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An Autonomous Robot to Perform Wooden Peg Placing Task

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Abstract

As we are living in a country like Pakistan where most of the industrial task was performing manually and now a days are industries efforts to move toward the latest technology and automatic machinery, this research is related to the similar effort in which we have design a general purpose, path following, Autonomous Robot that can perform pre-defined tasks. Basically the theme was to build an autonomous robot which can perform a well-defined task on a certain time limit. It has an important industrial application in displacing and arrangement of stock packages, serving in hotels or any application that involves predetermined station stops. To identify the subject, custom designed IR proximity sensors come into play. Some of the important components are differential drive, IR sensors, DC motors and a controlling device to perform the task according to instructions feed

Keywords: *Industrial robots, Pick and Place Robot.*

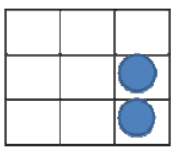
1. Introduction

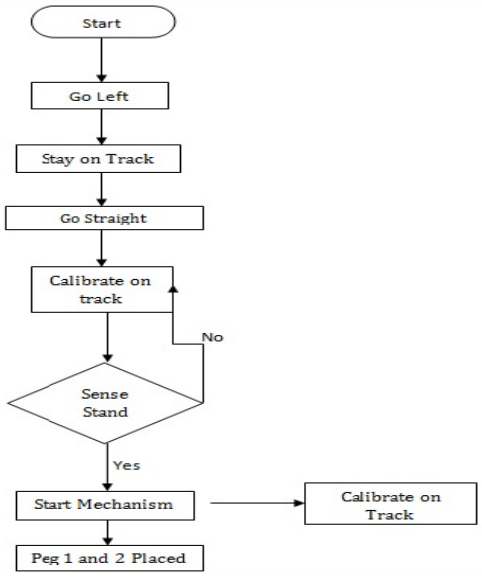
Industrial automation is the use of computing devices to control industrial machinery and processes, replacing human operators [1]. It is a step beyond mechanization, where human operators are provided with machinery to help them in their tasks [2], whereas in automation they are provided with isolation from the working environment and relieved of repeated less productive tasks such as monitoring etc. The most visible part of automation can be said to be industrial robotics [3] . Robots in industries play different roles depending on their mobility features. Some carry out their operations being fixed while others by moving. They use different techniques to execute their movement on the floor, one such technique is line following.

Our design makes use of this modus operandi by employing a line-grid layout for both, robot movement and identification of subjects.

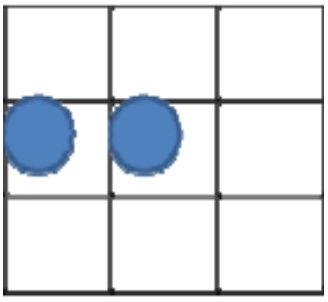
Using the robot we have to place 8 wooden pegs on a stand having 9 holes Following flowcharts will illustrate the whole working of ROBOT.

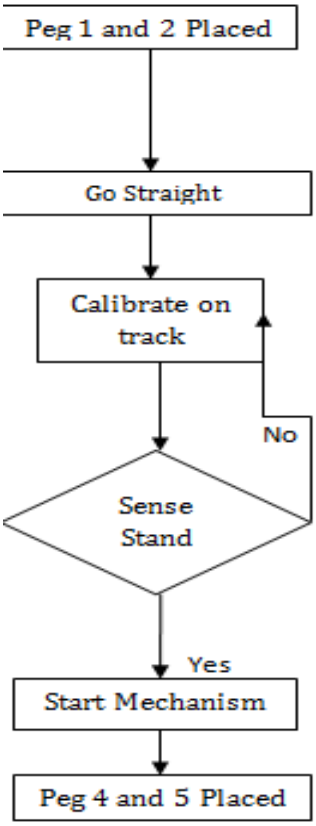
1.1 Flow Chart for compartment 1 and 2



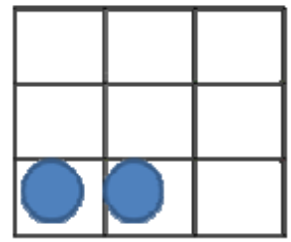


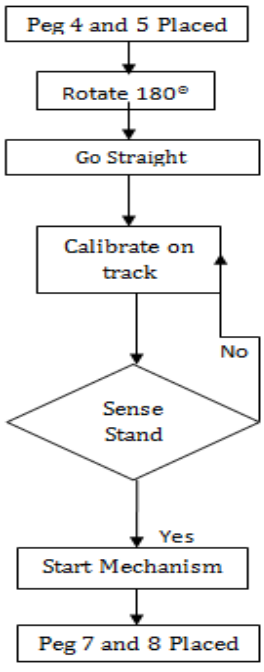
1.2 Flow Chart for hole 4 and 5



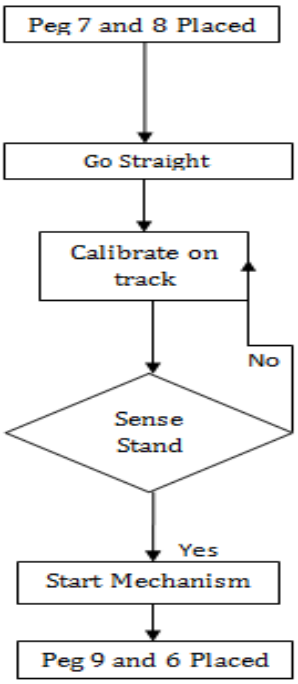


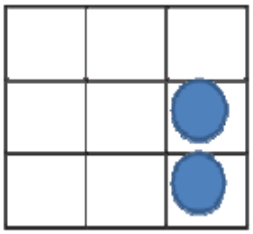
1.3 Flow Chart for hole 7 and 8





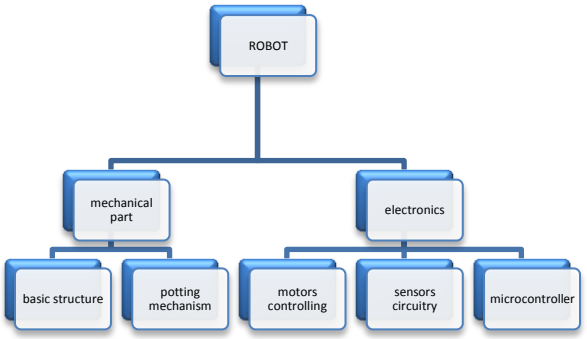
1.4 Flow Chart for hole 6 and 9





2. System Model

The structure and design of a robot is an important feature, which determines its efficient performance in a particular environment, and designing a robot is an art which involves the knowledge of different fields like Software, mechanical and electronic hardware etc.
Figure 2.1



2.1 Mechanical Structure

The robot was designed to ramp, the Aluminum angle was used to construct the basic structure of the robot, a

power window motors were used to move robot in all the direction along with the free wheel, the angle was attached with each other with the help of screws and bolt to make basic structure strong.

Figure 2.2

The potting was consisting of Aluminum cubic box with the dimension of 6cm length and 3cm wide.

There was two motors used in the potting to move the mechanism in forwards direction and other was used to place the peg and one motor is used to rotate the mechanism in the clock and anti-clock wise.

2.2 Electronics Design

Overall System block diagram

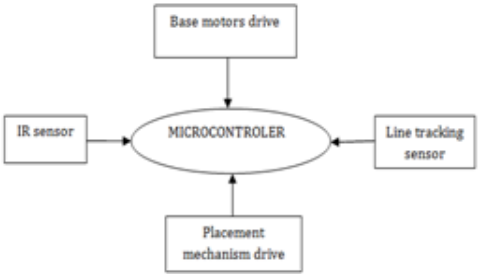


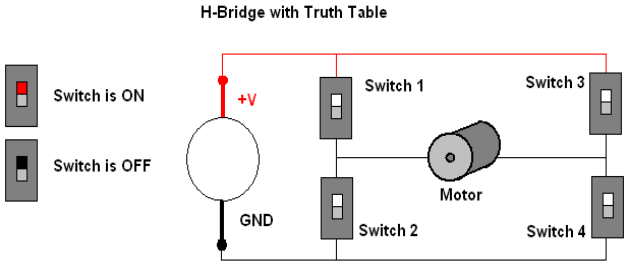
Figure 2.3

2.2.1 Motor Control

We have employed the H-bridge for the bi-directional speed control of the motor. The bridge is designed such that it controls the motor on two speed levels for forward and one for reverse direction. For forward-low, running voltage is 12V, for forward-high, running voltage is 24V and for reverse the only running voltage is 12V

2.2.2 Differential Drive

Differential drive uses the relative movement of the wheels (motors) to carry out its turning motion. The H-bridge has 4 input pins namely H, L, R and G. Control instructions come from the microcontroller in the form of an 8-bit word out of which, 4 bits control the movement of one of the motors. They function according to the following truth table.



Switch 1	Switch 2	Switch 3	Switch 4	Motor Output
0	0	0	0	Motor disconnected
0	1	0	1	Motor braking
0	1	1	0	Motor runs (*current moves left*)
1	0	0	1	Motor runs opposite direction (*current moves right*)

Figure 2.4

The consequences of this configuration can be exploited to perform various different motion patterns. These motion patterns allow better maneuvers for the robot and hence increasing the control over its motion. Other than this differential drive also facilitates rectangular turning, as well as the about turn of the robot.

2.2.3 Sensors

Sensors provide the realization of electrical or digital feedback from the actual physical and natural surroundings. Sensors can be chosen based on the application and purpose of the design.

2.2.3.1Line tracking sensor

These sensors provide the feedback signal to the control circuit, regarding the position and alignment of the robot relative to the grid lines that are specially drawn or placed for the robot to follow.

In our design we have coupled LED-LDR with an opaque partition between them, which ensures that only the reflected light reaches the LDR.

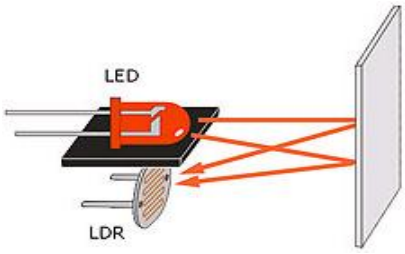


Figure 2.5

We have placed the LED and the LDR deep in a pipe like structure made of an internally reflective material such as Aluminum to provide as much reflected signal from the surface as it can. The pipe like structure helps to block or to minimize the effect of ambient light changes. A shallow design is vulnerable to sense erratic signals and hence providing false feedback.

2.2.3.2 IR Proximity Sensors

IR sensors is used to detect whether the robot has reached the targeted object or not, and if not then it must be an obstacle which can be waited for pass away. To differentiate between the obstacle and the subject we keep check the number of nodes that the robot has crossed so that when the proximity sensor senses an object it compares with the count of nodes and identifies whether the subject has been reached or not.

2.2.4. Control Mechanism

The main controlling device used in the design of this robot is the Atmel's AT89C52 microcontroller, which is based upon Intel's 8052 architecture. It provides cost effective solution to embedded control applications and is thereby used at the heart of the control mechanism.
The port 0 of the controller is used to give signals to the input terminals of the H-Bridge, drive control of the motors. Due to the inability of the controller to source higher currents, the output from the controller is interfaced with the H-Bridge by opto-couplers. The 4 bits out of the 8-bit word sent by the controller, instructs the H-Bridge to bring the motors' movement in any of the four possible modes.

3. Conclusions

In this paper we presented an economical and easy way to design a robot that is able to perform pre-defined tasks. Simple modifications and enhance component can make this robot able to work in industries according to the application.

4. References

[1]http://manmaik.blogspot.com/2011/01/what-is-automation-what-are-steps.html
[2]http://manmaik.blogspot.com/2011/01/what-is-automation-what-are-steps.html
[3]http://manmaik.blogspot.com/2011/01/what-is-automation-what-are-steps.html