The Line Follower -and- Pick and Place Robot.

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Abstract - Concept of object pick-and-place and Line follower robot which will be functioned following a particular line may help an industry to attenuate the labor cost or may be alternatives of the labors. Nowadays the industries are following the concept of automation and for this purpose robots are the best alternatives. Single type of robot is most commonly used in industry is a robotic manipulator or simply a mechanical arm. It is an open or closed kinematic mechanism chain of rigid links interconnected by movables joints. We have pile up a mechanical arm with a line follower robot which will be able to pick an object from a certain place then carry it to the defined place by following a predefined line. A robotic system that is capable of both picking up and releasing micro-objects with high accuracy, high precision, reliability and speed.

Key words: Line Follower robot, Pick and place robot, Microcontroller, Motor driver, Sensors.

1. INTRODUCTION

Robotics is a branch of technology that deals with the design, construction, operation and application of Robots and computer systems for their control, sensory feedback and information processing. The use of robots in industrial field intensifies the production rate. Robotics in industries has taken an important role and is replacing humans in all the dangerous, menial or boring tasks. They can emphasize on simple repetitive tasks. They can be defined as a programmable device which is self-controlled consisting of electronic, electrical and mechanical equipment. The term "robot" was first appeared in a Czechoslovakian satirical play, Rossum's Universal Robots, by Karel Capek in 1920The various parts of the puppets were driven by linkage and cams and they were controlled by rotating drum.

Line follower robot is known as a learning tool for Automation. It is machine that follows a line either a black line on white surface or vice-versa. Normally, the line is individualized follow the specific path that can be either perceptible like a black line on a white surface with a high contrasted color. Mainly, a fixed microcontroller for the line follower robot attached with the main controller is developed. A proper algorithm system and the embedded program are needed to do it with ease. The various movement systems are accustomed to turning the robot. Mainly, a fixed microcontroller for the line follower robot attached with the main controller is developed. A programming in Arduino and sensory system also associated for fulfilling the operational loop.

Pick and place capabilities are commonly used in manufacturing plans. In today's advanced technology man power are critical constrains for completion of task in large scales. The automation is playing vital role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination. These moves of objects on a specified path to pick the components from one location and place them on desired locations. Basically, the object carrying robot is a microcontroller-based mechatronic system that finds out the object from the particular place, picks the object from location and places at a specific destination. A robotic arm is a robot manipulator configuration, usually using a sequence of function by the controlled program, with resembling functions to a human arm. The robot arms can be self-explanatory or operated manually and can be used to perform different tasks with great accuracy.

2. METHODOLOGY

i. Arduino UNO

It's the main control unit of the robot and also called as brains of the robot. It processes all data and provides the required command to the parts as it is ordered. This microcontroller board based on ATMega32. It has 14 digitals input and output pins among them 6 can be used as PWM outputs, 6 analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. The program can easily be uploaded from the computer through USB cable. It can be powered by both a USB connection and an external power supply.

ii. IR sensor module

In this Arduino, we have used IR Transmitters and IR receivers also called photodiodes. The transmitter is an infrared emitting LED and photodiodes acts as a receiver which receives the infrared rays and passes on the signal to Microcontroller. When infrared light falls on the white surface, it's reflected back and caught by photodiodes which generate some voltage changes, at same time IR rays fall on a black surface which is absorbed and no rays are reflected back, thus photodiode does not receive any light or rays. Proper placement and shielding of sensors will go a long way to help get accurate with precision readings off the track.

iii. Ultrasonic sensor

The ultrasonic sensor is a device which can measure the distance to an object by using sound waves and it is based on HCSR04. Ultrasonic sensors (also known as transceivers when they both send and receive) work on the principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively and also bring about high-frequency sound waves and evaluate the echo which is received back by the sensor. Sensors are able to calculate the time interval between sending and receiving the echo to a certain distance to an object.

iv. Motor driver module

Motor drivers are circuit which allows controlling of motors. One needs them because one can't power a motor with just a microcontroller's supply. Motor Drivers are available in IC form, implemented in the form of an "H-Bridge" IC L293D. They allow one to switch on and off a motor using an output from a microcontroller, and the best feature is the permits one to run the motor in both forward and the reverse condition. This means for each motor has 2 dedicated inputs from a single microcontroller, one for direction control and one as an ON-OFF switch.

v. 7- segment Display module

The 7 Segment display can be used to display the data such as time called multiplex display. It uses a specific chip with LED drive and control so that the digital tube can be controlled easier. It has four SSD multiplexed to be operated by 4 display selection pins.

vi. Servo Motor

A Servo motor is a motor which performs a part of servomechanism. Servo motors do not rotate 360 deg freely like a normal standard DC motor. The angle of rotation is limited range is 0-180 Degrees back and forth. Servo motors receive a control signal that constitutes an output position and applies power to the DC motor until the shaft turns to the desired position which determined by the position sensor. It provides fast, high torque, accurate rotation within a limited angle.

vii. Dot Matrix

5 X 7 Dot Matrix LED display is used for displaying symbols. The method of displaying a message on dot matrix displays is the same as seven-segment multiplexing. The column of dot matrix is moving in a very fast means greater than seventeen times in a second and same time changing in a row data source to display some information on it.

viii. Battery

We used lithium battery. Internal or on-board supply requires batteries, which means it needs to be rechargeable because run through alkaline batteries faster than one knows it so, one gets rechargeable ones, l need a charger too. The current capacity, the weight and the rating of the battery also have to be accounted for it.

3. WORKING

[1] Line Follower Robot:

The robot has 3 pairs of IR Transmitter and Receiver and 2 modules with one pair each. These Sensors can be utilized and operated to receive a non-electrical data from the environment and to convert it to an electrical signal. This signal can thus further processed by the brain of our robot. So this is how it works, in the line following mode the sensor sense the white line over the black surface. There are 6 sensors at the bottom of the robot which constantly keep tracking of the black path. When the left sensor senses the white surface, the left wheel slows down and the right wheel takes a

turn. The same process takes place when the right wheel senses the white surface. When both sensors sense black line it goes on straight with both wheels rotating at the same speed. Ultrasonic sensors can be used to solve for the most complicated tasks involving object detection or the level of measurement with millimeter precision because their measuring method works reliably under almost all conditions.

The Ultrasonic sensors transmit ultrasonic waves from its sensor system and again receive the ultrasonic waves reflected from an object. By measuring the length of time from the transmission to the reception of the sonic wave, it detects the position of the object at the same time the bulb will blow. The 7 segment display interfacing with 8051 Microcontroller to calibrated an IC timer that overall time taken to complete the job. The robot is working perfectly as per accurate design and functionality. The robot was tested on a path tracking testing which resulted in sensing of white line over a black surface.
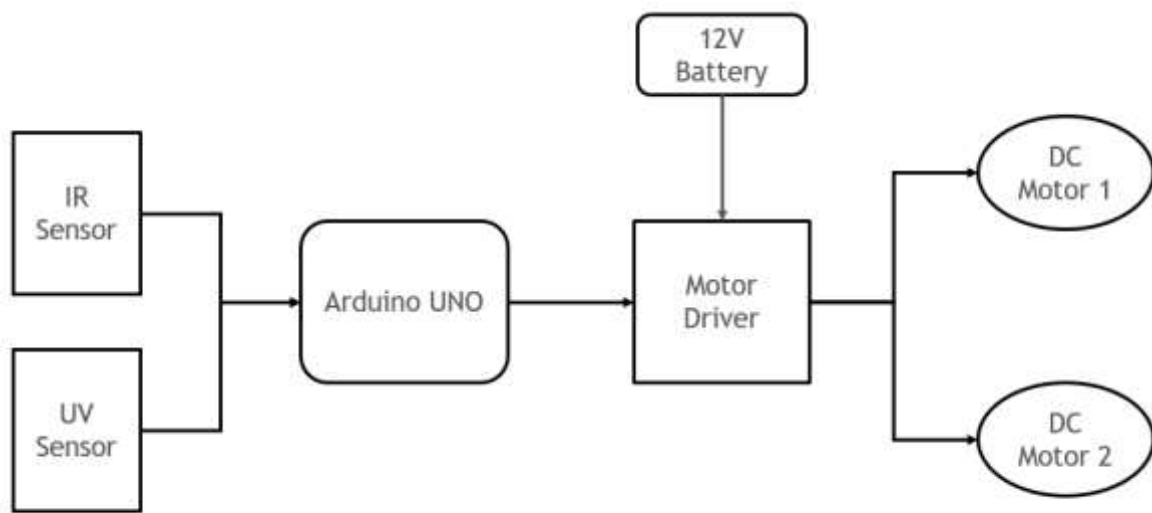

Fig 1: Block diagram of Line follower robot

Fig 2: Implemented Line follower prototype model

[2] Pick and Place Robot:

The robotic arm is a type of mechanical arm which is usually programmable, with similar functions to a human arm and human-controlled based system. The pick and place robotic arm consists of a robotic arm placed on a moving vehicle (chassis) on a particular position. The vehicle which is able to move along any type of surfaces irrespective of it is smooth or rough. The pick and place robot uses four motors for the operation of the chassis and two motors for the arm assembly for the up and down motion and one servo motor for the pick and place operation. The pick and place arm

consists of an arm assembly with a jaw controlling, which is able to move in open and close direction. For the controlling of the motor, motor driver IC and Atmega328 microcontroller are used to work in elements from any source to destination. The input signal or controlling signal is given from a wireless play station, which is interfaced with the microcontroller by an RF receiver module. When the signal is sent from the play station it is decoded in the controller and proper controlling signal is sent to actuators (dc motors or servo motor) in the system. The motors were selected according to the torque required for the working system of the robotic arm.

Fig 3: Bluetooth control panel for pick and place robot

The mobile App Sends Numbers Through The Bluetooth Connection (Serial Communication), The Arduino Receives This Numbers And Check The (If Conditions) In The Arduino Code Then Executes The Instructions If The (If Condition) Returns True, For Example: If the Press The Forward Button On The Mobile App, It Sends Number (200) Then The Arduino Found That When It Receives (200) Go Forward, So The Car Will Move Forward. For Instance: If I Press on the Gripper Angle 0 On the Mobile App, it sends the number and the Arduino receives this number then go to the (if conditions) and executes the instruction for the (if conditions) which returns perfectly in this case.
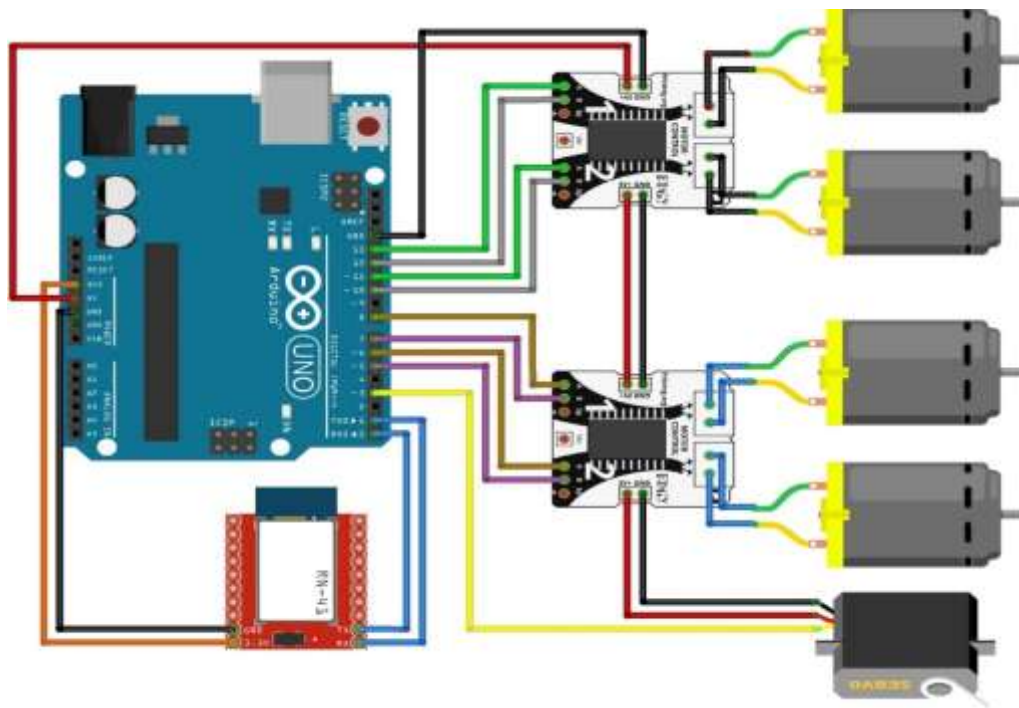

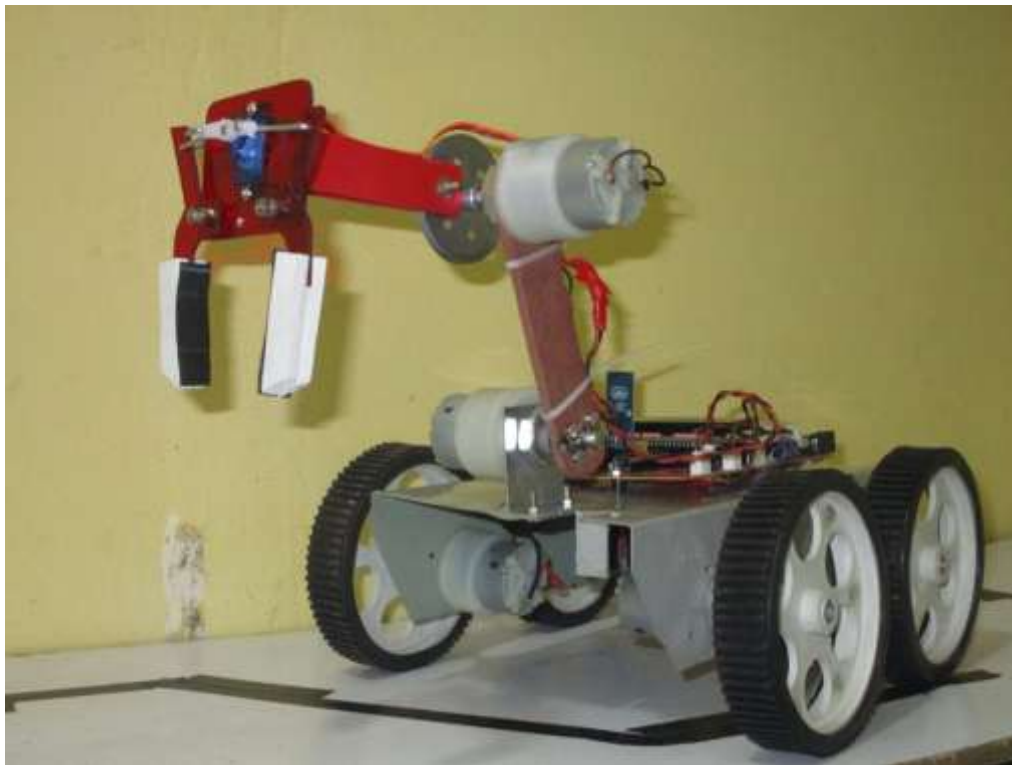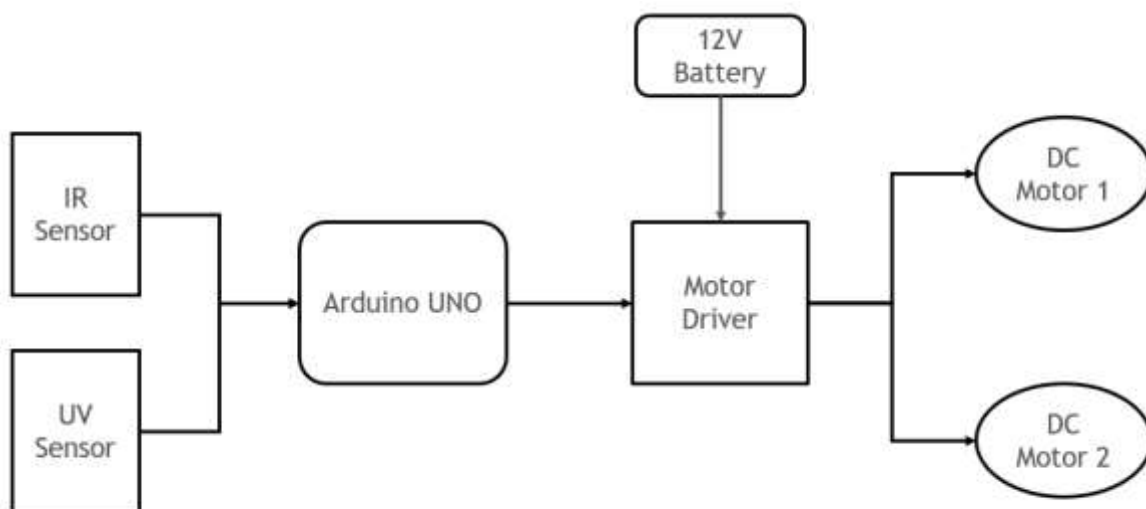*Fig 4: Schematic representation of pick and place robot*

Fig 5: Implemented Pick and place prototype model

4. CONCLUSIONS

The aim of this project is the development of an automatic pick and place robot arm controlled using Arduino. The pick and place robots are popular in industries, where repetitive tasks are present. Since the assembly line is mostly about fixing different parts into the right section of the end product, it is best done by the pick and place robots which can work effectively without being bored. In the modern era, time and manpower are major constraints for the completion of a task. The proposed system is capable of lifting weights by introducing high torque providing motor large weights can be picked.

The coordinates of the line are transmitted serially. The Arduino is given as an input to pin library and its output of pin library is used to drive the servo motor attached on echo library. By using the slider mechanism accurate motion with the help of ultrasonic sensor is achieved. Many sensors used in a robot simultaneously collaborating each other the

same situation can be implemented in the Industry "Clean Energy Recharging the World" to create the awareness of efficient energy consumption and clean renewable energy utilization.

5. Future scope

Instead of manpower, the robot will be used in factories, industries to reduce labour and cost of carrying objects. Besides following the fixed-line, the robot will carry the necessary amount of load, it will be greatly useful to industry, supermarket, library, healthcare and home in various applications. Though it is a prototype there may be some imperfections but the actual product can maintain all the following features. Most importantly, the robot will save time which is one of the main factors for rapid production with effective work. So that without any doubt, it can be chosen wherever it is necessary. In future to make this both line follower and pick and place robot much better, the microcontroller can be used which will reduce the cost.

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