An- Najah National University

Faculty of Engineering & Information Technology

Computer Engineering Department
Hardware Graduation Project

Robot bring the selected Object based on shape and using keypad

Supervisor: Dr.Luai Malhis

Students : Eman Hamayel &Rana Abumazen

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Abstract

The demand for technology has increased with the development of life and the use of robots that facilitate human life, which saves time and effort and makes it easier for him to do many necessary tasks such as cleaning, arranging, bringing things based on specific orders.

Our project is a robot that brings the objects of parallel rectangles,
the triangular pyramid and the ball based on the orders of the keypad,
where pressure is pressed on number 4 of the keypad, and the command is to identify and search for the shape of cuboid, and so on. After that, the robot searches for the desired stereoscope as it moves left and right to search for it, of course, by using the camera and when it finds the stereotype it heads towards it and captures it and takes it to the desired location.Therefore the main objective of the project is to design a robot that brings the body based on the required shape and of course this has benefits in the future as it can be developed to bring other things and tools to save more time and effort.

Chapter 1

Introduction

1.1 Problem

With the development of life and it has become more busy and the development of technology and the demand for it in a large and large the need has emerged to use it extensively and to search for simple and easy technological means that make our life easy and simple as the world witnessed a tremendous acceleration in scientific progress during the recent times where many developments in the field of technology appeared, including The appetite for making and using robots greatly because they are useful and that helps in serving the human being and facilitating his life in all circumstances. It has the ability to do household chores quickly and save time.

Where the robot is one of the branches of modern engineering where it enters into engineering disciplines such as mechanics, electronics, computer science and artificial intelligence where artificial intelligence is one of the branches of computer science and specializes in the production of computerized software that simulates human mental capabilities and patterns of work.And other disciplines based on the mission performed by the robot

We will talk in this search for the project that we have done, which is a robot that receives commands to bring the stereotype based on the required form where the command is sent from the keypad and thus the robot searches for the desired shape and goes towards it to catch it and then returns it to the desired location .And we will talk about the history of the robot and its use, and some of the previous similar projects..

1.2 Objectives

The main objectives of this project is to make a robot that easies the human life so that it brings the objects based on shape by reciveing commands from Keypad which contains numbers and based on number the robot brings the requested object using its arm and sends it to the required place.

1.3 Importance of Work

The importance of this robot that saves the time and effort of pepole and automatically work and bring the object based on the command from the keypad so that by choosing the required number it brings the requested object.

1.4 Organization Of the report

The report is divided as follows in six Chapters.
In Chapter 1 we will briefly talk about an introduction about robots and in Chapter 2 we will talk about the limitations and Restrictions
we faced during the work of the robot. Chapter 3 will talk about the history of robots and the differences between our project and previous projects.
In Chapter 4, we will talk about the parts that we used, methodology
and we will talk about them, how they work, and how we used these parts.In Chapter 5, we will discuss our findings recently on the conclusion and future work,
how to take advantage of the robot, and how to develop and improve it for wider use.

Chapter 2

Constraints,Standards and Earlier Work

2.1 Constraints and Restrictions

Problems with motors and speed control so we used a driver.
Problems in the algorithm include making an examination of the shapes and choosing the desired shape, as the degree of light had an effect on the shape, and thus the difficulty of finding the required body and making ignorance of other objects.
Difficulty dealing with the Raisbury Bay, entering it and linking it with Arduino.
We had a problem specifying the camera to avoid checking the arm.

2.2 Codes/Standards

We have used available functions of arduino and get the concept of detection shapes code .also we defined variable states for dc motors and servo motor and the connected pins .so we write understandable functions .

2.3 Earlier Course Work

we use our basic knowledge from the following Courses:

PIC Microcontroller Course:

We use our knowledge from this course to control motors and measure the value of sensor

Image Processing Course:

We use our knowledge from this course to detect shapes .

2.4 Components Cost

The following table shows the cost of components :

Component	Number of Pieces	Price /unit	Total Price
Arduino Mega	**1**	**120₪**	**120₪**
Raspberrypi with camera	**1**	**420₪**	**420₪**
Keypad	**1**	**10₪**	**10₪**
StandForCamera	**1**	**20₪**	**20₪**
Dc Motor with wheel	**4**	**50₪**	**200₪**
Arm	**1**	**160₪**	**160₪**
Servo motor	**1**	**70₪**	**70₪**
Battary	**2**	**35₪**	**70₪**
IR Sensor	**1**	**20₪**	**20₪**
Dual H-Bridge Motor Controller.	**2**	**20₪**	**40₪**
Jumper wires		**36₪**	**36₪**

So the cost is : 1166₪.

Chapter 3

Literature Review

The idea of a robot emerged when the Czech writer chose the robot as one of the heroes of a story he wrote in 1923 CE to help humans
The word robot was derived from the Czech word robota, which refers to forced labor.

The research center at Stanford University, USA, worked from 1977 to 1972 to implement research on the production of a mobile robot, which they named Shaki. Where the robot was able to visualize the environment that surrounds it. It explores the nature of the path that it walks along as it succeeds in bringing and rearranging objects. The first robot used video cameras that were used in television photography at the time and it was controlled by radio waves.

Of course there are a lot of models that were made to obtain a specific stereoscope or bring it, for example by voice or a Bluetooth signal, which encouraged us to create a robot that brings the required stereo based on the shape based on orders from the keypad and we also benefited from the idea of IMAGEprocessing where we used the Raspberry Pi to do an examination of
the appropriate form.

In our project, we combined those ideas where the robot is waiting for an order from the keypad to choose the desired shape and then the robot will move left and right to search for it and then go towards it when it is found.

Chapter 4

Methodology

4.1 Hardware Part

4.1.1 Overview

In this section we will talk about the pieces that we used and why We used a DC motor to move the car, and we used an infrared sensor to find out if the stereo was captured or not, and therefore, the arm opens or closes .Also we use the keypad to select the requested shape.

We also used the Raspberry Pi with the camera to do a body scan to identify the desired shape. In addition to using the arm to hold the body, we also controlled it via a servo motor, we controlled the motors by using the Arduino.

- **Dc Motor**
- **Servo Motor**
- **Dual H-bridge motor controller**
- **Keypad**
- **Arduino**
- **RaspberryPi**
- **IR sensor**
- **Jumper wires**

4.1.2 Description about components

In this section we will talk about the descriptions of these components and how and why we use each of them.

Dc Motor:

we used four dc motors to move the car in forward ,backward ,left and right in order to search for the requested object .so when initially the robot receives command from the keypad it starts to move to search for the object.

Figure 1: The Dc Motor

Servo Motor:

we use one servo motor to control the arm to pick the object ,so when the sensor turn off so the arm will close to get the object.

Figure 2: The Servo Motor

Dual H-bridge Motor Controller:

we use two H-bridge as drivers to control the directions
of motors left and right ,the driver needs power from 7-35v.

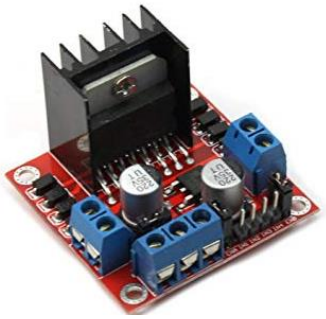

Figure 3: Dual H-bridge Motor Controller

Keypad :

We use a keypad contains four numbers to select the requested shape
We connect it with raspberry pins(33,35,37) with numbers 1,3,4
So if we pressed 4 then the selected object is Pyramid.

Figure 4: Keypad

Arduino:

It's an Arduino 2560 mega microcontroller ,can be used as an input or output, it contains 54 digital pins,15 PWM output , Reset button,16 analog pins and 4USARTS work on 16MHZ
we use the Arduino to control the motors

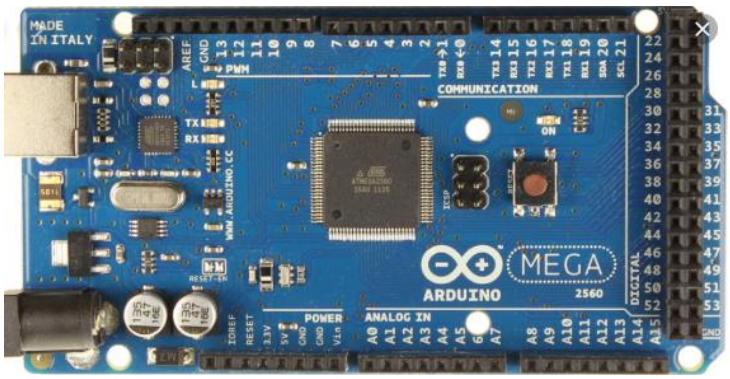

Figure 5: Arduino

RaspberryPi:

It is a computer that has an operating system that provides a lot of programs and uses the Python language ,so we used it to download the image code on it to identify the desired shape and use the camera to search for the shape.

Figure 6: RaspberryPi

IR Sensor:

Is an electronic device to sense the surroundings and discover the movement. we use it to check if there is an object to get or not.

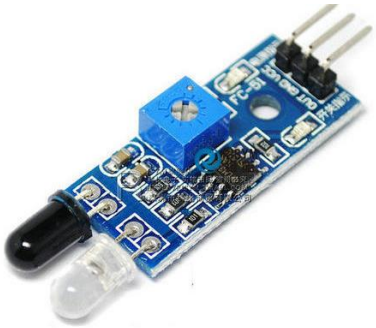

Figure 7: IR Sensor

Jumper wires:

We use these wires to connect components.

Figure 8: Jumper wires

4.2 Software Part

4.2.1 Overview

In this part of the project we have to make an algorithm for the robot to bring up the stereo of the required shape.
Therefore, in the beginning, the user chooses the shape of either a triangle, a rectangle, or a ball by choosing a number from the keypad where, for example, if he chooses a number 1, then a triangular pyramid is required. The robot moves in search of the desired shape, and during his examination of the problem it searches for it.so we must determine and control the direction of motors and servo motor to pick the object .Also we must be careful to ignore the very big or small objects that may affect the detection Process.

4.2.2 Project Flow

In this section we will see how the robot will move to search for the desired shape, starting by choosing the shape from the keypad and thus the robot will move to search for it and when it finds it will go to pick it up with the arm that is controlled by the servo motor.

4.2.3 Algorithms and code analysis

Here we will show what are the codes that we write and use in our project so we have these codes:

Arduino Code:

This code shows how the arduino controls the motors to move backward ,forward ,left or right in order to find the object that is selected from the keypad.

Here part of the code shows how we enable and disable the motors

```
void MotorStep(int ms)
{

  if (rMotorState == MOTOR_STATE_STOPPED)
  {
    digitalWrite(motor2[1], false);
    digitalWrite(motor2[3], false);
    digitalWrite(motor2[0], false);
    digitalWrite(motor2[2], false);
  }
  else if (rMotorState == MOTOR_STATE_FORWARD)
  {
    digitalWrite(motor2[1], false);
    digitalWrite(motor2[3], false);
    digitalWrite(motor2[0], true);
    digitalWrite(motor2[2], true);
  }
  else if (rMotorState == MOTOR_STATE_BACKWARD)
  {
    digitalWrite(motor2[1], true);
    digitalWrite(motor2[3], true);
    digitalWrite(motor2[0], false);
    digitalWrite(motor2[2], false);
  }
```

Keypad Code:

The keypad code is added to the image shape detection code such that based on the selected number from the keypad the robot will search for that object

As shown :

Here to define pins that are connected to raspberry pi

```
PIN1 = 33
PIN2 = 35
PIN3 = 37

GPIO.setwarnings(False) # Ignore warning for now
GPIO.setmode(GPIO.BOARD) # Use physical pin numbering
GPIO.setup(PIN1, GPIO.IN, pull_up_down=GPIO.PUD_DOWN) # Set pin 10 to be an input pin and set initial value to be pulled l
GPIO.setup(PIN2, GPIO.IN, pull_up_down=GPIO.PUD_DOWN) # Set pin 10 to be an input pin and set initial value to be pulled l
GPIO.setup(PIN3, GPIO.IN, pull_up_down=GPIO.PUD_DOWN) # Set pin 10 to be an input pin and set initial value to be pulled l
```

And here to check which is the selected one:

```
while (True):
    # Capture frame-by-frame
    ret, frame = cap.read()

    rect = frame.shape

    if GPIO.input(PIN1) == GPIO.HIGH:
        userShape = "S"

    if GPIO.input(PIN2) == GPIO.HIGH:
        userShape = "C"

    if GPIO.input(PIN3) == GPIO.HIGH:
        userShape = "P"
```

Raspberry Pi Code:

We wrote the code and use some similar codes to detect shapes And we used Opencv program .

Here to detect shapes (part of the code):

So we detect the vertices of the shapes as shown:

```
def detect(shapes):
    output = []
    for c in shapes:
        # initialize the shape name and approximate the contour
        shape = "unidentified"
        peri = cv2.arcLength(c, True)
        approx = cv2.approxPolyDP(c, 0.04 * peri, True)

        # if the shape is a triangle, it will have 3 vertices
        if len(approx) == 3:
            shape = "P"

        # if the shape has 4 vertices, it is either a square or
        # a rectangle
        elif len(approx) == 4:
            # compute the bounding box of the contour and use the
            # bounding box to compute the aspect ratio
            (x, y, w, h) = cv2.boundingRect(approx)
            ar = w / float(h)

            # a square will have an aspect ratio that is approximately
            # equal to one, otherwise, the shape is a rectangle
            shape = "C" if ar >= 0.95 and ar <= 1.05 else "C"

        # if the shape is a pentagon, it will have 5 vertices
        elif len(approx) == 5:
            shape = "S"

        # otherwise, we assume the shape is a circle
        else:
            shape = "S"
```

Chapter 5
Results And Discussion

We have achieved a robot that brings the body based on the shape that is chosen from the keypad and thus this makes it easier for the user to choose the desired shape that he wants and thus can be improved to bring other various purposes

Chapter 6
Conclusion And Future Work

In this project we have achieved a good robot that brings the desired shape which is chosen from the keypad and thus this saves effort and time

We hope in the future by adding features and features that depend on adding distinctive algorithms, useful and sophisticated.

- Making the work of the robot not only limited to specific shapes, but also extends to various different shapes and bodies.
- Control the robot wirelessly, for example, a mobile application
  Or for example, controlling it by voice.

References

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3 Arduino Tutorial .URL: https://www.arduino.cc/en/Tutorial/HomePage

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