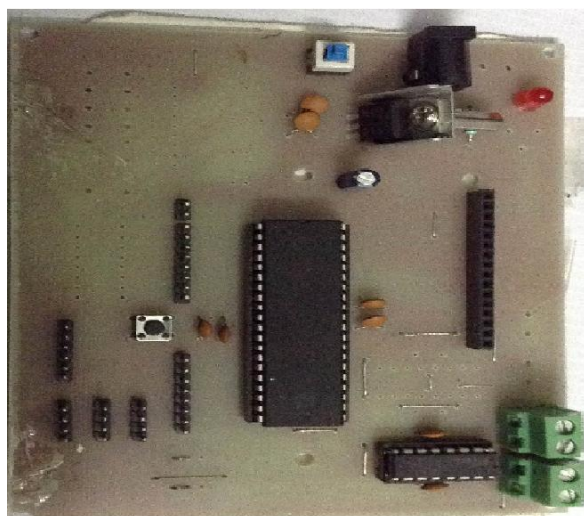


Figure 6 Microcontroller board.

4) Motor Driver

Motor controlling is the most important aspect of the line follower Robot. On the basis of sensors output motor's motion is decided. Two IR sensors are used to follow the black line.

Sensors give logic 1 for white and logic 0 for black. Robot has to follow black line on white surface.

Two DC motors (M1 and M2) are used to move the Robot.

Let us see how to decide motors motion based on four combinations of two sensors.

Left Sensor	Right Sensor	Left Motor(M1)	Right Motor(M2)
0	0	ON	ON
0	1	OFF	ON
1	0	ON	OFF
1	1	OFF	OFF

Table 2 Motion of the motors.



Figure 7 DC motors.

5) Body

A body consists of an internal framework that supports a manmade object in its construction and uses it. Body can be made by any materials such as wood, plastic, plywood, aluminum, and brass. But for designing Robot light weight, flexible material is preferred which can resist conduction.

In the designed Robot aluminum has been used because of its light weight and mechanical strength.

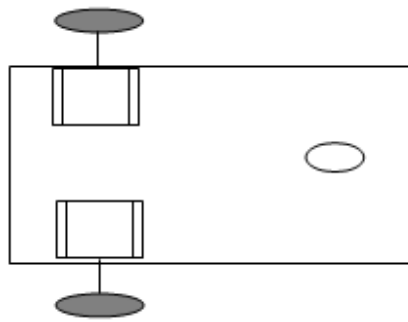


Figure 8 Body of the Robot.

IV. Conclusion

Thus, our Robot system using RF module is a fairly accurate means of transporting goods. It achieves the goal within less time and also consumes lesser power. Thus with the above advantages and hardly any short coming, the system has bright prospect for application in industries

References

- [1] Ankita Saxena, Abhinav Saxena "A new generation grid solver Robot system for object picking using shortest path" 2012 IEEE.
- [2] Atul Patel, Anupam Dubey, Ajitesh Pandey, Siddharth Dutt Choubey "Vision Guided Shortest Path Estimation Using Flood fill Algorithm for Mobile Robot Applications" 2012 IEEE.
- [3] Yichao Li, Xiaoling Wu, Dongik Shin, Weijun Wang, Jianing Bai, Qing He, Fei Luo, Weimin Zheng "An Improved Line Following Optimization Algorithm for Mobile Robot".
- [4] Zhuang Cai, Lu Ye, Ang Yang "Flood fill maze solving with expected toll of penetrating unknown walls for micro mouse" 2012 IEEE.
- [5] Brooks, R.A., "A robust layered control system for a mobile robot", IEEE Journal of Robotics and Automation, vol. 2, no. 1, (1986): 14-23.
- [6] Thirumurugan. J, Kartheeswaran. G, Vinoth. M, Vishwanathan. M, "Line following robot for library inventory management system", International Conference on Emerging Trends in Robotics and Communication Technologies (INTERACT), pp.3-5, Dec 2010.
- [7] Jae Sung and Byung Kook Kim, "Minimum-Time Grid Coverage Trajectory Planning Algorithm for Mobile Robots with Battery Voltage Constraints", International Conference on Control, Automation and Systems, 2010.