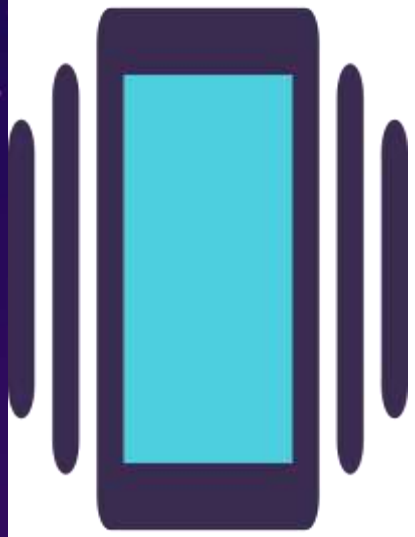


ROBOTIC ARM

PRESENTATION

BY
SISAY,TEKLHIWOT & YIBELTAL

Content

1

Objective of project

Replace normal operation of p&p inhouse holding activities by programmable robotic system.

2

Scope of project

To simplify p&p of object in house holding using robotic arm instructed by android app.

3

Android mobile app interface

List of buttons used to ordered robotic arm. Like forward, backward, open, close etc.

4

Algorithm of the system

False code, flowchart, and code fragment of robotic arm.

Content

Objective

Our main objective is to replace the normal operation of pick and place object activities in house holding to programmable robotic system

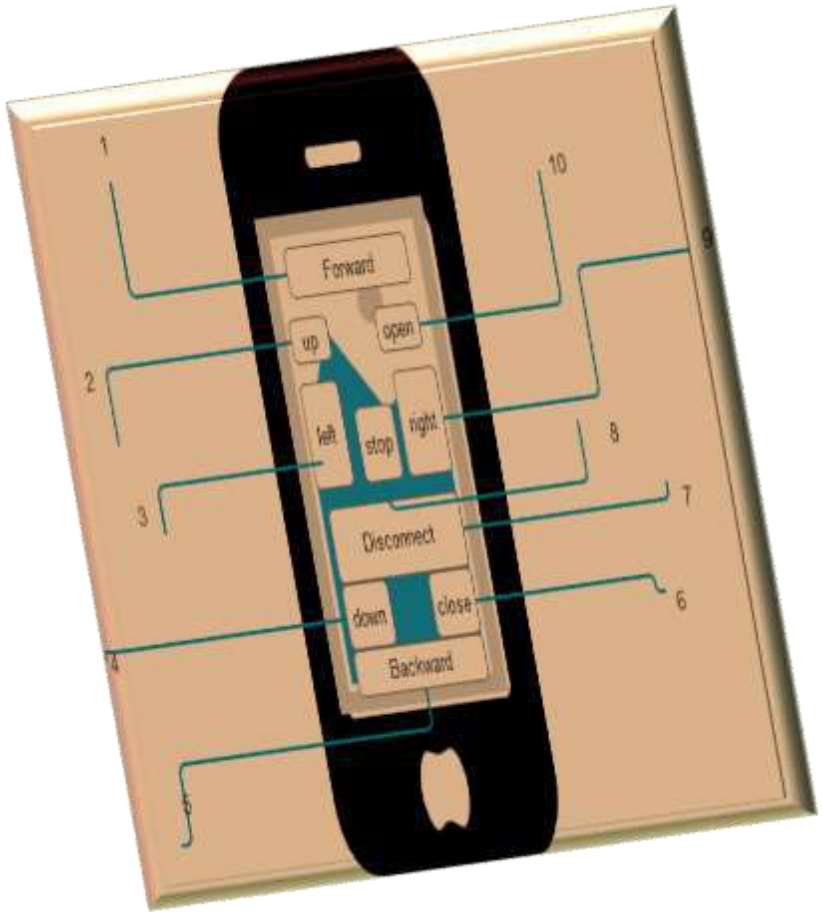
Specific objectives

- To integrate system component
- To design system
- To develop program to robotic arm
- To develop wireless android app
- To develop 2DOF robotic arm

Scope

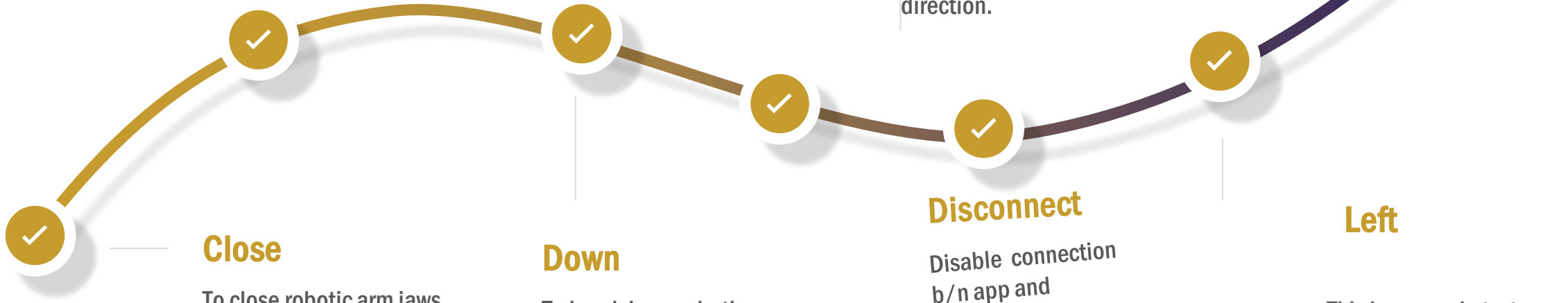
Our project aims to simplify the picking and placing of objects in house holding tasks by providing a system instructed by human wirelessly using android application

Android application interface



On the next slides we will try to describe each buttons.

Description of each android app buttons



Open

To open robotic arm jaws

Close

To close robotic arm jaws

Forward

To move vehicle forward direction.

Down

To bend down robotic arm

Up

To move robotic arm to upward direction.

Disconnect

Disable connection b/n app and Bluetooth module

Right

Vehicle of robotic arm move in right direction.

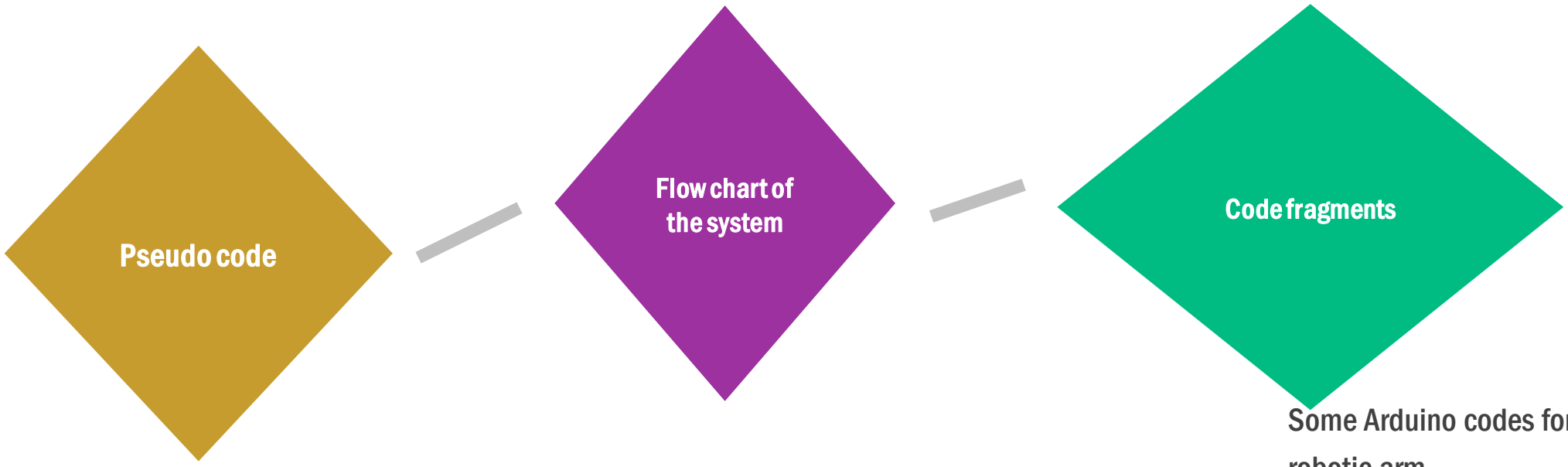
Left

This is a sample text. Insert your desired text here.

backward

Algorithm of the system

The steps follow by system in statements



Flow diagram of the system

Some Arduino codes for controlling robotic arm

Pseudo code of the system

Option 01

Start the process

Option 02

Establish connection B/n Bluetooth module and android

Option 03

If connection is created wait for command

Option 04

Else retire to connect and find paired device.

Option 05

. If input data is F, robotic vehicle move forward

Option 06

. If input data is B, robotic vehicle move reverse

Pseudo code of the system

Option 07

If input data is R, robotic move to right

Option 12

If no input data it doesn't does any task..

Option 08

If input data is L, robotic vehicle move to left direction.

Option 11

If input data is S, robotic arm stop its movement and any task it does..

Option 09

If input data is P, robotic arm pick material. Here if the jaw is closed and arm move upward direction picking operation is performed.

Option 10

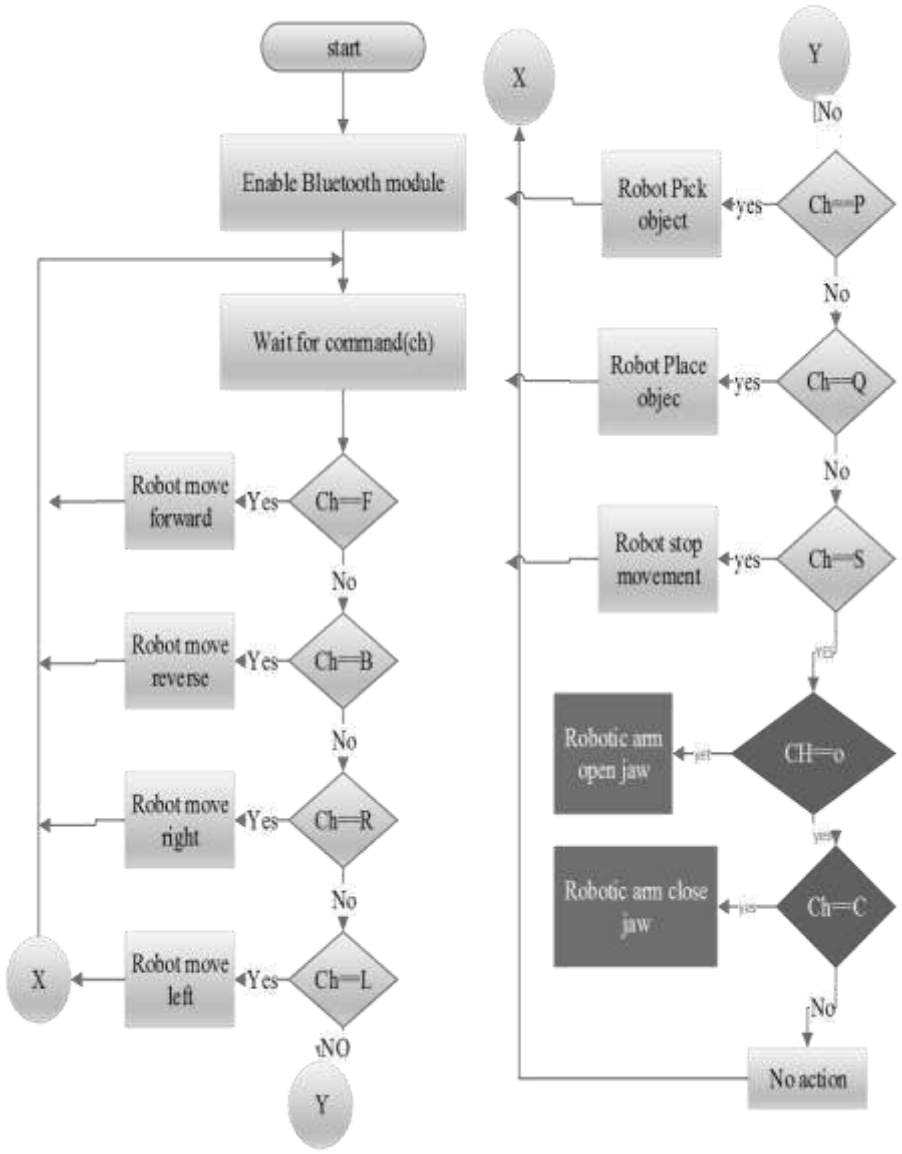
If input data is Q, robotic arm place object. It does by opening the jaw when it inclined its arm..

Flowchart of system

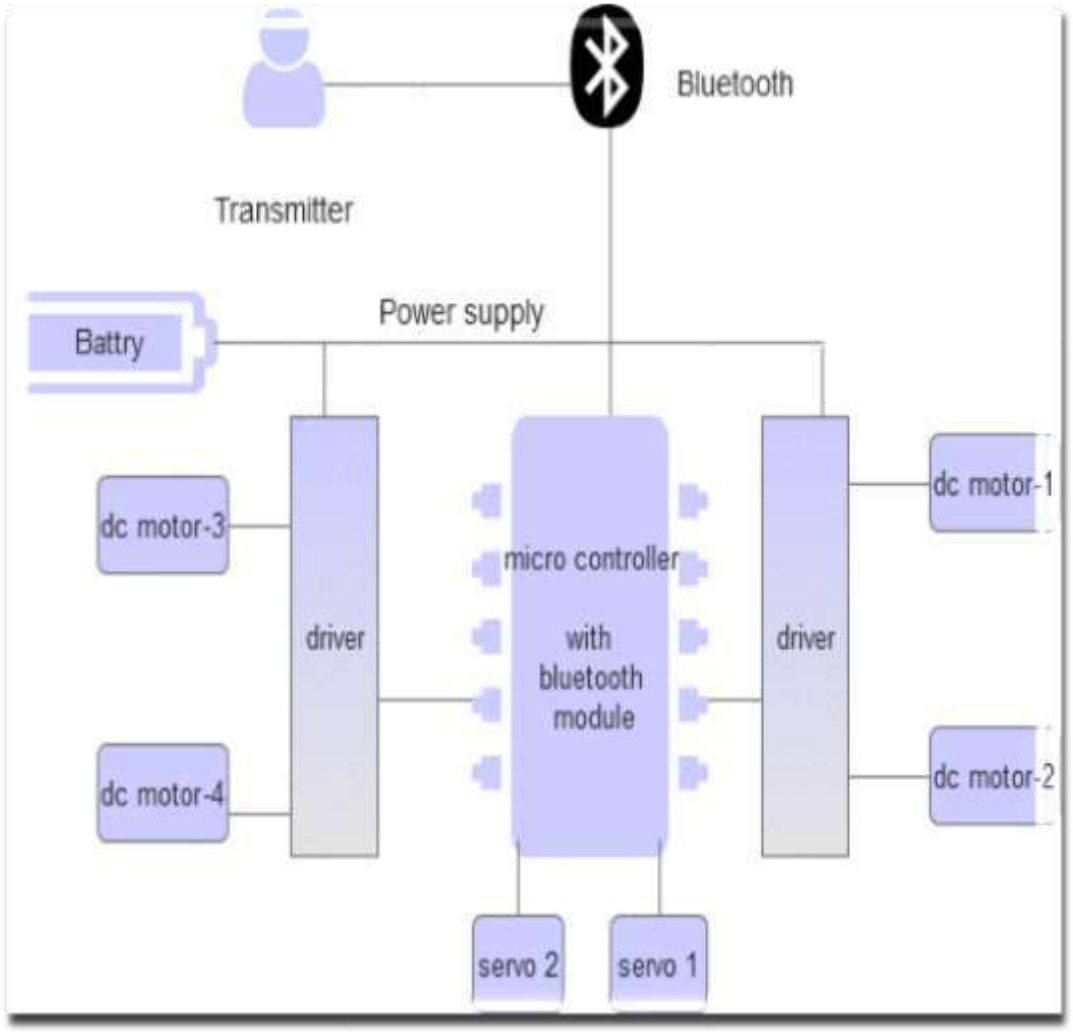
Character input from android app then, system check and order robotic arm to do its task accordingly

If no data is put, nothing done by robotic arm

Flow chart



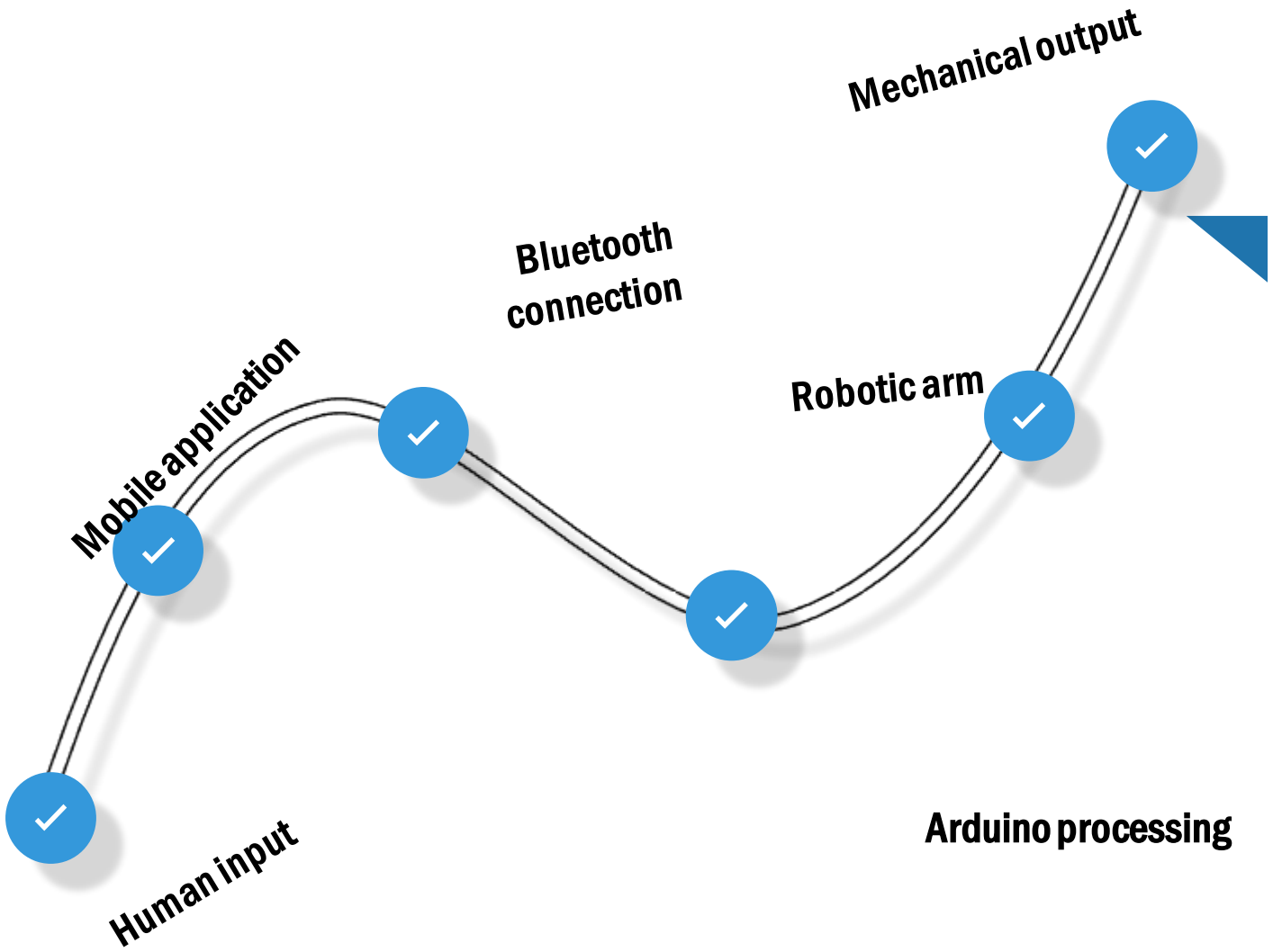
System Design and Analysis



Block diagram

- ✓ Block diagram consists of microcontroller[on Arduino board]-brain of the system, dc motor with its driver, servo motor and power supply.
- ✓ Its arm placed on moving vehicles. The vehicle consists the dc motor-Moving
- ✓ Servo1- grasp and servo2-up and down movement of robotic arm. Both lies on robotic arm.
- ✓ For controlling purpose – microcontroller and ***input data*** come from android app through wireless com.
- ✓ Input data is decoded and proper controlling signal is send to actuator.

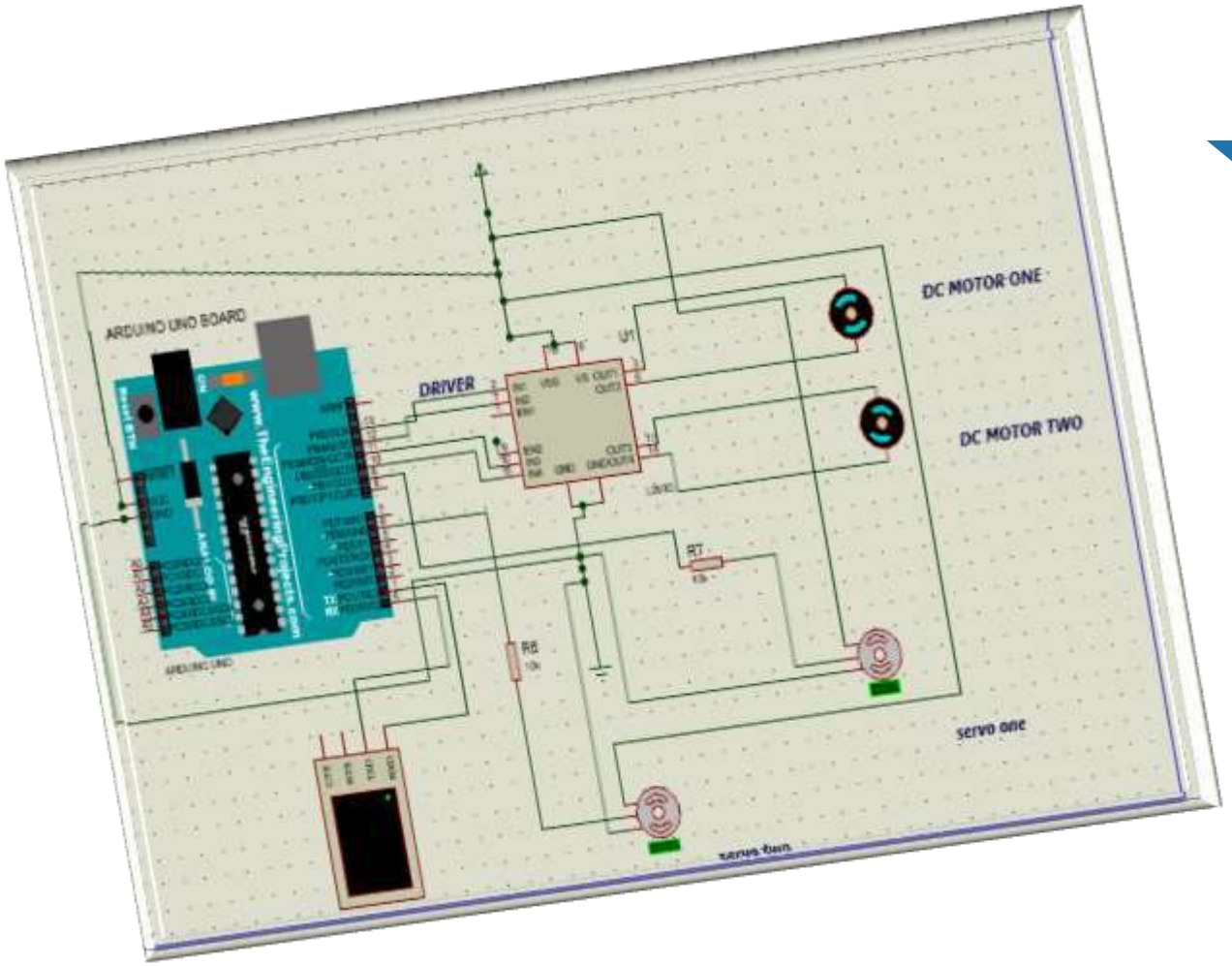
System Design and Analysis



workflow

- ✓ Human input
- ✓ Mobile application
- ✓ Bluetooth connection
- ✓ Arduino processing
- ✓ Robotic arm
- ✓ Tangible mechanical output..

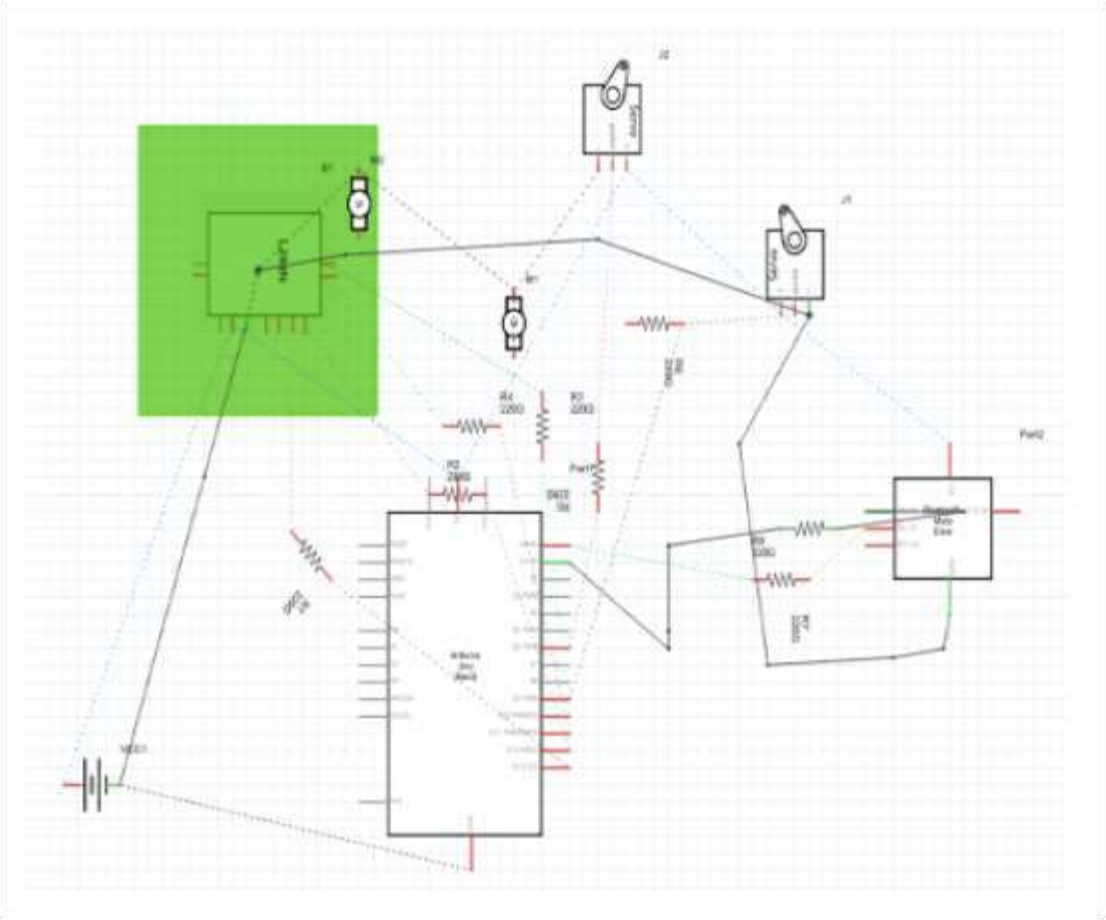
System Design and Analysis



Schema diagram of robotic arm

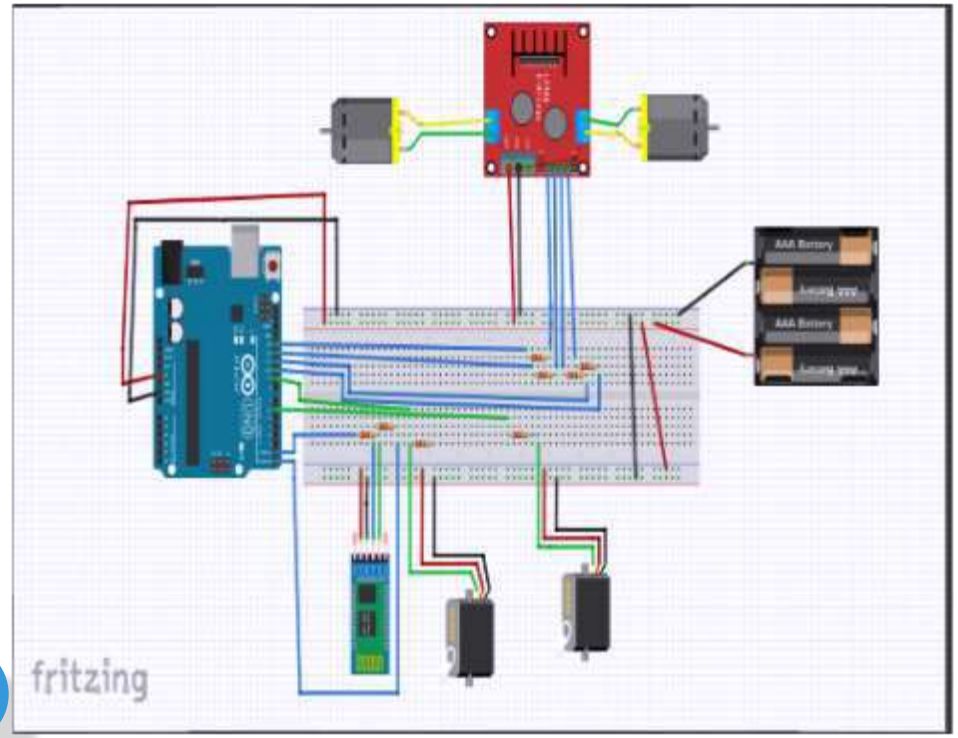
- ✓ Electrical circuit diagram for a better understanding on the connections of the circuit
- ✓ We use resistor
- ✓ 2 dc with motor driver[pin 10,11,12,13]
- ✓ Servo motor on Arduino[pin 9,6]

System Design and Analysis



Schema diagram of robotic arm

- ✓ schematic diagram of robotic arm designed using fritzing.



Mechanical Design

Introduction

- ✓ The mechanical design of the robotic arm is based on a robot manipulator with similar functions to a human arm.
- ✓ #degree of freedom=#independent links
- ✓ Two degree of freedom [one end-base and second one- end effector/gripper].

Mechanical Design

Introduction

- ✓ The mechanical design of the robotic arm is based on a robot manipulator with similar functions to a human arm.
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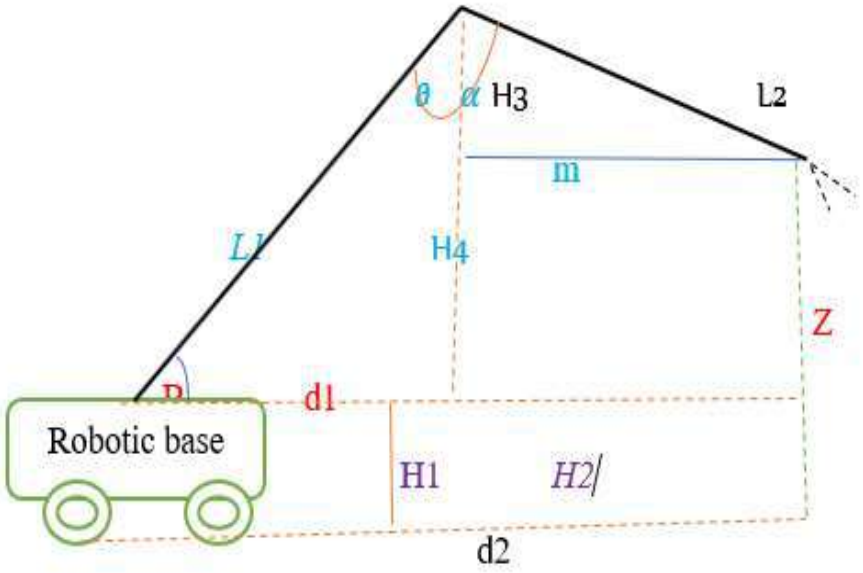
Mechanical Design

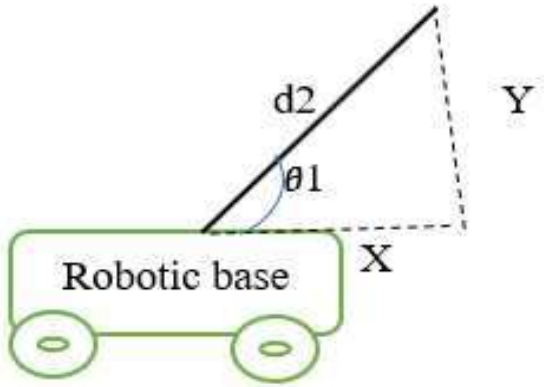
kinematics manipulation of robotic arm

- ✓ Kinematics is the analysis of motion with out regarding to force or torque.
- ✓ Forward and inverse kinematics.

- ✓ [180-0] opening jaws
- ✓ [0-180] closing jaws
- ✓ [90-0] up robotic arm
- ✓ [0-90] down robotic arm

Mechanical Design

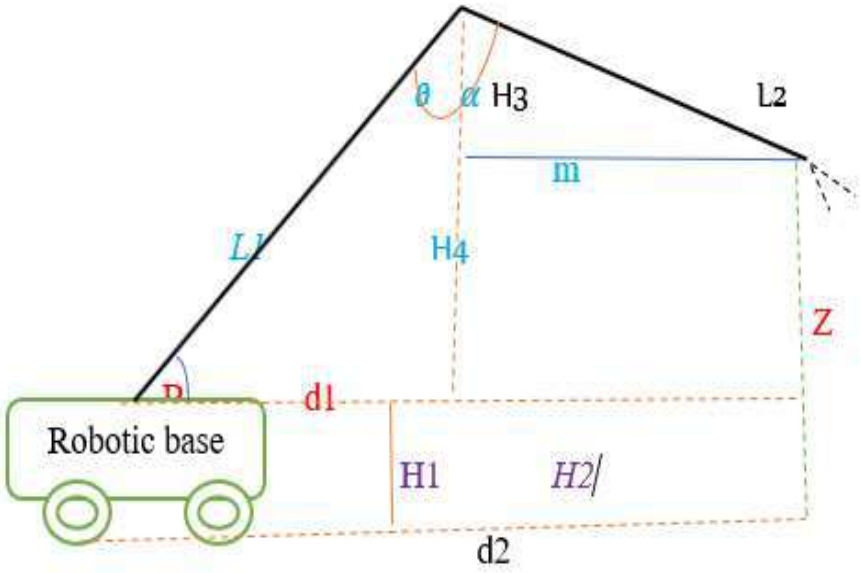


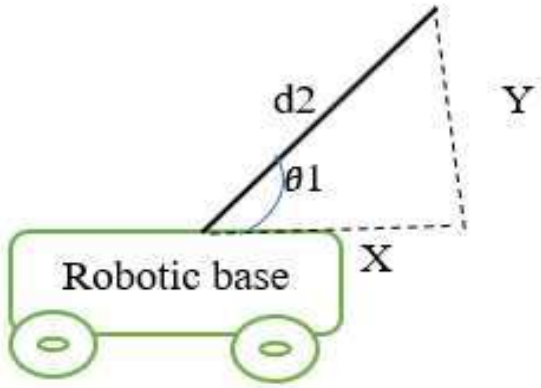


Forward kinematic

- ✓ Determine where the robot hand is (all joint variables are known). Here you are given length of each link, angles of each joint.so, you must find the position any point (i.e. its (x, y, z) coordinate).
- ✓ L1,L2, $\beta 1 = \theta + \alpha$, β, θ1, H1 given

Mechanical Design





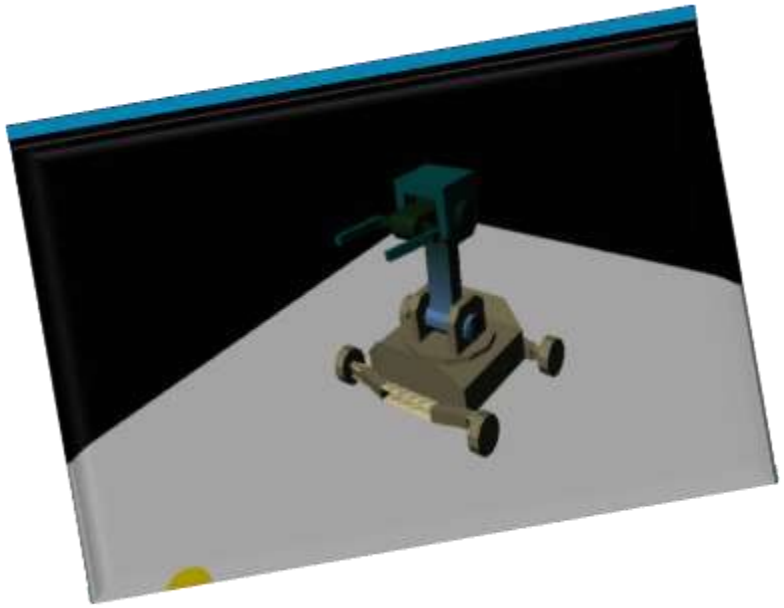
Forward kinematic

$$\beta = 30$$

- ✓ Let L1=L2=140mm, β1,
- ✓ θ1=60 and H1=40mm. Solution
- ✓ θ=180-90-30=60 so, $\alpha = 80$
- ✓ H3= l2cos α=24.3mm, ***H4=L1sin β***=70mm
- ✓ *Z=H4+H1-H3=85.7mm*
- ✓ d1=L1cos β=121.24mm, m= L2*sinα=137.87mm
- ✓ d2=d1+m=259.11mm
- ✓ X=d2cos θ1=159.56mm, Y=224.39mm
- ✓ (X,y,z)=(159.56mm,24.39mm,85.7mm)

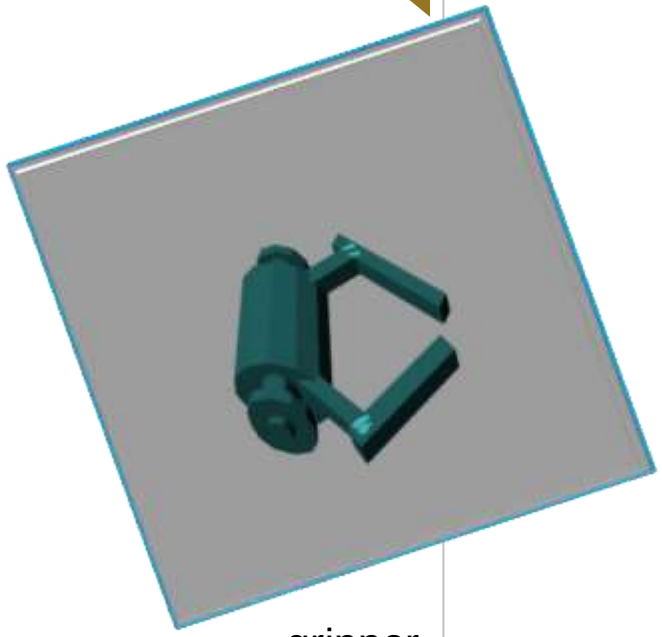
Mechanical Design

- perspective view of robotic arm



Robotic arm image

- Robotic arm during picking object



gripper

Testing and Evaluation

Testing answers

- ✓ Should any one of these systems fail?
- ✓ In what reason? either due to a hardware or software issue
- ✓ how a recovery plan must be in place to either repair a non-fatal error, or to shut down the platform as quickly as possible if it is non recoverable

Introduction

- ✓ Testing usually starts with test plan and ends with acceptance testing.
- ✓ Inputs are SRS, project plan, design, code, etc.
- ✓ Test plan identifies what levels of testing will be done, what units will be tested, etc. in the project
- ✓ The purpose of testing concern for the RACBWAA to check how the integration of the hardware and software subsystems and its components

Testing and Evaluation

Test Items

Here we intended to test about.

- ✓ how the integration of hardware component is work
- ✓ how signal conversation by PWM work
- ✓ how the wireless connection is work
- ✓ how motors are work their task
- ✓ how block diagram of the system design and its subsystems.

feature to be tested

- ✓ Component Testing: like power distribution, motor modules, dc motor driver controller, microcontroller board, wireless communication .
- ✓ Software Unit Testing: software to hardware interface[like command line interface and UART interface] , individual software commands
- ✓ System Integration Testing: power distribution Subsystem [Connection with Microcontroller, Connection with Motor Driver], Microcontroller [Connection with Motor Drivers, Connection with servo motor, Connection with Wireless android app]

Testing and Evaluation

feature not to be tested

In our system feature that cannot test according to users' viewpoints are:

- ✓ quality of the actuator,
- ✓ specification of wireless app and,
- ✓ Bluetooth module and power supply to the system.

But those are essential to developers.

Test Cases

- ✓ These test cases cover software testing and hardware testing. Let us see some written testcase even if it is difficult to include all testcase in this document.

Testing and Evaluation

Serial connection establishing test

Test Case Field	Description		
Test case ID	RATC001	Name	Sisay
Test Designed by	Teklhiwot Mekonen	Date of test designed	27/04/2011
Test Executed by	Yibeltal Assefa	Date of Execution	29/04/2011
Test Priority	High		
Description	Serial connection establishing test		
Pre-condition	1. Accessing power to microcontroller. 2. Accessing wireless application. 3. Must have connector.		
Test Steps	1. Supply 5Vpower to microcontroller 2. Connect USB cable to microcontroller and personal computer. 3. Open terminal on pc and set baud rate to 9600. 4. Open connection to microcontroller. 5. Verify that a command prompt appears.		
Expected Results	Microcontroller powers on and communicate via USB connection.		
Post-Condition	Serial communication is established.		
Status (Fail/Pass)	pass		
Requirements	1. Existence of power 2. Appropriate USB cable to board.		
Automation? (Yes/No)	Yes		

Testing and Evaluation

Impulse generation for servo motor to move it to right direction test.

Test Case Field	Description		
Test case ID	RCTC005	Name	Teklhiwot
Test Designed by	Teklhiwot Mekonen	Date of test designed	10/05/2011
Test Executed by	Sisay Negash	Date of Execution	12/05/2011
Test Priority	High		
Description	Impulse generation for servo motor to move it to right direction test.		
Pre-condition	Servo motor connect to Arduino board properly.		
Test Steps	1. Supply 5V power to board. 2. Send signal or order from android application. 3. Generate impulse from input. 4. Order servo motor to move right direction.		
Expected Results	Servo motor rotates		
Post-Condition	Robotic arm moves to the right direction.		
Status (Fail/Pass)	pass		
Requirements	Signal from android app. Proper configuration of driver.		
Automation? (Yes/No)	yes		

Recommendation and references

Recommendation

We would like recommend by somebody

- ✓ advance to its working area like for military, scientific expedition purpose.
- ✓ Obstacle avoider
- ✓ Climate sensor
- ✓ Add sound supporting command

Reference

M. W. Spong, Vidyasagar, Robot Dynamics and Control, 1989.
www.Arduino.org
https://www.instructable.com/electronic.class
https://en.wikipedia.org/wiki/Servomotor
https://learningengineering

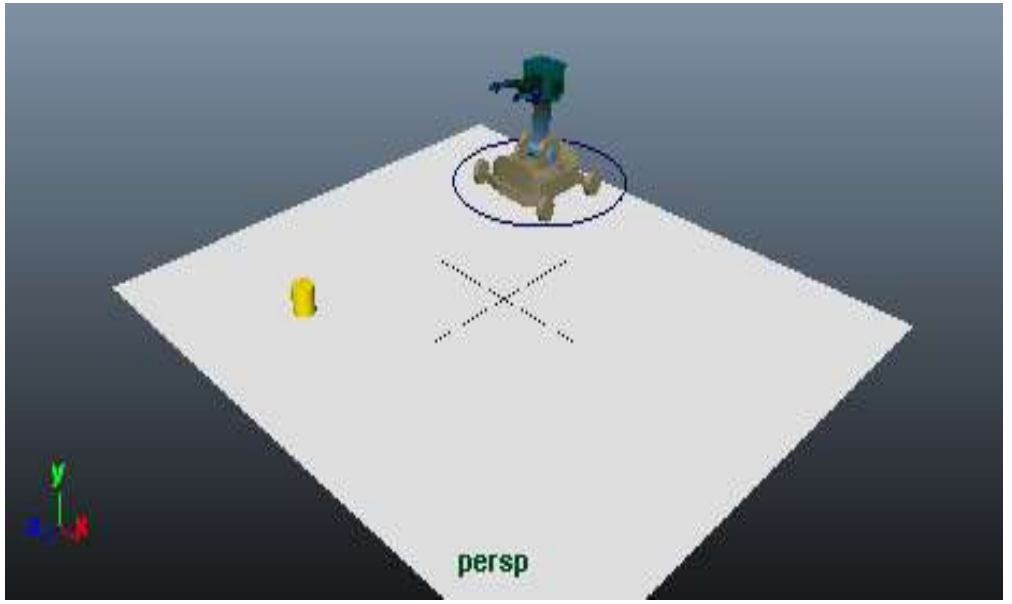
Generally

Picking and placing

Look

Robotic arm during picking

And placing objects



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Thank You