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AUTOMATIC PICK AND PLACE ROBOT ARM WITH FIRE FIGHTING UNIT

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Abstract— Robotics is the branch of engineering science & Technology related to robots, and their design, manufacture, application, and structural disposition. In this highly developing society time and man power are critical constrains for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination. This project is referring to the design of robot that capable to move and extinguish fire automatically. Implementation of this robot is tested with high fire temperature to evaluate the sensitivity of detecting, after that expunges the fire by using water mechanism.

Adjustable gripper for robotic system that is capable in identifying shape and size of an object is needed in many applications especially for picking and placing operation. This is due to some of the grippers' design are limited only to one specific shape or size that make picking and placing operation difficult.

The main objective is to design a robust gripper that can perform easier and faster picking and placing operation for multiple shapes and sizes objects. This adjustable gripper for robotic system can to improve the picking and placing operation in manufacturing field in producing more outputs without the needs to. The proposed vehicle has a water jet spray which is capable of sprinkling water. The sprinkler can be moved towards the required direction. The advent of new high-speed technology provided realistic opportunity for new robot controls and realization of new methods of control theory.

Keywords — Robot ARM, Fire Sensor, Arduino Controller, Motor.

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I. INTRODUCTION

Robotics is the branch of engineering science & Technology related to robots, and their design, manufacture, application, and structural disposition. Robotics is related to electronics, mechanics, and software. Robotics research today is focused on developing systems that exhibit modularity, flexibility, redundancy, fault-tolerance, a general and extensible software environment and seamless connectivity to other machines, some researchers focus on completely automating a manufacturing process or a task, by providing sensor based intelligence to the robot arm, while others try to solidify the analytical foundations on which many of the basic concepts in robotics are built [1]. In this highly developing society time and man power are critical constrains for completion of task in large scales. The proposed vehicle has a water jet spray which is capable of sprinkling water. The sprinkler can be moved towards the required direction. The advent of new high-speed technology provided realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent robots using new robots control devices, new drivers and advanced control algorithms. This project describes a new economical solution of robot control systems [2]. The presented robot control system can be used for different sophisticated robotic applications. Whether due to technological curiosity to build machines that mimic human's or desire to automate work with machine, research in speech recognition as a first step towards human-machine communication. Pick and place is one of the most famous applications which have been used widely. This pick and place operation is done everywhere and every time because a lot of human movement involves picking and placing objects [3-5]. Pick and place robot can be defined as a simple robot, often with only two or three degree of freedom and little or no trajectory control, which the main function is to transfer items from one place to another. A pick and place robot has been

strategically programmed to pick literally any object and to place it wherever required. The pick and place operation is very common in pharmaceutical industry, electronic industry, food industry and consumer goods industry [6].

For industrial profitability, manipulators that able to perform such motions in the shortest possible cycle time are required. For this purpose, the gripper should able to perform the task at high speed and high acceleration. In order to fulfill the criteria of an adjustable gripper that able to perform pick and place operation with difference size and shape of object, the robot must have feedback input that can control robot's movement and actuator. The smart device is one of the important electronic equipment need to be considered because the gripper robot involved with adjustable mechanism [7]. This smart device which is conceptually referred as sensor-actuator subsystem with rich sensing and also function as the feedback input to the system for identifying various object with different shape and size [8]. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination [9].

II. PICK AND PLACE ROBOT

The pick and place robot is a microcontroller based Mechatronics system that detects the object, picks that object from source location and places at desired location. For detection of object, infrared sensors are used which detect presence of object as the transmitter to receiver path for infrared sensor is interrupted by placed object.

Our work focuses on multi robot coordinated manipulation as defined in multiple end effectors may interact with the same object during the task, either subsequently or at the same time. In this letter, a novel approach to perform object moving that can handle multi arm robots is reported.

Vision software recognizes the object present in the scene and then an operator selects the final goal for the object through a user interface. A high-level plan is generated on a suitable graph representation built using information stored in a database (DB), and it is then translated into a Cartesian plan that will be executed by the robot.

The robot arm can be designed in a number of different ways, the size and shape of this arm is critical to the robotic architecture of the robot. The arm is the part of the robot that positions the final grabber arm or spray head to do their preprogrammed business. If the design of the arm is too large or small, this positioning may not be possible. Many arms resemble the human arm, containing shoulders, elbows wrists and hands.

III. FIRE FIGHTING ROBOT

The Fire Fighting Robot Competition is an international competition where the challenge is to design and construct a Fire Fighting Robot which would and its way through an arena that represents a model house, and a lit candle that represents are in the house, and extinguish there in the shortest time whilst avoiding any obstacles in the robots path. As the contests web page states, the main purpose of this contest is to "provide an incentive for the robotics community to develop what will be a practical application for a real-world robot". Although the competition is considered a simulation of the real world in order to be able to know the robots could be able to do on the large scale.

The arm robot is the crucial part in the pick and place robot. The first stage in the design process is to design the gripper and select the actuator to control it. After that, the arm of robot will be designed to support the gripper without disturbing its operation. The size, length and weight of the gripper will be determined according to the requirement.

Normally, the mechanical design of the gripper is based on average adult human. The mechanical design of robotic gripper needed to address the required interaction between the robot and the environment in order to grasp and hold the object securely when executing the operation.

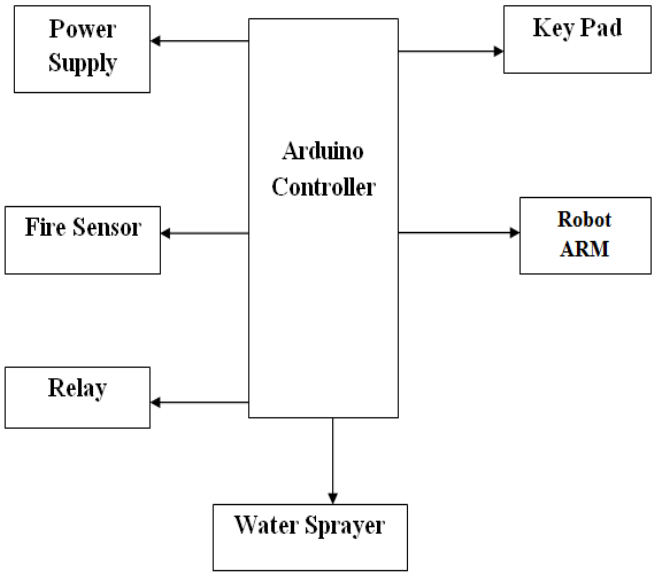

Fig.1. Block Diagram

The electronic part of this design robot involve with sensor circuit, onboard microcontroller development and motor and driver to power up the system. The electronic system for pick and place operation is shown in Figure 6. The input of this operation is photoelectric sensor also known as color sensor and the main controller is Arduino microcontroller. Each part plays important task as Manual input will take the size of the object that needs to be picked by the adjustable gripper.

IV. WORKING

A. THE POWER SUPPLY:

To drive every one of the segments in the transmitter segment 5V dc and 12V dc are required. The mains give the 230V air conditioning. The 230V air conditioning is ventured down to 12V air conditioning by utilizing venture down transformer. At that point the yield is given to the full wave rectifier. The rectifier takes out the negative crest voltage of the info voltage .The yield of the rectifier is the throbbing dc. The blunder heartbeats are dispensing with by utilizing capacitor channel. At that point the yield at the parallel of the capacitor is the 12V dc. In any case, the Micro Controller takes a shot at 5V dc .To change over the 12V dc into 5V dc a controller is utilized.

B. ROBOT ARM FUNCTION:

Rotation speed of mechanical component being measure of full rotations completed in one minute for motor called revolutions per minutes or RPM. Selecting a suitable DC motor is also important as each DC motor has different rate of speed, torque, input voltage, power and dimension. DC motor requires either high torque or high speed where high torque equal to slow speed but strong when stopping or holding meanwhile high speed is faster but not strong when stopping. Normally, DC motor that high torque being used for heavy task such lifting, starting movement for heavy robot and holding item where DC motor with high speed being use for task that need quick and easy task such as pick small and light weight item.

The planning of the behavior is starts by configuring the size of object that need to be picked up using sensor at the gripper. Then, the sensor at the main structure indicates the movement of arm robot in term of height. After that, object will be picked and be held before arm robot being raised upward until certain height as indicated by the sensor at the main structure. Finally, the arm robot will place the object back in it position after being held few seconds and arm robot will be back to its initial position.

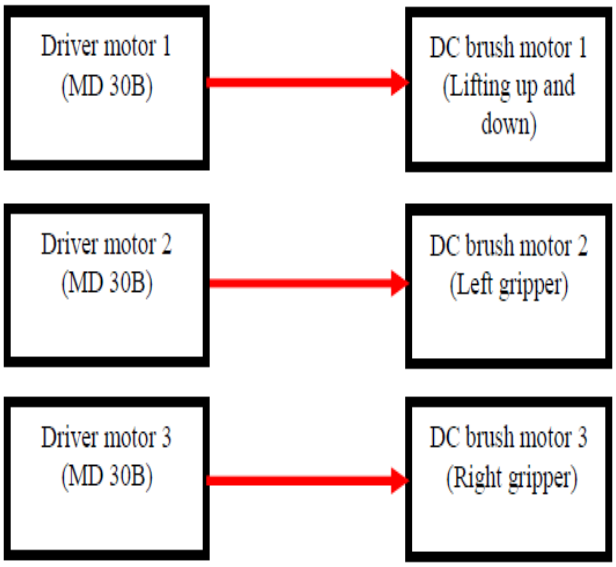

fig.2. The connection between motor drive and DC brush motor

C. FIRE FIGHTING ROBOT:

The microcontroller forms this information as indicated by the information got that is which order is acquired. To give the orders to the robot switches are utilized here are four switches are associated for forward, in reverse, right and left development of the robot. The robot is stacked with water tanker and a pump which is controlled over remote correspondence to toss water. At the accepting end five engines are interfaced to the microcontroller where four of them are utilized for the movement of the vehicle and the one is to position the arm of the robot. What's more, one DC pump engine is utilized for the activity of the water pump. The receiver translates before nourishing it to another microcontroller to drive DC engines by means of engine driver IC for vital work. A water tank alongside water pump is mounted on the robot body and its operation is carried out from the microcontroller yield through appropriate signal from the transmitting end. The entire operation is controlled by PIC microcontroller.

V. RESULT AND DISCUSSION

The robotic vehicle, i.e. transmitter section and receiver section had been designed and the programs were burned into both the PIC microcontrollers at receiver and transmitter section. The project is successfully tested for all the commands and it also detected the fire with the help of a flame sensor. Once

the flame is detected, a buzzer is activated and a motor drives the water pump.

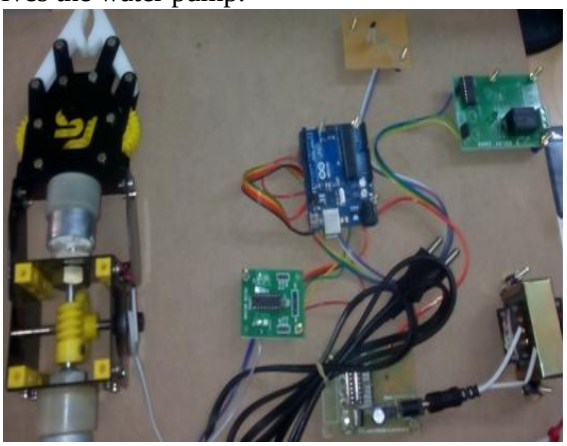

Fig.3 Hardware Implementation

The commands are provided by pressing the switches connected on the transmitter section for forward, backward, right and left movement of the robotic vehicle. A camera is provided to get the live video feedback of the room for the smooth movement of the robot.

VI. ADVANTAGES, DISADVANTAGES

1) Advantages:

1. Prevention from dangerous incidents.
2. Minimization of ecological consequences financial loss a threat to a human life.

2) Disadvantages:

1. Doesn't predict nor interfere with operators thoughts.
2. Cannot force directly the operator to work.

VII. CONCLUSION

In this project we are designing and fabricating of a 4-DOF manipulator has been successfully completed. With reference to many available manipulators and mobile platforms in market, a practical design for the manipulator has been perceived and computer aided designing tools. The designing of a sustainable system to control the speed and orientation of a geared DC Motor was successfully implemented in this paper. DC motors have speed control capabilities which means that speed, torque and even direction of rotation can be changed at anytime to meet new condition. The security system of the home and building contains fire fighting robot security vehicle, RF module. The main controller of the fire fighting robot is a microcontroller. We programmed the microcontroller to control the robotic vehicle to acquire flame sensor data, and run the vehicle towards fire by giving directions using speech recognition module. Once the flame is detected by flame sensor, buzzer is activated. The water pump is activated in automatic mode.

VIII. FUTURE SCOPE:

In the present condition it can extinguish fire only in the way and not in all the rooms. It can be extended to a real fire extinguisher by replacing the water carrier by a carbon-di-oxide carrier and by making it to extinguish fires of the entire room using microcontroller programming. Also the robot could not be run through the batteries because at some conditions the current requirement for the circuit rises to about .8A which is very high and cannot be obtained using batteries.

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