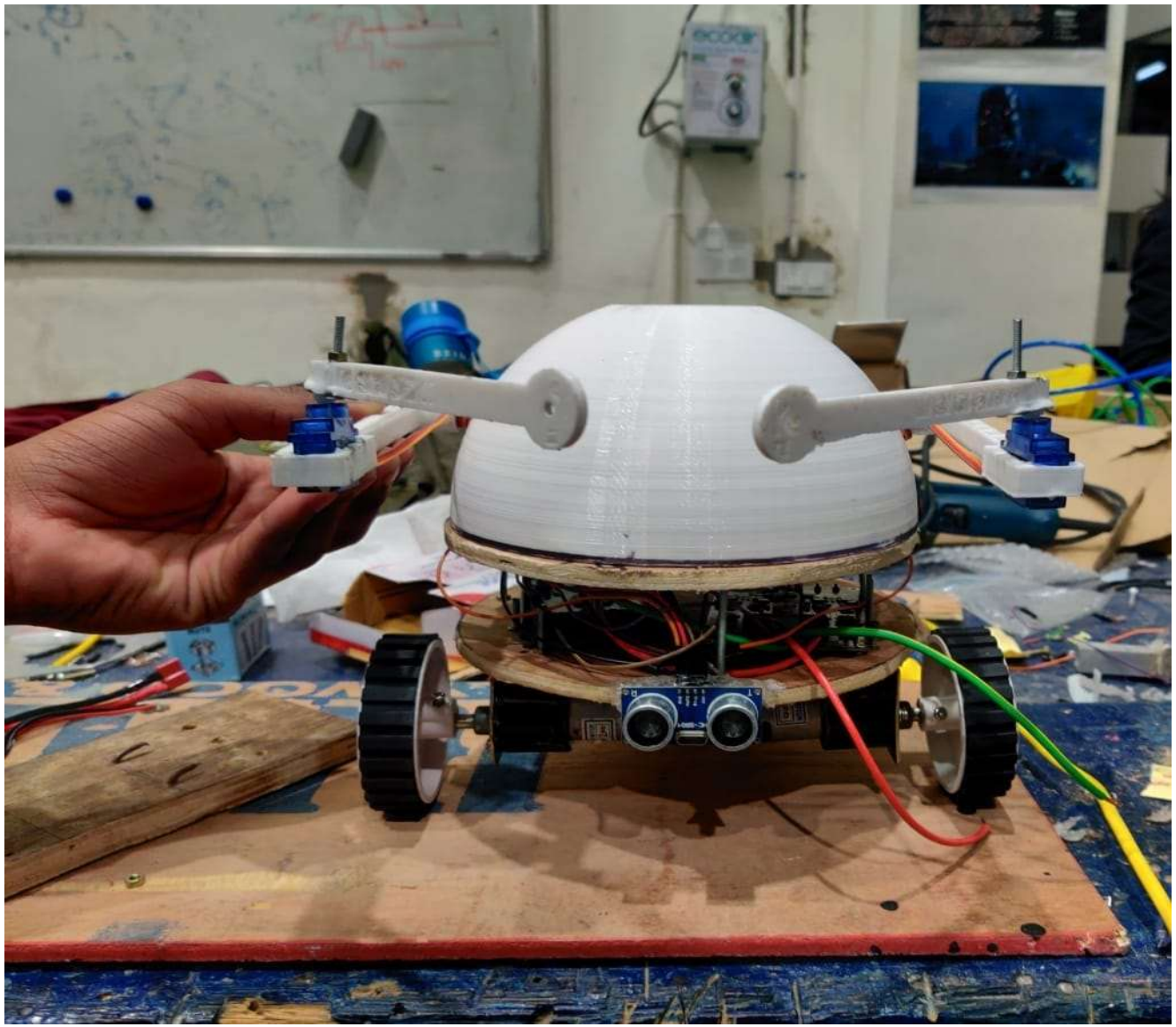
FETCHING BOT-ROOH



ABSTRACT

The main objective of our bot is to detect and fetch any particular object in a defined area. It works in the following manner

- Searches for the QR code on the object in defined area.
- Scans the QR code just for verifying the object
- Aligns in the direction of code and moves towards it.
- Fetches the object upon reaching it.

MOTIVATION

It can be used for general household purposes and even in distribution chain of any product, thus making our job easy.

MECHANICAL FEATURES

1.Chassis

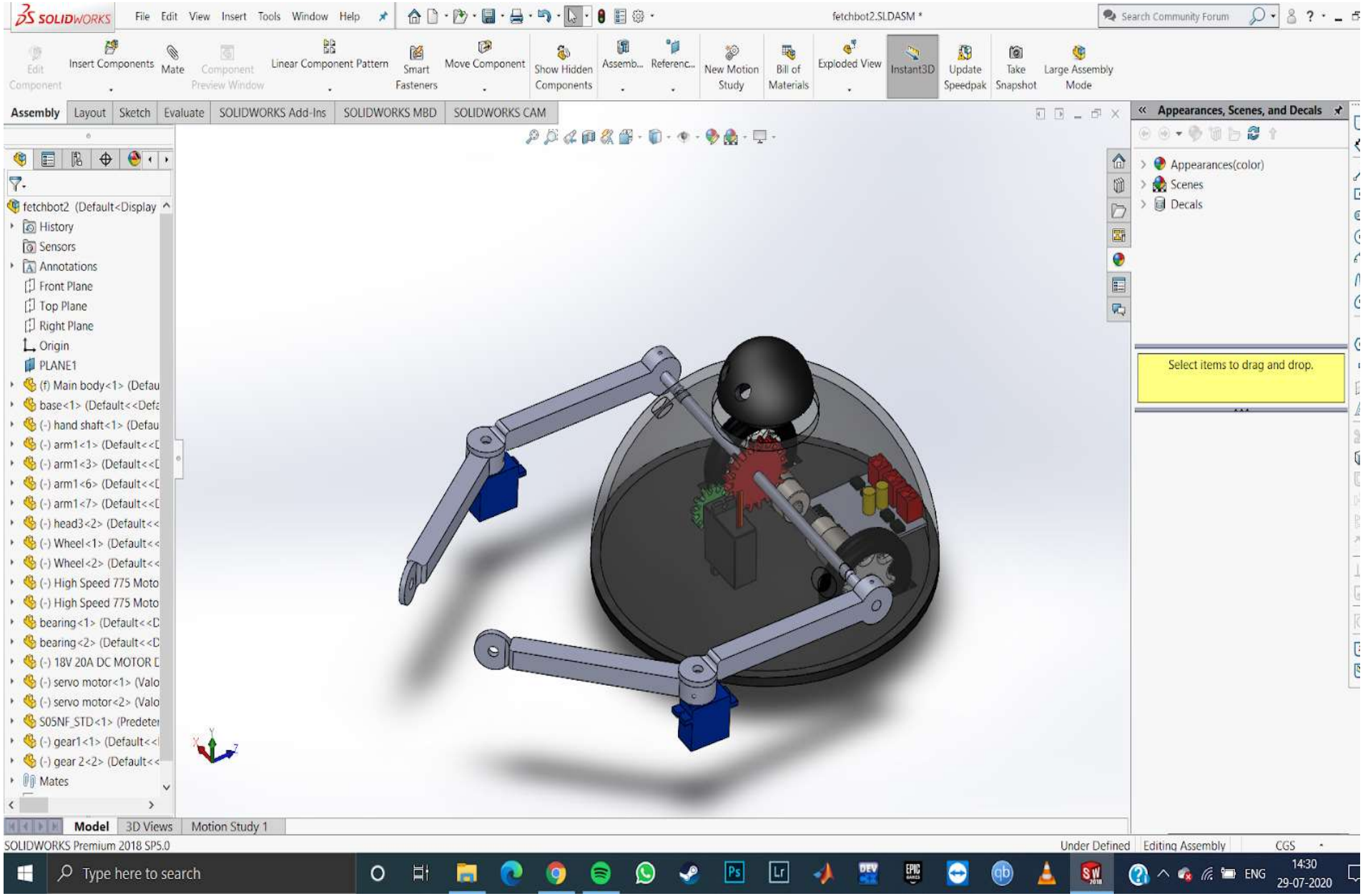
The main body of the FetchBot is 3D printed and comprises the base, a head, and the outer body to cover and contain all the inside components. The shape of the body is hemispherical and the dimensions are 18cm x 18 cm x 9 cm. The body is supposed to be lightweight and rigid.

2.Drive Mechanism

The FetchBot uses a two wheel differential for movement, the idea behind it being that this system will simplify the turn movements as well as rectilinear motion.

3.Fetching Mechanism

The FetchBot uses two arms hinges at a place and rotated with a common metal servo motor inside the body with a two gear system. For fetching two mini servo motors are placed at the elbow of the arm. This mechanism helps the bot to fetch and lift the object.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Scenes
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Select items to drag and drop.
Model
3D Views
Motion Study 1
SOLIDWORKS Premium 2018 SP5.0
Under Defined
Editing Assembly
CGS
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ENG
14:30
29-07-2020

Electronics Aspect of the Design

Microcontroller

We have used Arduino Uno to control the movement of the motors and get the feedback from the ultrasonic sensor. Arduino Uno provides the simplest and most efficient way to implement the functions of our bot. We also used serial communication to communicate with Raspberry Pi to get the feedback of the image taken by the camera.

Actuator

The robot uses two 12 volt- 100 rpm motors. These motors are relatively light, weighing a few hundred grams and overall have a small and compact size. They provide stable movement for our bot without adding too much weight to it.

We also have two servo motors for the sideways movement of the forearms to grab the object and a metal servo motor to rotate the arms together to lift and drop the object

Motor Driver

We used the Cytron motor driver to control the rotation of our dc motors easily. We preferred it over the L298 motor driver because of the simplicity in connection and coding of the motors.

Sensor

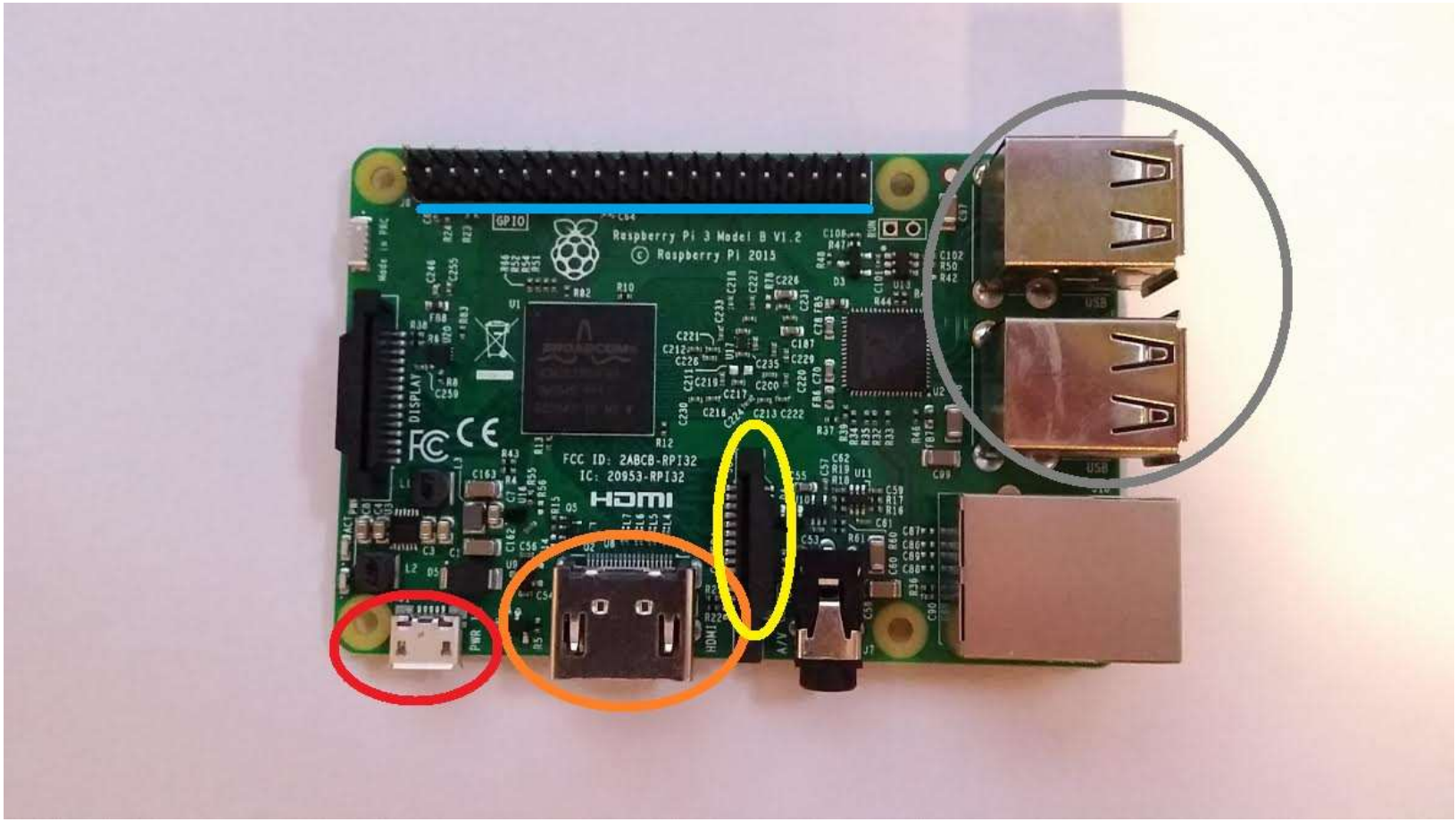
We have used an ultrasonic sensor to get realtime feedback of the distance between the object and the bot. We have mounted it in the lower front of the bot to get the best measurements possible.

RASPBERRY PI 3

•Setup and OS

Assuming you've got your board, and an SD card, you're ready to carry on. Being a full computer, the Raspberry Pi uses an Operating System. There are also a few ways to install and use an operating system on the Raspberry Pi. The most user-friendly method is to use the NOOBS (New Out of Box Software) installer. If you're comfortable enough, you can just simply download the operating system ISO, format the SD card, mount the ISO, and boot the Pi. If that sounds like gibberish to you, then follow along with the First, we must format the SD card. If you are on Windows, you can use SD Formatter.

Once you're done, great. Now, assuming you've downloaded the NOOBS package, let's go ahead and extract that. Now, we want to copy all these NOOBS contents to our SD Card. Do not drag the directory, but rather the contents:


GPIO
Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
DISPLAY
FCC ID: 2ABCB-RPI32
IC: 20953-RPI32
HDMI
PWR
HDMI
A/V
USB
USB

Once everything is transferred to the micro SD card, you can put it in the Raspberry Pi. The slot is on the bottom side of the board, circled in yellow here:

Once you've got the SD card plugged in, go ahead and plug in your keyboard, mouse, and HDMI cable to your monitor. Finally, plug in the power, and this will start up the Raspberry Pi. Once fully loaded, you should land on the screen.

Alright, once we've connected to our network, we'd like to actually interface with the Pi. First, we want to update. Open a terminal by either right clicking on the desktop and opening terminal that way, or by doing control+alt+t. Now, in the terminal, do:

```
$ sudo apt-get update
```

and then

```
$ sudo apt-get upgrade
```

You do not type the $ sign, it's there to denote when you're typing something in the command line. The upgrade might take a minute. While we wait, your Raspberry Pi's default credentials are: username: pi password: raspberry

RASPBERRY PI 3

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•Installing OpenCV and python3

Steps to Install OpenCV

1. Install Python on your system
2. Install pip
3. Install OpenCV library using pip

1. Install Python

Open the terminal. The following command will download the Python directly onto your machine.

```
sudo apt-get install python
```

2. Install pip

Pip is the package installer for Python. With pip, we can easily manage the installation of Python packages. To install pip, simply run this command on the terminal.

```
sudo apt-get install python3-pip
```

3. Install OpenCV library with pip

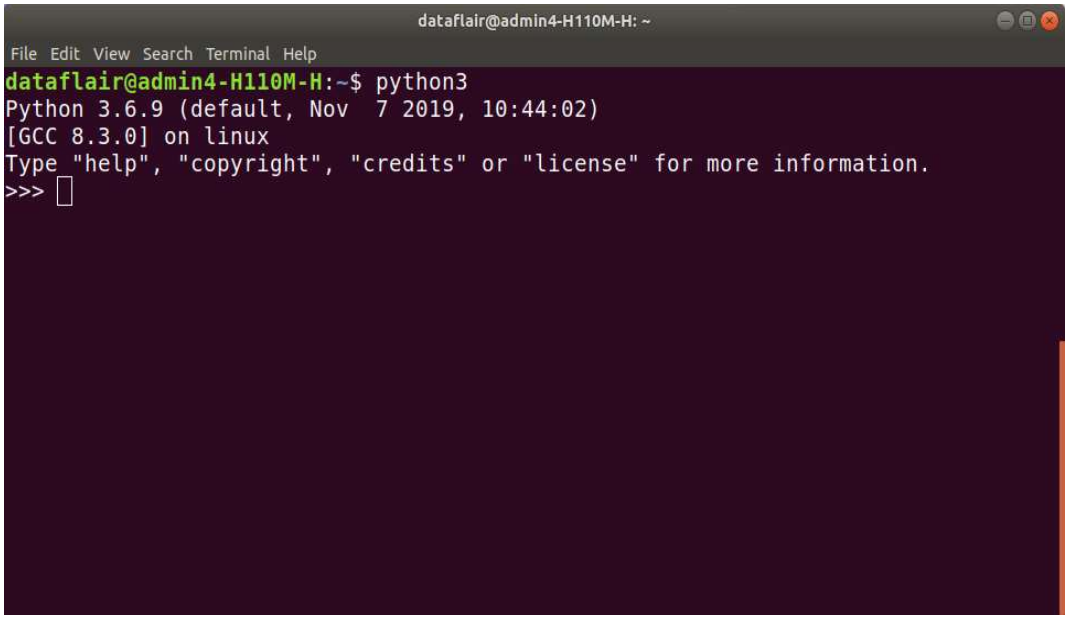
After the installation of the Python and pip, we can directly install the OpenCV library and start using them. To install the library, we need to enter the given command in the terminal.

```
pip3 install opencv-python
```

How to Verify the OpenCV Installation is Complete?
To check if everything is installed properly, follow the below steps:

1. Open the terminal in your system.
2. Start the Python shell by typing python3 and then hit enter. You will be inside the Python shell where you can execute your Python code.
3. Import the cv2 package which is the name of the OpenCV module. Type “import cv2” and hit enter.

If you don’t get any error after completing these steps, then you have successfully installed the Python and OpenCV library.



QR Code Scanner with OpenCV

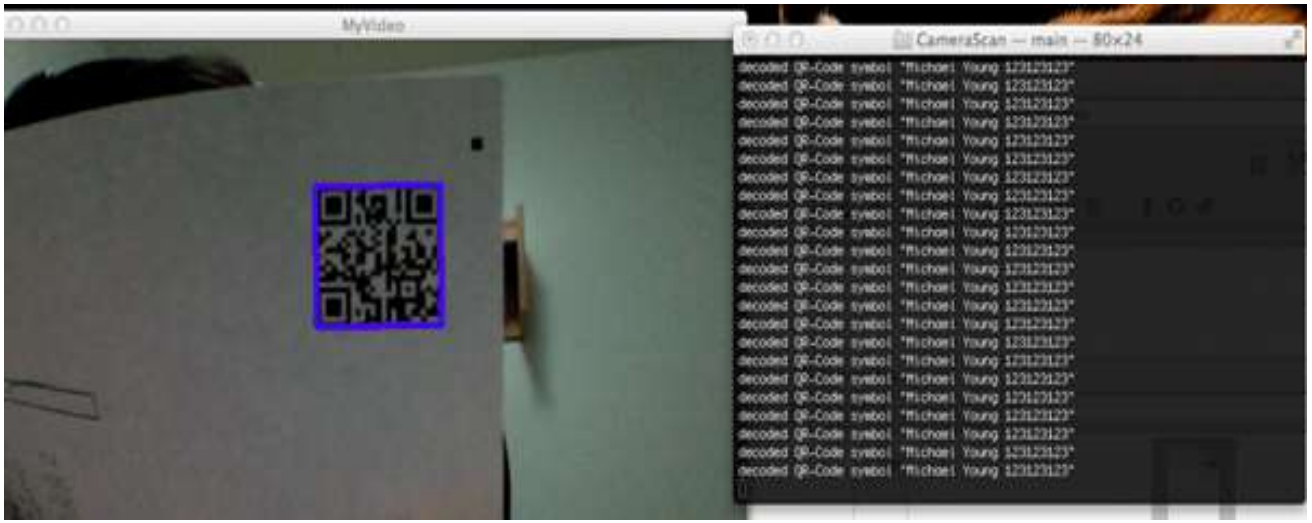
OBJECTIVE:

The main objective of bot was to identify the object that he wants to fetch. To do that we thought to identify QR code on the object with the help of a camera in bot face, and then bot moves on that way after recognizing QR code.

ABOUT CODE:

Code identifies QR code with the help of detectandDecode() function that extracts data and coordinates of QR code in data , bbox . And then we use coordinates to make sure that QR code comes in the centre of the Camera so that bot moves in the correct direction. We also planned it to be done by colour identification in OpenCV in future.

Z-bar is a library in python that is more concerned in QR code detection but we didn’tused it .



SERIAL COMMUNICATION BETWEEN ARDUINO AND RASPBERRY PI

Serial communication is simply **a way to transfer data**. The data will be sent sequentially, one bit at a time (1 byte = 8 bits), contrary to parallel communication, where many bits are sent at the same time.

UART protocol

More specifically, when you use Serial with Arduino and Raspberry Pi, you're using the UART protocol. UART means "Universal Asynchronous Reception and Transmission".

Hardware setup for Serial communication

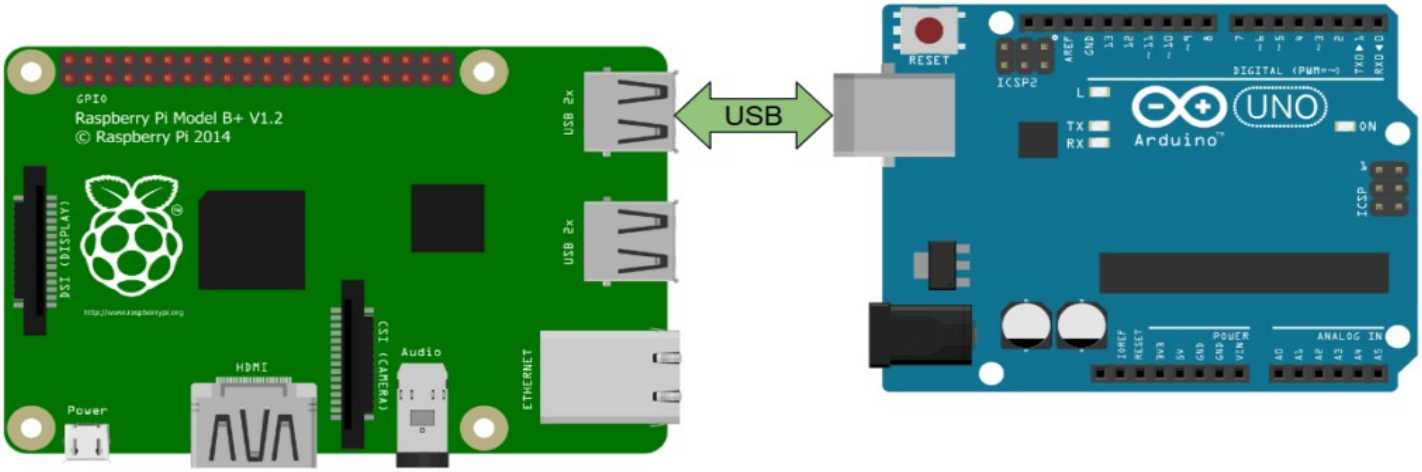
Serial via USB

The easiest way is to use a USB cable between both board.

On the Raspberry Pi side, a simple USB connector is all you need. You can choose any of the 4 USB ports available on the board.

For Arduino, you will use the USB port that you use to upload code from your computer (with the Arduino IDE) to your board. Here the USB connector will depend on which version you have. For boards like Arduino Uno and Mega, the connector will be different from Arduino Nano, and from Arduino Zero.

For this example I've used an Arduino Uno board.



Raspberry Pi Software setup

You don't need any special setup for Arduino. Just make sure you have downloaded and installed the Arduino IDE.

Now, on your Raspberry Pi, a few things are required to make the communication work.

Connect to your Raspberry Pi, either via ssh, or by plugin a screen+mouse+keyboard, and open a terminal. If you haven't installed an OS on your Pi yet, you can install Raspbian or Ubuntu very easily on a SD card.

Detect the Arduino board

When connecting the Arduino with a USB cable, you should see it appear as /dev/ttyACM0, or /dev/ttyUSB0 (sometimes the number can be different, for example /dev/ttyACM1).

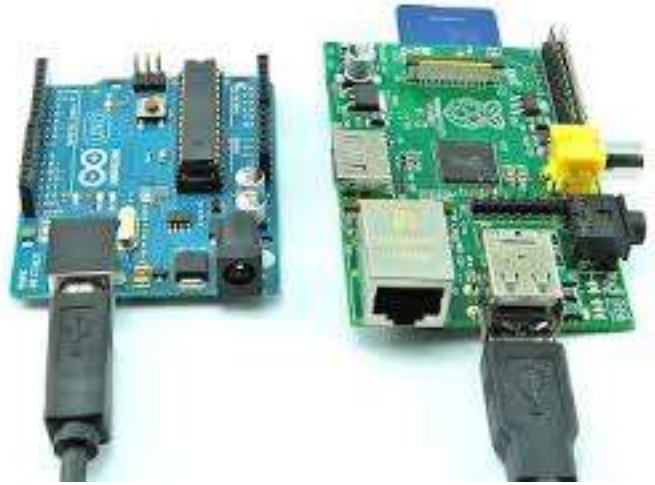
Simply run
ls /dev/tty* and you should see it. At this point if you're not sure which device is the Arduino board, simply disconnect the board (remove the USB cable), and run ls /dev/tty* again. This way you will easily spot the serial device name of your Arduino.

Install Python Serial library on Raspberry Pi

You need to install a library to be able to use the Serial interface with Python.To install it:

```
python3 -m pip install pyserial
```

This Python library is well-known and used in a lot of applications.



We need to send the data from raspberry pi to arduino.
Here we will use some basic data like hello etc for demonstration.Actually we need to send 1-0 according to the input from camera if it has detected the QR code in the particular direction or not accordingly.

Here we check if the Arduino has received data with Serial.available(). This will give you the number of bytes already arrived and stored in the receive buffer.
If some data has arrived, we use Serial.readStringUntil() with a newline character '\n' to get the next line. This is similar to the readline() function. All the bytes received until '\n' are automatically converted and added in an Arduino String object.
Then, we just print back the data we received, with an additional piece of text.
Note: if you want to read bytes one by one, you can do so with the Serial.read() function. Then you'll have to convert this(those) byte(s) if needed: int, String, etc.

Use the pySerial function write() to send data to the Arduino. Here you can see that I've added a 'b' before the string to send. This will encode the string to bytes, because you can only send bytes through Serial. Any data which is not a byte or byte array must be converted before being sent.

MATERIAL	COST
2 NORMAL WHEELS	60
1 CASTOR WHEEL	25
ULTRASONIC SENSOR	100
ARDUINO UNO	400
RASPBERRY PI 3	3000
CYTRON MOTOR DRIVER	1000
2 JOHNSON MOTOR	1200
2 SERVO MOTOR	80
SD CARD	350
OTHER ITEMS	500
TOTAL	6715

Applications

- Can be used in distribution process of factories.
- Can be used for various domestic purposes.
- As shopping bots, to deliver products door-to-door.

Limitations

- The weight that bot can lift is limited so that point should be taken into account during the work.
- We have a predefined area within which our bot works.

Future Improvements

- It can be extended to be used for a wide variety of objects, not only which have QR code on them. An example is color blob detection.
- Its field of working can be increased and load limit can also be made variable.

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REFERENCES:-

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- https://roboticsbackend.com/raspberry-pi-arduino-serial-communication/