

Design of Material handling pick and place Robot System using Zigbee Technology for Communication

Savitha H Goudar

M.Tech Student

Under the Guidance of

Sushma S J

Associate Professor

Department of Digital Communication &

Networking GSSSIETW

Abstract — Robot manipulator is an essential motion subsystem component of robotic system for positioning, Orientating object so that robot can perform useful task. The main aim of our work is to handle materials by picking and placing objects from one place to another in a single pick and place robotic arm. This robot can be self-

Operational in controlling, stating with simple tasks such as lifting, placing and releasing in a single robotic arm. The main focus of our work is to design two robotic arms for the above mentioned purpose and display status of parent and child on task completion. Robotic arm consists of revolute Joints that allowed angular movement between adjacent joint. Robot manipulators are designed to execute required movements. By using this collaborated mechanism the success rate of pick and place robots are increased.

Keywords — multi-robot; pick-and-place; design; coordination algorithms; practical tool

INTRODUCTION

Pick and place robots are essential in industrial systems due to their effect on saving labor costs, and doing required tasks rapidly and accurately. In particular, they can be used to perform different tasks depending on the production requirements. Mainly they are used for assembling, packaging, bin picking, inspecting, and picking and placing products from one conveyor belt to another. Although the use of pick-and-place systems in industrial applications has been operative for many years, the design process must deal with many challenges which have yet to be overcome. The sizing process of a team of robots to be used in pick-and-place applications is a lengthy and usually complicated process since it depends on a high number of variables that are sometimes unknown, or not easily measurable and, when measured, may assume different or random values during execution. For these reasons, the design process of the multi-robot system becomes complex and usually heuristic methods are used to perform this task.

I. SCOPE OF PICK AND PLACE ROBOT IN PRESENT PROJECT

In the present project, Two robots start moving with IR

sensor attached to the robots' for detecting the objects in place. On detection of object, the object is picked and placed from one location to another location by communicating with each other for task completion. It continues to its location, does its work at that location and stops. Thus, a co-operative system of individual robots that interact with each other and perform tasks is created. At a bigger level, if more number of such robots is considered to perform tasks in this fashion to achieve perfection and finish task without any human effort. This system can be used for various applications in the field of home automation, military services, manufacturing industries and many more. In this paper we have used Zigbee modules as a communication medium for the robots.

To address the problem statement, the sizing procedure must take into consideration a large number of variables which can be grouped into two main categories:

- Product characteristics: depending on the production in terms of the number of products that have to be picked in a given time together with the consideration of how these products are distributed on the conveyor belt, i.e., in a constant flow or haphazardly. The size of the product as well as the distance between them also affects the result.

- Robot characteristics: the robot type affects the cycle time or time required to do a pick-and-place task. Characteristics such as the type of gripper influence how many parts are picked at the same time. The motion control law used to define the dynamics and the trajectory planning optimization algorithm to pick and to place different parts has also to be taken into consideration.

II. LITERATURE REVIEW

John Iovine [1], in this book various aspects of designing a Robot is described. It deals with different types of Arm design, controlling techniques, vehicle design etc. ER. Rajput, in this book the operation and control of robots is discussed.

Arduino cookbook, in this book details and methods of interfacing hardware components such as DC motor, Servo motor and RF Transmitter and Receiver is been discussed. The other references listed in the references section discusses similar concepts in its various fields such as color identification and segregation robot, robot for surveillance, pick and place robot controlled using android etc.

displays' its task completion status on LCD.

III. PROBLEM STATEMENT

The pick and place robot being implemented to ease the process of sorting, process of moving heavy materials etc. Usually the transfer process of the heavy materials is being carried out, using man power and if the transfer process is repeated for a period of time, it can cause injuries to the operator. By using the particular robot the operator, will no longer have to bent and lift up heavy loads thus preventing injuries and increasing the efficiency of the work. Operator will make mistakes whether small or big in a while. In the industrial world, the industry cannot afford to take any kind of mistakes. As every mistake is costly whether in terms of time, money and material.

IV. OBJECTIVE

The main objectives of this project are:

- To provide two robots forming a distributed system that can be used to pick and place the elements from any source to destination by using IR sensor for detection of objects in place.
- To communicate between two robots to display the status of task completion.

V. METHODOLOGY

In the present project, two robots start moving towards their target locations by detecting the object using IR sensor and perform the task of pick and place. On completion of task, the status of child robot is sent to parent robot and the task completion status is displayed on LCD display. Thus, a co-operative system of individual robots that interact with each other and perform tasks is created. Knowing their own present locations, the robots communicate using the Zigbee Wireless communication system.

The block diagram of the proposed system is shown in Fig1 and Fig2. It consists of an Atmega328 Microcontroller IC, four DC Motors with driver IC, two servo motor, power supply for each robot and Zigbee transmitter and receiver. The pick and place robotic arm consists of a robotic arm placed on a moving vehicle (chassis). The vehicle 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, two servo motors for the operation pick and place operation. The pick and place arm consists of an arm assembly with a jaw, which is only able to move in up and down direction. There are two motors for the arm assembly, one for the up and down motion and other for jaw opening and closing. For the controlling of motor, motor driver IC and Atmega328 micro controller is used.

All the four motors are instructed to move in the forward direction by the controller for both parent and child robot. Hence chassis moves in forward direction in each case.

When the IR sensor detects the objects, it performs pick and place of object from one place to another through movement. Similar task of pick and place is performed by two robots individually acting as parent and child. On completion of the task, the task completion status of child is sent to parent robot displaying the same on LCD. Also, the parent robot

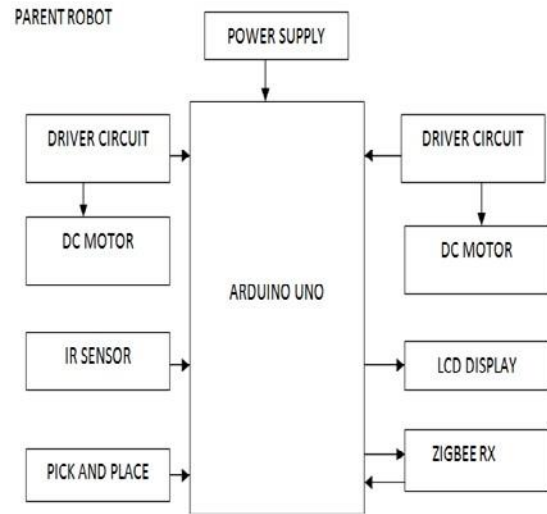


Fig. Parent-Robot block diagram

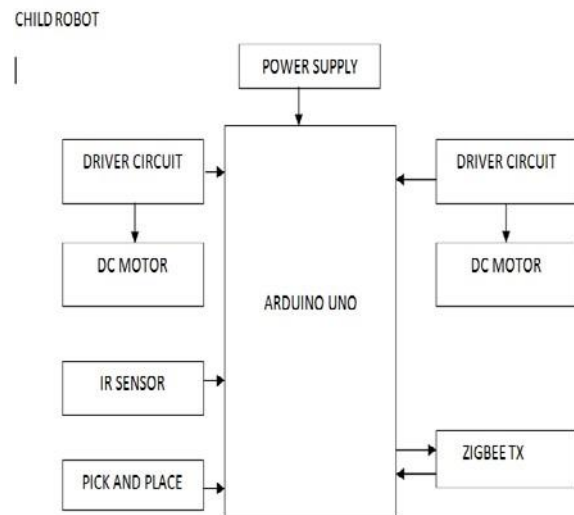


Fig. Child Robot block diagram

A. Algorithm for Parent Robot

- 1) Start
- 2) Switch ON Power supply.
- 3) Initialize the object sensor
- 4) Obtain the distance of object from the object sensor
- 5) Check the detection of object sensor.
- 6) If it is detected Stop the vehicle and perform pick and place otherwise keep moving till object detected.
- 7) On task completion, display the status of task completion on LCD.

B. Algorithm for child Robot

- 8) Start
- 9) Switch ON Power supply.
- 10) Initialize the object sensor

- 11) Obtain the distance of object from the object sensor
- 12) Check the detection of object sensor.
- 13) If it is detected Stop the vehicle and perform pick and place otherwise keep moving till object detected.
- 14) On task completion, send the status of task completion to parent robot for display on LCD.

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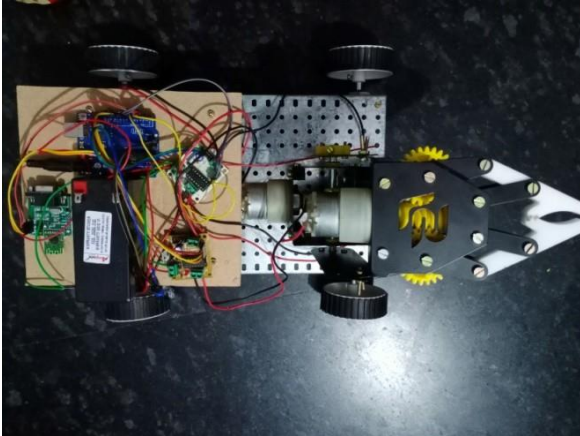


Fig. Fabricated Robot

VI. CONCLUSION

The proposed concept of pick and place robot using Arduino is implemented via Zigbee protocol. It is found that, the robot so implemented has the ability to locate itself to the location where the object to be lifted is available with the help of chassis and four dc motors. Further depending upon controlling action provided to servo motor it lifts the object and locates the same at required destination. Further sends information of task completion to display the same on LCD.

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