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AUOTOMATIC PICK AND PLACE ROBOT

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ABSTRACT

In this paper we deal with the implementation and creation of a Pick and Place Robot(P2R) using PIC microcontroller, sensors and wireless feedback. The implementation of the system is based on a simple, flexible and easiest control technology. The robot system has commands like for open and close, wrist up and down, base clockwise and anticlockwise, forward and backward, left and right.[03]

Pick and Place and Home position to moving the wrist purpose. Implementation of pick and place operation of the object using these commands are discussed. The mechanical hardware design of the Robotic arm based on connected double revolute joint mechanisms is briefed. The purpose of this paper is to design and implement a PIC microcontroller based on reliable and high performance robotic system for various industrial purpose and manufacturing lines. The robot is capable of picking objects and places them into particular area. For Example; The robot is capable of picking unbaked biscuits tray and places them into furnace and then after baking it picks the biscuits tray from the furnace. A special gripper is designed to pick and place the biscuits tray with flexibility.[08]

The pick-and-place processes are the primary requisite for many of the industrial and household application. Finally, the results of the experimental work for pick and place applications are enumerated.

Keywords: PIC Microcontroller, DC motors,L293D, Battery.

I. INTRODUCTION

With the growth of technology, the need of new devices grows accordingly. Computer and electronic sciences is mostly premier in raising the new technologies. Of course the new technology could affect different engineering fields. For instance, if the robotics and artificial intelligence are considered, it reveals that the technology with its high potential, affected many different fields of studies. Therefore related fields of study could be combined to generate new technologies that can be used in wide fields. The robots play important roles in our lives and are able to perform the tasks which cannot be *done by humans in terms of speed, accuracy and difficulty. Robots can be employed to imitate human behaviors and then apply these behaviors to the skills that leads the robot to achieve a certain task . They do not get tired or face the commands emotionally, and since they are designed by humans. They can be programmed and expected to obey and perform some specific tasks. In some cases the use of a robotic hand becomes remarkable. Robotic is applied in different forms and fields to simulate human behavior and motions . Our daily life is virtually affected by robots . The idea of robotic is to create practical and useful robots that facilitate our daily tasks.*

CONFIGURATION	ADVANTAGES	DISADVANTAGES
Cartesian (Three linear axes) x: base travel y: height z: reach	Easy to visualise. Rigid structure. Easy mechanical stop.	Reach only to front and back. Axes are hard to seal. Expensive.
Spherical (2 rotating and one linear axes) Θ: base rotation Φ: elevation angle z: reach	Can reach all around. Can reach above or below obstacles. Large work volume.	Cannot reach above itself. Short vertical reach.
Articulated (3 rotating axes) Θ: base rotation Φ: elevation angle Ψ: reach angle	Can reach above or below obstacles. Largest work area for least floor space.	Difficult to program off-line. Two of more ways to reach a point. Most complex robot.
Cylindrical (1 rotating and two linear axes) Θ: base rotation Φ: height z: reach	Can reach all around. Rigid y, z-axes. Θ-axis easy to seal.	Cannot reach above itself. Y-z-axes hard to seal. Horizontal motion is circular

II. RESULTS AND TABLE: COMPARISON OF FUNDAMENTAL.

Because of the independency of the robots, they have longer life time comparing with the humans and can be helpful in industry, dangerous tasks and nursing homes Most of tools, vehicles, electronic devices and cuisine are built and prepared with the help of industrial robots. For instance, there are industrial robot assembly lines which help in many cases that can operate more accurate and faster than humans.

III. RESEARCH OBJECTIVES

The main objective for this study was;

a) To increase the manufacturing capacity for local industries. b) To increase the labour productivity by the redistribution of labourers in the industries. c) Reducing the cost factor and manufacturing time of a product. d) To eliminate the manual based tasks and operations)To increase the use of robot for various purposes in home based application.

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IV. BUILDING THE KINEMATIC STRUCTURE

Fig.(a) Robot Arm

The first step of designing a robot is to decide the dimension and workspace configuration according to the requirements. The next step is to decide the specification of each an actuators. The structure of the robot is built with compacted wooden sheets in order to decrease the overall weight of the robot. The compacted wooden sheets are also strong enough to keep and hold the whole parts tightly together. The arm is attached to a base which is the most bottom part of the robot. It is important to mention that the base ought to have considerably heavy weight in order to maintain the general balance of the robot in case of grabbing an object.

V. PIC 16F877A MICROCONTROLLER

PIC 16F877A microcontroller has 40 pins and is a popular microcontroller capable of doing complex tasks. This microcontroller has 8192 × 14 flash program memory This consists of 368 bytes of RAM and 256 bytes of non-volatile EEPROM memory. 33 pins are dedicated for input/output pins and 8 multiplexed analogy/digital converters With 10 bits resolution. This microcontroller also has specifications such as PWM generator, 3 timers, analogy capture and comparator circuit, universal synchronous Receiver transmitter (USART), internal and external interrupts capabilities.

VI. SIMULATION RESULTS AND DISCUSSIONS

A virtual circuit containing PIC 16F877A microcontroller and DC motors are designed in Proteus in order to simulate and analyze the Results. There are some simulation steps in order to compile the program And write it on the microcontroller are available. Microcode studio compiles the Hex. File Since there are two types of Motors with different specifications in the arm robot, the Results obtained from the simulation on Proteus differ in terms of pulse width, angle And DC motor behaviour.The simulation considers The rotation angle with respect to the generated pulses with the pulse width ranges.

VII. ROBOT ARM & MECHANICAL GRIPPER

The robotic arm will be controlled via the designed controller and it will be able to grab, pick up and move objects according to their weights and shape.

design is mostly expected to pick up cubes and the geometric shapes like a box.

Depending on the numbers of joints, but generally robotic arms operate using 4 or 5 DC motors. The servo motors are popular for their desirable characteristics for robotic application [11].

- **A mechanical gripper (an end effectors):**

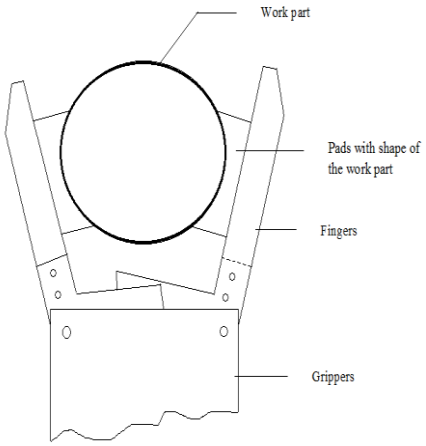

Fig.(b) physical construction method Of finger design

VIII. PROBLEM STATEMENT AND PROPOSED SOLUTION

This study intends to investigate the design, implementation and control of a 5 DC motors articulated robotic arm using DC motors and PIC 16F877A microcontroller. The Advantage of this microcontroller its low cost and in-circuit programmability [10]. The results are compared with the experimental results in order to obtain a general formula to find the exact Fonda required rotating the Motor to the expected degree. With the help of the proposed formula, it is possible to find the exact duration of signal which is required to meet the expectations. Simulation results and real-time robot arm behavior are then compared with the results presented in [10].

In this study robots are reviewed according to their structural properties[11].

- Linear Robots (including Cartesian and gantry)
- Cylindrical Robots
- Parallel Robots
- Spherical Robots
- SCARA Robots
- **Linear Robots**

A robot which has linear actuators cooperating with linear motors linked to a linear axis is known as a linear robot (also known as gantry or Cartesian). This link can be fixed or flexible connections between the actuators and the robot. The linear motor is

- Advantages:
  - Large workspace
  - High speed and stiffness
  - Good performance
  - Good for multiple machines and lines
- Disadvantages:
  - Large structural frame
  - Energy inefficiency
  - Limited workspace

Cylindrical Robots

Cylindrical robots have two prismatic joints: one rotary joint for positioning task and the end-effectors of the robot forms a cylindrical workspace. The main idea of the cylindrical robots is to mount a horizontal arm which moves in forward and backward directions.

- Advantages:
  - No collisions while moving
  - Two linear axis result in simpler design
- Disadvantages:
  - Large structural frame
  - Incompatible with other robots

Parallel Robots

The connection is done by at least two independent kinematic chains which provide the movements of the robot

- Advantages [12]
  - High stiffness
  - High accuracy
  - High load capacity
  - High damping
- Parallel robot disadvantage [12]
  - Limited kinematic dexterity

Spherical Robots

- The spherical robot (also known as polar robot) is huge in terms of size and has a Telescopic arm. Spherical robot basic movements are rotation at the base and angularly Up and down at the arm [10].

- Advantages of spherical robot are as follows [11]
  - Light weight
  - Simple kinematics
  - Compatible with other robots especially with ones in a common workspace
  - Sharp joints level
- Disadvantages of spherical robot are as follows [14]
  - Need of variable torque due to the large size.

SCARA

Selective Compliance Assembly Robot Arm (SCARA) was first designed and invented in early 1960s in Japan. SCARA robots are perfect for the applications which require high speed and repetitive point to point movements. This is why SCARA is used widely in assembly operation [14].

- Advantages:
  - Superb structural flexibility
  - Compatible with other robots operating in common workspace
  - High rotation speed
- Disadvantages:
  - Low accuracy and resolution because of rotary joints and positional errors

IX. CONCLUSION AND FUTURE WORK

- In this thesis, the procedure of building an articulated arm robot using a microcontroller and DC motors . The Building procedure consists of building the kinematic structure of robot, hardware Design and implementation, software design and implementation and microcontroller programming.
- It is important to first simulate the system and then implement it accordingly. It is also essential to consider the built-in oscillator of the microcontroller which is usually 12MHz. Different values of the oscillator can cause the system to not operate properly.

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