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Industrial robot for pick-and-place applications

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Abstract

Robotics can improve life quality of the society, production in the industry, logistic time improvements through the use of logical programs that together with sensors and actuators can achieve great goals, together we have created a robot that will upgrade the way the industry works. The purpose of this project is to make easier and faster the material transportation.

Keywords: pick-and-place, mobile, industry

1. Introduction

It has always been an arduous job to maintain an orderly and controlled inventory in the industry, for this reason we will focus on the design of a robot able to carry items and save them in the stores of the industries, allowing them to improve their flow of raw material inside and outside their establishment.

This paper shows the technical description and material needed to accomplish the goal of placing the items in a small amount of time.

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2. Function of components

To achieve the objective and fulfill the competition rules, a complete analysis of the necessary components was made. The following list shows a list of the main components and a brief description of its usefulness within the project:

- LiPo Battery: stores a large amount of energy; enough to give life to our robot.
- LiPo Balancer Charger: During the competition there are two rounds, between each round depending on the voltage that our battery has, we will charge this as many times as necessary, as well as to make tests before the competition.
- Circuit board: We will use a printed circuit whose function will be to control the speed and direction of rotation of the motors of our robot by means of the following electronic materials: MOSFET, couplers, resistors, base for circuit, terminal blocks and copper ceramic plate.
- Microcontroller: This electronic board will be programmed to process and translate the electronic signals into actions that help us to achieve the goal.
- Omni-wheels: These wheels are special because they allow our robot to move in any direction in a two-dimensional space.
- Step-motor: This motor allows the robot to move the gripper up-and-down through an endless screw.
- 360° servo-motor: This motor opens and closes the gripper to take and leave the items.
- Vex motors: These four motors are coupled to the omni-wheels and move the robot around the area.
- Driver A4988: This driver controls the spin-direction of the step-motor.
- Driver L298N: This driver controls the spin-direction of each one of the four motors, allowing to move in any direction of the plane.
- 7805 Voltage regulator: Provides the needed output to avoid damage of the 5V components.
- Acrylic, PLA and aluminum: The structure of the robot that supports all the parts and electronics.
- Other materials: Screws, nuts, wires, rubber.

3. Robot design

The robot is designed to satisfy mainly the next key points:

3.1. Objective

The following set of rules of the competition influenced the design and construction of the robot:

- The robot must satisfy size and weight specifications.
- The robot must start and finish in the marked yellow area (80 cm x 80 cm).
- The robot must be capable of picking and placing objects (dimension of objects: 15cm x 15 cm x 5cm).
- The objects must be placed inside the correct location so that both colors correspond.
- Two objects can not be arranged horizontally on the same square. But they can be stacked vertically.

3.2. Cost

Due to low budget, we designed a low cost robot manually-controlled using only the elemental components to achieve the desired goal.

Material	Cost (US Dollars)
Kit CNC	68.20
Acrylic	67.50
Electronics	12.95
Metal Forge	16.00
Mini-Arena	6.50
Tools	103.21
Motors	60.00
Wheels	60.00

3.3. Quality

Although the robot is low cost, the material was carefully selected to build a trustworthy and lightweight robot that will accomplish the main tasks.