ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

Line Tracking Pick and Place Robot Using RFID Technology

Sarabudla Harshith Reddy, Bharadwaj Vangipuram, Gattu Vishal

B.E, Dept. of ECE, MVSR Engineering College, Hyderabad, India

ABSTRACT : This project is about the working of an autonomous robot which is a pick and place robot with the help of line tracing. The project includes three main parts which are electric circuit, mechanical design and programming. To build a good autonomous robot, the robot must be very easy and free to be controlled by the pilot to ensure that it can perform well. Usually, the robot is used to pick and place items, for certain functions in the factory, send the container from the front of the line to the end of the line. Essentially, this robot uses multiple sensors to control the direction that has been lined with black tape and robot using multiple motors for motions. This project focuses on the use of PIC as a controller, the motor as a mover and sensor as the line guider. This robot works completely controlled by software that is programmable.

KEYWORDS : Line follower robot, Microcontroller, Radio-frequency identification (RFID), RFID Tag.

I. INTRODUCTION

A robot can be defined as a programmable and self-controlled device consisting of electronic, electrical or mechanical devices. More generally, it is a machine that functions in place of a live agent. Especially desirable are robots working for some functions because, unlike humans, they never get tired; They can work in the physical conditions that are uncomfortable or even dangerous; They can work in airless conditions; They must not be bored by repetition; And they cannot be distracted from the task at hand. This article is based on research that is an autonomous robot that will be used in the food industry. The robot is powerful, reliable and can be used in the hot area temperature where the people after working so long to get sick and exhausted. The most obvious reasons associated with the installation of robotic systems in the food industry saves on manpower, improved quality and efficiency, the ability to work in a hostile environment, increased uniformity and flexibility, increased yields and reduced wastage. In today's fast paced world of industry for competition is very fierce. Time is more than money than ever before. Efficiency and productivity are very important. In order to increase efficiency and productivity, losing time in each process should be eliminated. Walking time to transfer an object is a loss of time. This loss of time can be reduced or eliminated by using mobile robots with arm may carry a heavy load may have to carry many people. In this way the man power is reduced. Many factors must be considered in the workforce. The most important factor is fatigue. Break time should be given to avoid fatigue. Compared with human, robots can repeat the information continuously. In addition to fatigue, idleness and indolence of the operator, are factors contributing to low efficiency. WHY nowadays automation recommended power over man. The main purpose of ESTA is to develop an autonomous mobile robot for pick and place for raw materials in the industry. The project of a mobile autonomous robot industry, line follower technology used for mobility With Control from a microcontroller. The mechanical design of the robot is the most complex and difficult part of this project compared to circuit technology. Mechanical construction include the construction of a database of wheels for movement, a strong arm and fixed with joints to bend and an end effector at the end of the arm. End-effector is the part that holds the object, and then carries it drops it at another location. These operations may be programmed in a microcontroller in the correct sequence. Only when the mechanical construction is complete we can start with the electronic circuit design and interface them requirements for a good robotic design includes

1) The robot should be as light as possible.
2) The arm must be sufficiently rigid to withstand the forces generated due
   - Its own bodyweight
   - The weight of the object to be lifted.
   - The inertia forces due to changes in speed
   - Centrifugal forces due to changes in speed

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

• The cost should be minimized

II. EXISTING SYSTEM

In the technology before they were many methods used to design and implement and different algorithms were used to navigate the moving robot. Unlike bar codes, they require no clear line of sight to get an accurate reading. As the cost of high barcodes, we use RFID tags. The most common and popular navigation Suggested techniques in the art generally fall under one of the following categories: map-based technique, dead-reckoning-based technology, landmark-based technologies, vision-based technologies and behavior-based technology. Each navigation technology has its own advantages and disadvantages.

A. Dead reckoning : Dead reckoning allows navigation position, heading, linear and angular velocity of an autonomous mobile robot and it is widely used because of its simplicity and easy maintenance. The shortcomings of the dead reckoning navigation system are some small errors and sensor accuracy drifts that inevitably lead to increasing cumulative errors in the robot's position and orientation, unless an independent reference is periodically used to correct the error. To overcome these shortcomings, researchers Their attention shifted to the landmark-based mobile robot navigation system.

B. Landmark based navigation : Landmark based navigation strategies depend on the identification and subsequent recognition of various features or objects in the environment that may be known or extracted dynamically. But because of the noise of the sensors and possible change in the environment, perhaps recognition process functions or objects may be difficult. To solve these problems, some researchers investigated vision-based navigation system.

C. Vision based navigation : Where a mobile robot makes use of visual features to guide itself in the environment. Such techniques also have some disadvantages, which include the lack of information depth, complex image processing algorithms with high computational burden, and dependence on the working environment.

D. Behavior based navigation : Another research avenue was to select the behavior-based navigation system. This type of paradigm was credited for being suitable for unstructured environments because they can run into the large number of sensors. Also, they can, together with tools for calculating intelligence such as fuzzy logic, neural networks, genetic algorithms, and various combinations of them. Anyway, behavior-based navigation technology also requires a high computing power and in some cases they lead to some significant cumulative errors due to the unavoidable noise associated to the sensor. To overcome some of the disadvantages of the above mentioned technologies, integrating RFID systems recently emerged as a promising alternative method of navigation. In some studies, RFID tags were placed in predefined locations on the canvas and the robot was already equipped with RFID readers communicate with the tags during its navigation in the environment.

III. PROPOSED SYSTEM

To overcome the above problems we are using a different technique and microcontroller. The utilization of RFID technology is novel and might escalate the existed automation system. The PIC (16F877A) Microcontroller is used to control the proposed autonomous mobile robot and communicate with the RFID reader. Due to the uniqueness of RFID tag, the moving is controlled by commands such as turn right, turn left, speed up and speed down etc. The autonomous mobile robot can read the moving control commands from the tag and accomplish the proper actions. The novel localization system for a mobile robot is proposed to improve the efficiency of the system.

A. Electronic Design : The components that are needed for the electronic circuit design includes an LED, potentiometers, Phototransistor pairs, resistors, RFID Tag (transponder) and Reader, DC Geared motors, Motor Driver IC's and a microcontroller. The microcontroller used here is PIC 16F877A. Either L293D or ULN 2003 IC can be used as motor driver but ULN2003 requires relays to provide supply to the motors.

B. Block Diagram : The overall operation or design of the robot is classified into five blocks that is Power Supply block, Line Follower block, Controller block, Motor Driver Circuit block and the Radio Frequency. The power source used is a 12V DC rechargeable battery. This 12V supply is given directly to the motors used but for the operation of the IC's 5V supply is required and thus a regulator is connected to the output of this 12V battery. 7805 is a voltage regulator integrated circuit. The voltage source in the circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator maintains a constant output voltage. 7805 provides a +5V regulated power supply. Capacitors of suitable values are connected at input and output pins depending upon the respective voltage

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

levels. The optocoupler or optoisolator is a device that uses a short optical path to couple an electrical signal from one area to another. The optocoupler is a component that contains the elements required for an opto-isolator

• Light emitter: Light emitter is on the input side and takes the incoming signal and converts it into a light signal. Typically light emitting diode is used as the light emitter.

• Light detector: Light detector detects the light from the emitter and converts it into an electrical signal. The light detector can be a phototransistor.

IV.LINE FOLLOWER

The line follower is an autonomous robot that automatically detects and follows a dark line drawn on the floor. The path consists of a black line on a white surface or vice versa. The control unit sense the line and steers the robot to follow the path while consistently correcting the wrong moves using a feedback mechanism thus forming an effective closed loop system.

A. Basic design Requirements : The robot uses PIC 16F877A L293D, infrared sensors, LM324, platform consisting of a toy car chassis or handmade cardboard sheet chassis and two motors for controlling the wheels. Infrared sensors are attached to its bottom to detect the black surface to capture the line position with the help of optical sensors called optocouplers mounted to the robot at the front end. The opto-coupler is used to transfer electrical signals. When the sensors senses a black surface, output of comparator LM324 is low logic and for white surface the output becomes high it reports to the microcontroller for controlling and steering of the motors. Microcontroller PIC16F877A and motor driver IC's L293D and ULN 2003 are used to drive the motors.

B. Basic operation : The basic operations of the line follower are as follows

• Capture line position with the help of optical sensors. For this an optocoupler is used. The sensing process requires high resolution and high robustness.

• Steer robot to track the line with any steering mechanism. For this purpose, we use two motors governing the motion of the wheels.

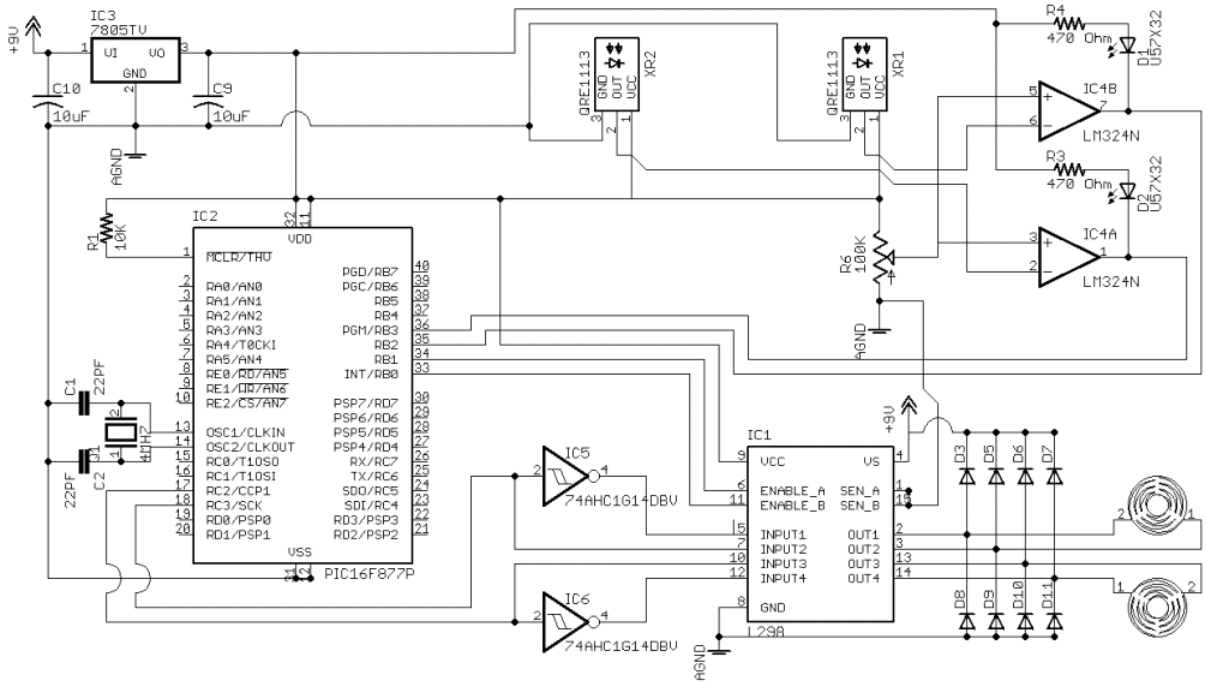

Fig1: Line Follower Circuit

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

V.RADIO-FREQUENCY IDENTIFICATION (RFID)

Radio Frequency Identification (RFID) is a wireless non-contact use of radio frequency electromagnetic fields to transfer data in order to automatically identify and track the tags attached to the items. Some tags require no battery and run and read at short distances via magnetic fields (electromagnetic induction). Other uses a local power source and emits radio waves (electromagnetic radiation at radio frequencies). The tag contains information that is stored electronically can be read from up to several meters away. Unlike a barcode, the label need not be within line of sight of the reader and may be embedded in the tracked object. The output of the microcontroller is insufficient to drive the motor. Thus, a driver IC is required between the micro and the engine that amplifies the output signal from the controller. The L293D is designed to provide bidirectional drive currents up to 600 mA at voltages from 4.5V to 36V.

A. Sensors : A Photodiode is a p-n junction or p-i-n structure. When an infrared photon of sufficient energy strikes the diode, it excites an electron thus creating a mobile electron and a positively charged electron hole. If absorption occurs in the junction's depletion region or one diffusion length away from it, these carriers will get swept from the junction by the built-in field of the depletion region producing a photo current. Photodiodes can be used under either zero bias (photovoltaic mode) or reverse bias (photoconductive mode). Reverse bias induces only little current (known as saturation or back current) along its direction. But a more important effect of reverse bias is broadening of the depletion layer (therefore expanding the reaction volume) and strengthening of the photocurrent when infrared rays falls onto it. There is a limit on the distance between IR LED and infrared sensor for the pair to operate in the desired manner. In our case distance is about 5mm. IR reflective sensors have one emitter (IR LED) and one receiver (Phototransistor or photodiode) which constitute a pair. They are placed in such a way that the light emitted by the LED is collected by the photo-transistor which brings a change in the resistance. If reflects the rays if it is a white surface and it will be sensed by the receiver, similarly it absorbs the light for a black surface and receiver doesn't sense any rays. Photodiode has a property that if IR rays fall on it its electrical resistance comes down (i.e. its comes down from 150kΩ to 10kΩ if no noise present). For sensing this change in resistance we use a voltage divider circuit. The output signal from the sensor is fed as an input to the inverting terminal of the comparator which compares this signal with the reference voltage set by a potentiometer manually which is fed to the non inverting terminal of the comparator .When the sensor or emitter pair is on a reflecting surface, the sensor is on low impedance mode in which one can easily view as LED corresponding to that sensor doesn't glow. The output of the OP-AMP is high signal and this high signal is given to the microcontroller. And when the sensor is on a non reflecting surface, it is off i.e., High impedance mode in which one can easily view as LED corresponding to that sensor glows and low signal is given to the microcontroller. The resistance of the sensor decreases when it receives the IR rays. A good sensor will have about zero resistance in the presence of light and a high resistance in the absence of light. The reference voltage of the comparator is fed to the inverting input of the comparator by a trim pot or a tuning device connected between the supply lines. LM324 is a comparator IC that digitizes the analog signal from the sensor array. Since the output of LM324 is TTL compatible it can be directly fed to the master microcontroller. The generalized connection diagram of Sensor Interfacing with microcontroller is shown below. The tuning potentiometer is used to set the reference voltage level of the comparator. In other words, it is used to adjust the sensitivity of the sensor.

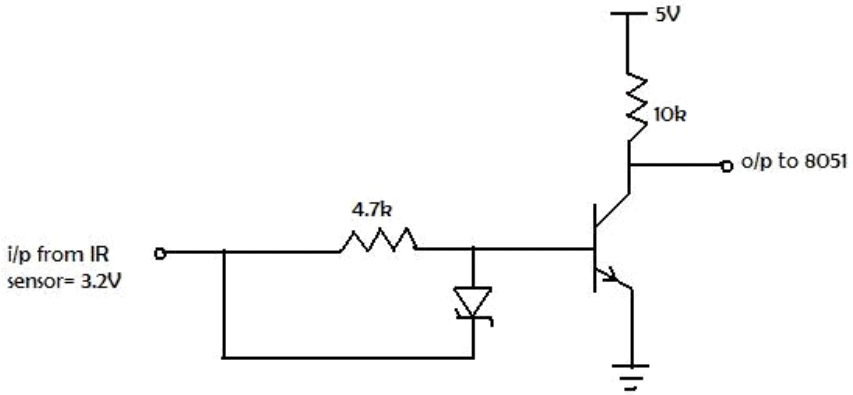

Fig.2 Sensor interfacing with microcontroller

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 10, October 2015

B. Basic Operation : When the power supply is given, the robot moves over the black line by continuously sensing the black and white surfaces. When the RFID reader detects the RFID tag, the mobility of the robot is stopped and the arm to picks to start the object. Once the object is picked, the robot continues moves over the black line and on sensing the other RFID tag, the robot stops and drops the object and the same operation is continued.

VII.CONCLUSION

An autonomous robot which can be controlled using wireless technology and this robot follows the line and moves to the desired location and performs pick and place operation of item .These Robots can be deployed in vital locations and can also be used in the military for rescue missions. These Autonomous unmanned robots can communicate with ad hoc network and can perform even better.

REFERENCES

1.Mustafa Alani, Widad Ismail, and JS.Mandeep, Active RFID system and applications. Electronics World, 115(1877):22–24, 2009.
2.Amit Kumar, M. Manjunata, A.K. Majumdar, J. Mukhopadayay and Rusha Patra, "An Electronic Travel Aid for Navigation of Visually Impaired Persons", 3'd International Conference on Communication Systems and Networks, pp.1-5, January 2011.
3. Barroso J, Faria J, Fernandez H, Martins P, "Electronic White Cane for Blind People Navigation Assistance", World Automation congress,pp.l-7,September 2010.
4. Oimitrios Oakopouslos and Nikolaos G.Bourbakis, "Wearable Obstacle Avoidance Electronic Travel Aids for Blind: A Survey", IEEE Transactions on Systems, Man and Cybernetics, Vo1.40, No.1, pp.25-35, January 2010.