Robots classifiers

TDP (Team Description paper). LARC 2010. IEEE Open Category

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***Abstract*— Due to the large overall development of the world population of this epoch and the high demand for products and services it requires, each day becomes more indispensable the use of technology in industry, distribution centers and warehouses, to collect, sort and deliver products and merchandise. The use of service robots is a great alternative to the need for optimization, efficiency, flexibility and speed for this type of classification work.**

The goal: developing a prototype robot that allows collecting a set of packages from a production area to vendors area, as required by the rules. The packages are represented by objects with form of cubes with different colors.

The strategy to meet the goal is based on the collection and classification of the cubes simultaneously. In the collection, the robot picks up the cubes one by one from a stack and places them in a storage structure according to the corresponding color. At the end of the way when all the blocks are stored, the robot goes to the vendor area, to put the blocks in an orderly manner in specific areas of the scenario, pushing the blocks from the storage structure.

For the manipulation of the blocks, the robot uses a clamp that moves vertically and horizontally, while the mobility of the entire system depends of eight engines, which allow greater mobility. For the color detection, an optical sensor is used with an artificial neural network.

I. INTRODUCTION

The large global population growth and heavy demands on goods and services requires strategies and technological tools that allow satisfy those needs effectively, in which the robots have taken a leading role in modern industry, fully meeting the requirements of efficiency and speed in the handling of products or packages.

In manufacturing companies, distribution centers and warehouses of products is always necessary to move packages from one place to another, where efficiency and speed translate into lower production costs, in turn, to supply the demand minimizing the time delivery.

Each company has its own requirements on the transfer and classification of products, so there is no standard or unique robot design to complete this task.

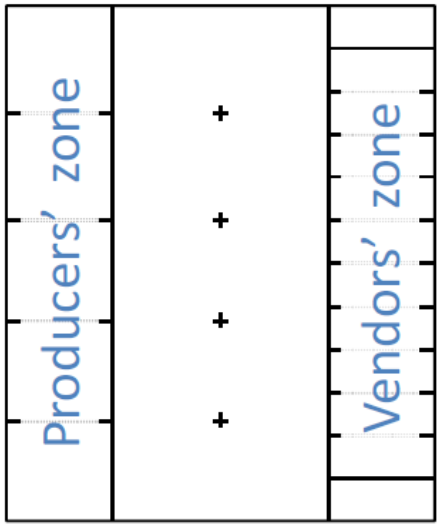
LARC 2010, Open Category has its own package management requirements, which will be analyzed to build a prototype robot made from readily available materials by students.

The prototype robot in question should be placed in the scenario model and then go to manufacturers area, which have five stacks of blocks, each stack has 12 wooden blocks and will be of a particular color. In this area, the robot must pick up the blocks using the collection strategy implemented, sorting the cubes by color and then go to the vendor area, where it must deposit 12 groups of five blocks in specifics areas from the scenario.

To accomplish this task, the robot will have a maximum of five minutes, so it is necessary to correct the movement optimization to place as many blocks as possible. It is estimated that the robot can place 30 blocks in this interval of time.

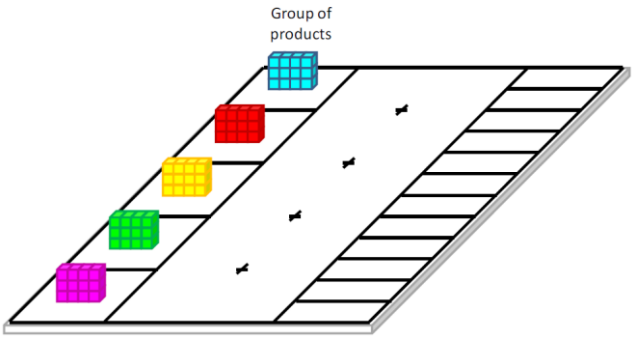
II. STRATEGY FOR THE COLLECTION AND CLASSIFICATION OF BLOCKS

The scenario model consists of a rectangular 200x240cm with white melamine surface, wherein each zone is delimited by spaces constituted by black lines 1.8mm with tape. Has four possible starting positions for the robot, represented by crosses. The robot's starting position is determined randomly, as well as the orientation of the same on scenario.



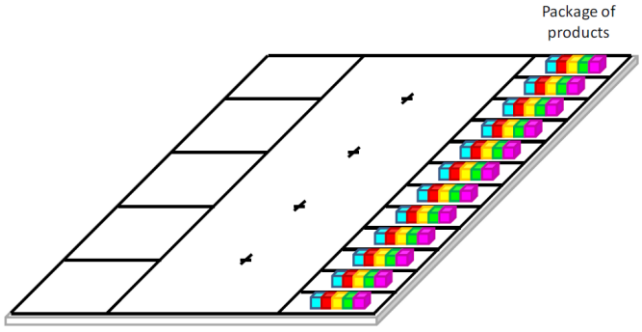
Definition of zones (superior view)

The blocks in the producers´ zone are distributed in piles of 4x3 blocks, and its are at the center of five areas identified. The location is as follows (the colors are chosen at random):



Initial situation

While the blocks in the vendors´ zone, must be deposited as follows (with the exact colors shown in the picture):



Desired final situation

The strategy used, first to establish the whereabouts of the blocks from the starting position of the robot making a sweep with an ultrasonic distance sensor.

Determined the location of the manufacturers area, the robot will go to one end of the scenario, where it began to collect a group of colored blocks using a clamp that moves horizontally and vertically. The color is specified when the clamp is holding a block, then gets up and placed in the appropriate column store. The robot has five columns store, for each color.

Completed a particular color, the robot moves toward the other blocks, to performing the same procedure to scroll through the five stacks or the five colors of blocks. The robot can carry up to 15 blocks, which means it can handle three sets of blocks at a time in order.

In the vendor area, the robot is positioned in each designated area, wherein the horizontal movement mechanism push the five blocks of the columns below warehouse until they are completely out of the robot. The same procedure is carried out in several areas of sellers until the completion of the cubes stored in the robot.

The robot has a square form and its mobility is made with eight motors (two in each corner) for a configuration of multiple movements.

III. COLOR DETECTION

The color detection system on the robot is composed of a light sensor (LDR) and a RGB LED. The sensor works only over short distances, so it is placed on the mechanical clamp is directly in contact with the blocks.

To capture color light up sequentially and three-color LED gives a voltage sensor for each LED on, obtaining the three RGB color components of the opaque object for this system. Such voltages normalized to enter an artificial neural network, which allows (with prior training) rank the five colors of the cubes without calibration or processing analytical methods.

IV. CONTROL

The robot control is effected by a PIC18F series microcontroller as the master device, which receives information from sensors and in turn communicates with the slave chips (other PIC microcontrollers), which is responsible for controlling the position of the robot and motorized parts robot.

The master PIC is responsible for the intelligence of the robot, then decide based on information from the sensors to take actions at all times, such as scrolling, search block, catch, sorting by color, etc.

The robot also has a 16x2 LCD display that reports the general conditions such as sensor values, battery, general variables, states, etc

V. CONCLUSION

The design of a robot prototype classifier allows the development and study of new methodologies, ideas and control form in the industry, intervening and improving those critical factors upon which the collection, sorting and delivery of products efficiently and quickly, points of vital importance that every company should consider in their task of growth and expansion.

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