Continuous Visual Feedback Warehouse Robot using Raspberry-Pi

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***Abstract*- The aim of the project is to focus all axes of manipulator to lift, carry and unload the objects at a desired location. This requires a precise drive motion control that incorporates electric motors as a drive system. Raspberry pi for processing the vision data, separately making the vision system capable of recognizing the required object as per program commands. The pick and place robot is one among the technologies in manufacturing industries which is meant to perform pick and place operations. The system is so designed that it eliminates the human error and human intervention to get more precise work. Arduino is an open-source electronics platform supported easy-to-use hardware and software. Materials handling is easy and it is applicable in warehouse and it can be used in industrial robot application.**

Keywords- Visual feedback, pick and place, Raspberry-pi

I. INTRODUCTION

Considering many years' people try to take the place of human work with machines. Machines are faster and more effective than humans. The term robotics is practically defined as the study, design and use of robot systems for introducing new methods of robots. Robots are usually performed unsafe, risky, highly repetitive, and causing discomfort tasks A robotic arm handles multi-part variables and distributes an assortment of single stuffs to their ultimate position in a single authorization. It transports by dropping the number of touches, allocations and conveyors required to run present sorters. The pick and place mechanical arm can be a human controlled based system that detects the thing ,which picks that object from source location and places at the specified location. In this project we are presenting a robotic arm which can choice up and insert the things. The soft catching gripper cast-off here holder objects safely. Based on the user guidelines the robot travels and pick and place the substances. The robotic arm used here is identical to human arm which is automated to perform the pick and place role.

II. LITERATURE SURVEY

According to this paper a robotic system that can automate the task of picking and stowing objects from and to a rack in an e-commerce fulfilment warehouse. The system primarily comprises of four main modules: (1) Perception module responsible for recognizing query objects and localizing them in the 3-dimensional robot workspace; (2) Planning module generates necessary paths that the robot end effector has to take for reaching the objects in the rack or in the tote; (3) Calibration module that defines the physical workspace for the robot visible through the on-board vision system; and (4) Gripping and suction system for picking and stowing different kinds of objects. The perception module uses a faster region-based Convolutional Neural Network (R-CNN) to recognize objects.[1][16]

Here author explained that a mobile dual-arm robot and an automated order picking system including the robot for warehouses that contain various kinds of products is made as a prototype. In this design the robot can automatically move to the front of the shelf that has a target product, fetch the product from the shelf and put the product in a carton transported by an automated guided vehicle by the use of self-localization, model-based object recognition and arm trajectory planning. Taking into consideration the storage situations and the sizes of objects, the robot makes two arms collaborate and mounts tables to lift and rotate two arms and four different types of end effectors. The robot successfully picked out bottles in a case and picked up two different sizes of boxes directly placed on shelves with different heights in experimental tests. Eventually, proposed system can automate whole order picking operations in warehouses which is currently operated by workers.[2]

In this proposed system various controllers are used in the arm. A robot is a system that combines many subsystems which interacts and the environment in which the robot works. The end effectors in the robotics are a device at the end of a robotic arm, which is designed to interact with the environment. Gripper is used to grasp any physical thing that may be any instrument or human hand. These are the main objectives. In order to achieve this goal it is intended to incorporate a simple linkage actuation mechanism. In the proposed system an AC motor is used along with spur gears and a threaded shaft arrangement. The gripper performs the basic function of picking, holding and grasping of objects by a DC motor and it forms the mechanism for the spot welding. The basis of this project is human hand which develops a robotic gripper. And it is the source of inspiration to achieve the sufficient level of dexterity in the domain of grasping and manipulation.[3]

In this paper, the design analysis of a Remote Controlled "Pick and Place" Robotic vehicle has been presented. The man should always take safety precautions at workplace even in its environment and able to handle some specific tasks, like sending the robotic vehicle to hazardous environment to obtain samples for chemical analysis. A

typical Robotic Vehicle is can travel over various region and traversing obstacles. Robotic arm which is having five degree of freedom with its base is placed on top of the vehicle. The body consists of four drive wheels coupled to the ends. The wheels are selectively powered to travel the vehicle.[8]

In this paper author explained, the first and foremost goal of this research and development project is to build an automatic pick and place robot for material handling systems. This automatic pick and place robot integrates object detection with the pick and place method where by the identifying of an item would power up the item gripper; kick starting the pick and place process. With the purpose of building a user friendly and reasonably system, the developed model high sufficiently shows the use of technology in material handling systems. There are several categories of pick and place systems. For example, portable things handling systems, industrial manipulators. This kind of pick and place robotic arm with chassis can be freely moved from one end to another. A pick and place robot manipulator can be used to identify and detach an item and place it in a methodological arrangement to get a final destination. A pick and place use few operators and produce intense output with efficiency. With a wide space it is used in distinct industry to pick a distinct item and place in allocated destination.[10]

This paper proposes an Autonomous Robot system for Warehouse using Image Processing. There are different quite Robot which may be divided into several categories this technique deals with wheeled autonomous robot. Which has no vision? The PC or MATLAB will maintain the vision with the assistance of camera or web camera. The most purpose of this paper is to avoid obstacle and find shortest path for image processing based robotic technique in known environment. By avoiding obstacles along the way the proposed system finds and analyses an optimal path for a Robot. Web camera or the other camera will first capture the highest view of the warehouse as a picture. Template matching method is employed to get the shortest path then obstacle detecting methods are performed to spot the obstacles within the known environment.[15]

III. METHODOLOGY

The system consist of raspberry pi as a microcontroller 293d motor driver module for the motors, pick and place robotic arm, 4 wheel chassis robot and camera. The whole module is controlled by the android app, the android app will have the buttons to control the movement of the robot i.e. forward, left right stop and there will be some buttons for pick and place both the device needs internet connection. Using the camera module we can visualize the live streaming. Raspberry pi is used to make the robotic arm vehicle wireless. Pi cam is interfaced with raspberry pi and then the videos are transmitted wirelessly to the observer (user's monitor) from where the user can control the robotic arm vehicle movement. This is a reliable connection and a continuous video feedback is enabled to control the robotic vehicle.

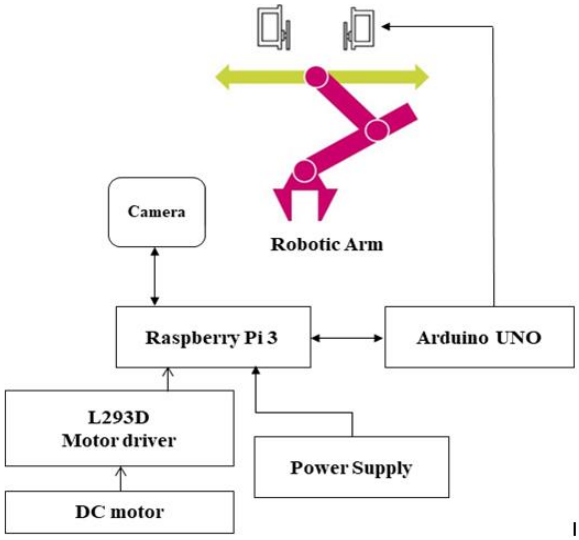

Fig. 1. Block diagram of the robotic system

The flowchart of the model is shown in the figure. Initially the system captures the frames, that the pi camera which is interfaced with raspberry pi will capture the object position. Next the distance from the system to the object is calculated. The arduino UNO which is interacted with movement of robot commands the vehicle to move towards the object. The robotic arm picks the desired object which in turn is visualized in android app. The arm moves and it places the object in destination.

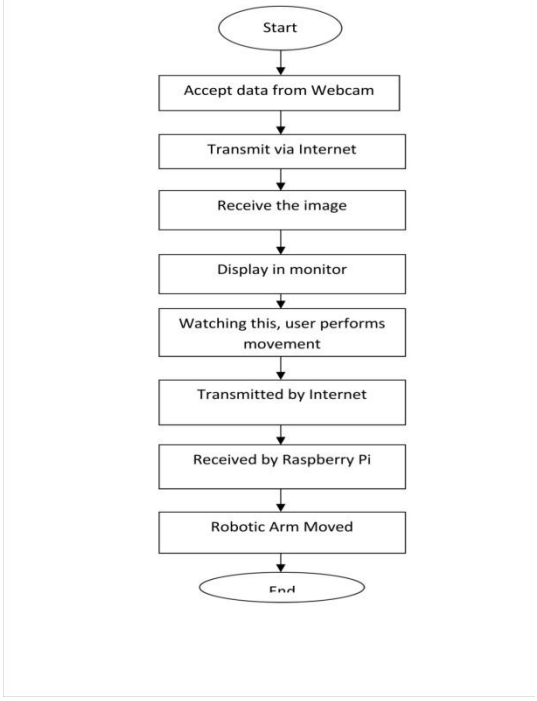

Fig. 2. Flowchart of the system

IV. SAMPLE CODE

Here we use some software requirements like Java, Raspain, and Python. Java is a general-purpose programming language that's class-based, object-oriented, and designed to possess as few implementation dependencies as possible. Java was originally developed by James Gosling at Sun Microsystems

and released in 1995. It is an object-oriented language almost like C++, but with advanced and simplified features. Raspian OS is one of the official operating systems available for free to download and use. The system is based on Debian Linux and is optimized to work efficiently with the Raspberry Pi computer. As we already know an OS is a set of basic programs and utilities that runs on a specified hardware, in this case the Pi. Debian is very lightweight and makes a great choice for the Pi. The Raspbian includes tools for python programming, browsing and a GUI desktop.

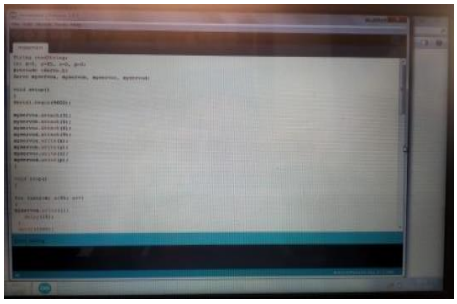

Fig. 3. Arduino code

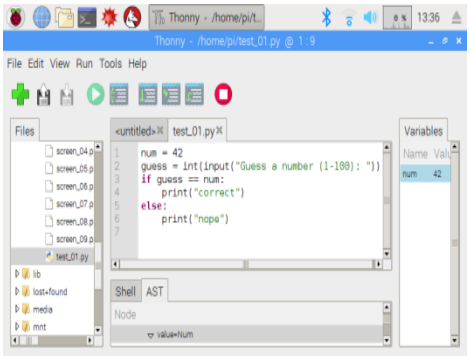

Fig. 4. Python code

And also we used Android application for controlling purpose. Android may be a Linux based OS it's designed primarily for touch screens mobile devices like smartphones and tablet computers. The OS has developed tons within the last 15 years ranging from black and white phones to recent smartphones or mini computers. One of the foremost widely used mobile OS lately is android. The android is software that was founded in Palo Alto of California in 2003.

V. APPLICATIONS

- Robot can be used for materials handling in case of large volumes in the e-commerce fields.
- It is effectively used in warehouse management system in Amazon, flip-kart etc.
- Robotic can be used in industries for pick and place of object by monitoring it from remote place through android app or touch screen.

VI. RESULTS

Automated robot that will pick and place objects from racks or shelves. Robot will be operated remotely using camera streaming. Controlling of all the operation will be done using android app or a touch screen.

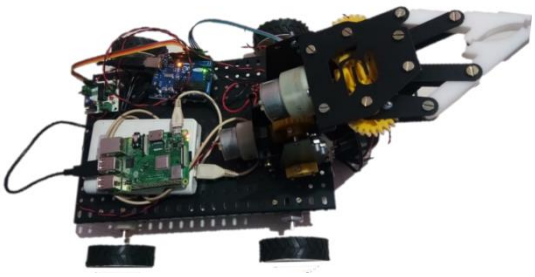

Fig. 5. Robotic vehicle

VII. CONCLUSION

This paper describes a controlled robotic arm with continuous surveillance of actions. The aim of the project is the development of automatic pick and place robotic arm controlled using arduino. The robotic arm used here contains a soft catching gripper which safely handles the object which can work round the clock without being tired or bored. In the modern era man power and time are major constraints for the completion of a task. By the use of robot the industrial activities and hazardous operations can be done easily and safely in a short span of time. The proposed system is capable of lifting objects and thus it overcomes some problems in warehouses.

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