Industrial Robot Arm

TECHTURTLES Group:
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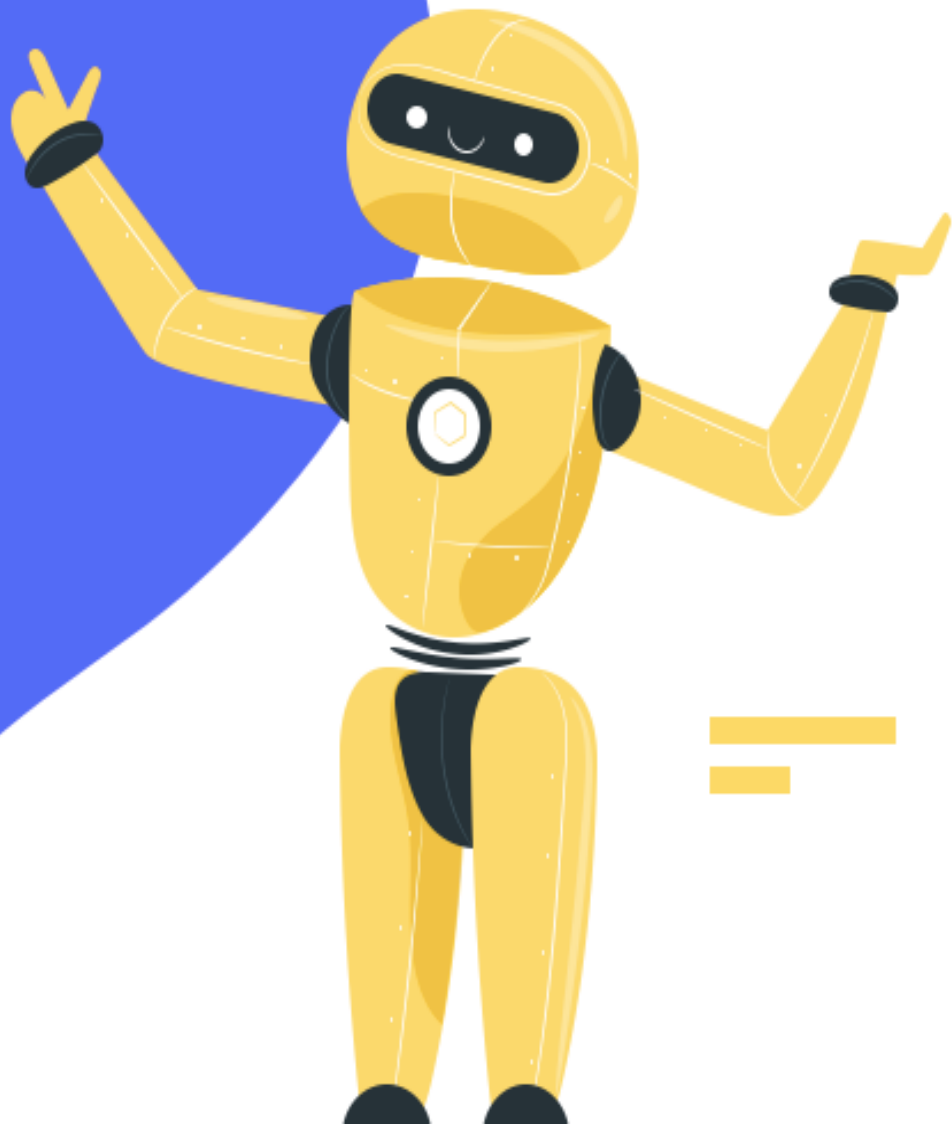
Operation File
Smart Methods



Operation

Project Operation Summary :

system design includes three main parts:

1. The hand gloves
2. The robotic arm
3. The navigation platform

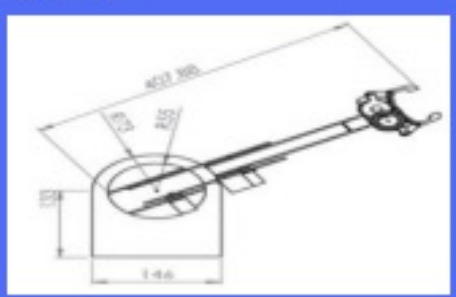
Wireless gesture controlled robotic arms are designed and implemented to prevent the involvement of human in the dangerous work like the biohazardous areas or performing a heavy lifting task. The robotic arm is designed to act after the operator actions and duplicate it by using sensors that are placed on a glove worn by the human hand to senses the gesture or movement of the hand, and send it to a microcontroller, where the sensed data will be processed and then sent through a RF transmitter to a RF receiver on the robotic arm part, where it will be processed by the second microcontroller, which will translate the sensed data to the motors of the robotic arm and the navigation platform to perform the movement according to the data input given by the operator.

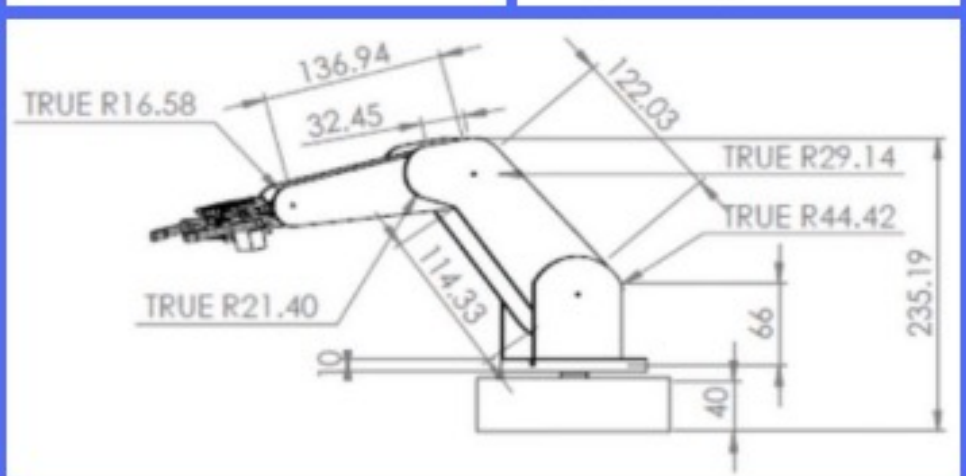
Operation

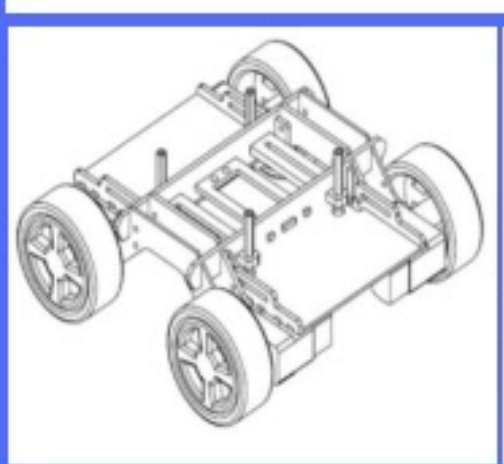
1-ROBORT DIMENSIONS:

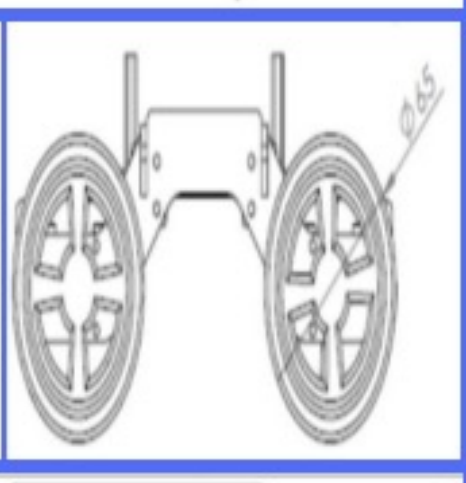
Typical robot sizes range from a reach of 0.5 to over 3.5 m and carrying capacities from 3 to over 1000 kg.
There are also a number of four axis articulated arms. These have been developed specifically for applications such as palletising, packing, and picking where it is not necessary to orientate the tool.

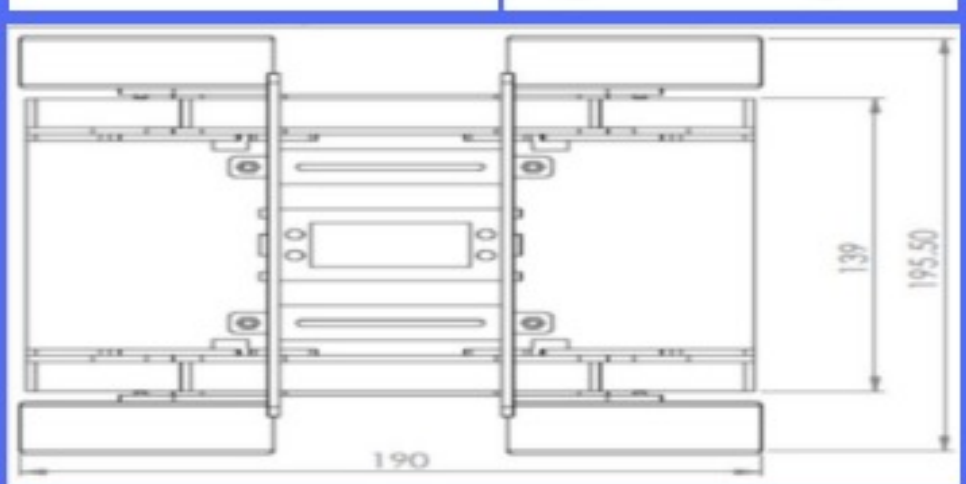
The robot arm consists of **three main parts** shown in the following pictures with dimensions :









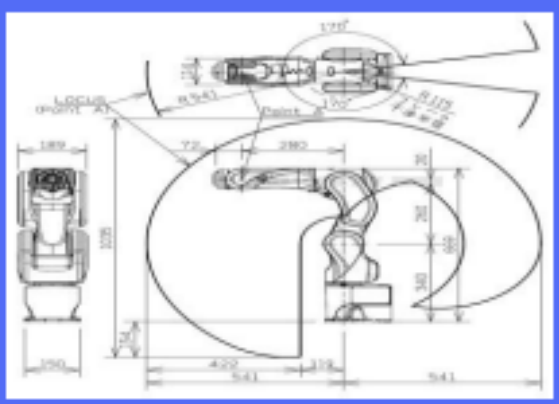


Operation

2- PLAYGROUND DMENSIONS:

The Components of a robotic arm are the shoulder, elbow, and wrist, Scara robot has 4-axis.
The 3 axes are nothing but 3 translational motion in X, Y, and Z directions, and the fourth axis will be used to rotate the tool.

Parameter	Length (mm)
L0	160
L1	140
L2	200
L3	80
L4	90



3-OPERATING RULES:

It will be ..
1- Wait 5 minutes for the green lights.
2- Never step/jump over the guardrail.
3- ROBOT Arm, stay on the workspace during the operation.
4- Players, stay off the workspace during the operation.
5- No wandering during the operation.

4-CONTROL PLAN:

FOR THE ARM CONTROL WE WILL USE THE NEXT

1-Motor Column : To choose which motor will be controlled .
2-ON / OFF button : to turn the controller on / off to save values and run the arm .
3-Degree column: to choose the degree of motor with range slider.
4-Value column: to shows the degree chosen by the slider and make sure of it.
5-SAVE button : to save values in data base for the chosen motor based on the range slider.

Operation

5-TECHNICAL OPERATION DETALS :

This chapter consists of the technical and detailed information for the design and implementation of gesture controlled robotic arm with vision . With a visual aid of a schematic diagram , an overall block diagram of the entire system and the working principle explaining how the prototype works with the help of a flowchart . After explaining the hardware part of the system , the program section for this chapter provides the coding explanation for the system . The chapter concludes with the hardware results for the prototype .

Testing

Unit testing :

The part	Result
Motor 1	Works
Motor 2	Works
Motor 3	Works
Base	The base's proportions and area are suitable for the size of the wheels and match the arm's specifications.
Wheels	All wheels work well

Integration testing :

The part	
Arm : motors	All motors work, and we tasted all and exulted positive
Base	We assembled all the base engines and tested them and discovered that they all work fine.
Wheels	Four wheels operate well and are excellent in addition to being able to bear arm weight and walk long distances.

Discission project finding& testing

Testing of the wireless gesture controlled robotic arm with vison is done to analyze the performance of the prototype and justify the flaws to improve for the studies in the future. some testing were done which were essential.

1- Accuracy of Gesture Response Test

Definition

The purpose of this test is to see how accurate the accelerometer and flex sensor are at detecting hand gestures and the robotic arm's response.

Test number	Senor	Gesture	Expected response	Accuracy
1	Accelerometer	Rotate 30°	Rotate 30°	65%
2	Accelerometer	forward 30°	forward 30°	80%
3	Accelerometer	Backward 30°	Backward 30°	80%
4	Accelerometer	Up 30°	Up 30°	80%
5	Accelerometer	Down 30°	Down 30°	80%
6	Flex sensor	Bend 90°	Bend 90°	90%
7	Flex sensor	Bend 60°	Bend 60°	90%

2- Testing the Range of the Radio Communication

Definition

The range of radio communication between the controlling glov and a beeping device on the other microcontroller will be tested both indoors and outdoors to see how far it can travel

Test number	Indoor \outdoor	Range in mater	How powerful in signal
1	Indoor	2m	100%
2	Indoor	5m	100%
3	Indoor	10m	100%
4	Indoor	15m	100%
5	Indoor	30m	80%
6	Indoor	50m	0%
7	Outdoor	80m	100%
8	Outdoor	160m	100%
9	Outdoor	300m	100%
10	Outdoor	500m	100%
11	Outdoor	600m	90%

3- Accuracy Test in Multiple Ranges

Definition

This test is performed to demonstrate the accuracy of the gesture and the system's response over a wide range of distances, as the system is intended to be operated from a distance.

Test number	senor	Range	Gesture	Expected response	Accuracy
1	Flex senor	5m	Bend 90°	Rotate 90°	100%
2	Flex senor	15m	Bend 60°	Rotate 60°	100%
3	Flex senor	30m	Bend 90°	Rotate 90°	100%
4	Flex senor	50m	Bend 60°	Rotate 60°	80%
5	Flex senor	100m	Bend 90°	Rotate 90°	100%
6	Flex senor	120m	Bend 60°	Rotate 60°	100%

4-Testing the Servo Motor Performance

Definition

This test is used to verify the robotic arm's ability to carry the load objects and maintain an angle while performing the pick and place task.

Number	Weight	Angle	Time held over 60 s	Performance percentage
1	5000g	90°	60 sec	100%
2	750g	60°	60 sec	100%
3	1kg	90°	50 sec	83.3%
4	2kg	90°	30 sec	50 %

Performance testing:

-Load: the robot arm can hold up to 2kg perfectly for 30 seconds. Also, it can operate at 6Volts.

-Stress testing: we wanted to see how much more the robot arm can withstand. So, we started increasing the weight. We started with 2.5kg then 3 then 3.5 and it finally broke at 4kg.

Scalability test: we tested the scalability of the robot arm by enlarging the workspace. We concluded that it could be enlarged up to 9 times, but after that, the number of errors will be too high.

Stability: the robot arm can work under extreme weather conditions; as low as -10o c and as high as 1232o c.

Usability testing:

we commanded the arm to lift a box and drop it continuously for 40 minutes. The robot arm succeeded in doing so. Therefore, the robot arm works flawlessly.

Compatibility testing:

We tested the arm along with 3 other arms to see how they will work synchronously, and it did. No problems or comment.

Tolerance

By defining the tolerance, we could make the process easier by being prepared for any risk, and a good tolerance table will increase efficiency.

01 Mechanic

1- Various locations or the number of wheels.

2- The disparity in dimensions.

3- Weight difference.

4- Pieces of poor quality.

5- Pieces that are missing.

6- Parts that are heavy.

7- Bearing deterioration.

8- Apply a lot of force on the pieces.

9- Incorrect assembly.

10- Excessive use of the robot.

02 Electronics

1- Using the incorrect motors.

2- Using the incorrect wiring.

3- Using loose wires or soldering.

4- Incorrectly connecting parts.

5- Supplying the motor with excessive a voltage.

03 AI

1- Change the location of the files.

2- Incorrect file linkage.

3- Files that are duplicates of one other.

4- the names of the libraries are incorrect.

5- The time it takes for a response.

6- There are no libraries installed.

7- Incorrect detection.

8- Versions are not in sync.

04 IOT

1- Viruses and Cyber Hacking.

2- Data loss.

3- No internet connectivity.

4- Overwhelming website traffic.

5- There is a deficiency in inquiry speed.

6- There is an excessive amount of time between the request and the response.

7Cause the server to crash.

8- Security risks.

9-The database or API connection has failed.

05 Industrial

1- Disorganization of thought.

2- Members of losing control and disorganization.

3- There is a lack of follow-up on a regular basis.

4- Inadequate writing.

5- Dates that are difficult for some members.

6- There is a sense of urgency and a lack of time management.

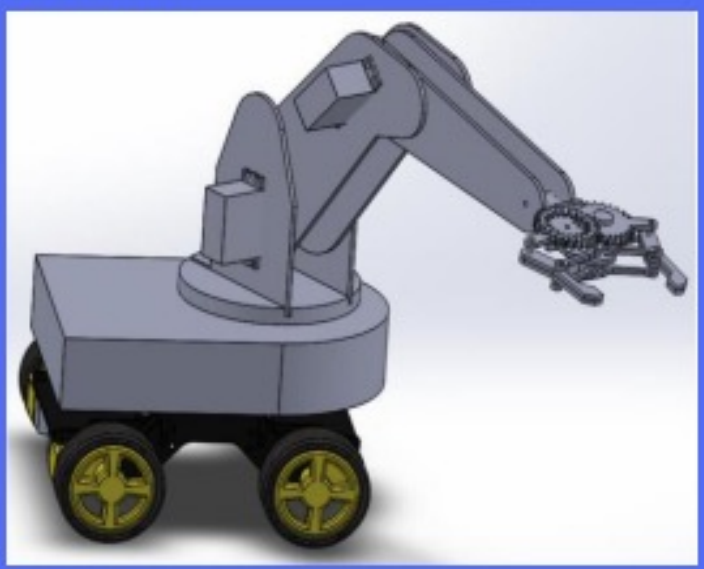
7- Inadequate management.

8- Interpersonal incompatibility

User manual

The robot includes 3 parts, the glove, arm, and base which contains wheels.

First you must attach the arm to the manipulator and then to the wheels until you get the full robot that should look like this:



As for controlling the robot, you will have to download our app (ErrorX) over there, you will see the motor column, which allows you to choose which motor to control

Then, there's the on/off button that turns the controller on and off.

After that we have the degree and value button which allow you to choose and shows which degree of motor range slider and make sure of it.

Finally, you have the save button and it allows you to to save values in data base for the chosen motor based on the range slider .

WARNINGS:

1- Keep the robot and small components away from children under 3 years old at all times to prevent injury or damage.

2- To prevent the spread of fire, keep candles or other open flames away from the robot at all times.

3-Conversion or modifications to this product not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

4- Avoid installation in extremely hot, rainy or water splashing, or being placed in high temperature or moist environment.

5- DO NOT throw the battery in fire, short circuit the contacts, disassemble the battery or throw the battery in municipal waste.

Warranty

Since it is a large product with so many pieces, the product is warranted for a period of 360 days(a year).

The warranty does not cover:

-any modification made to any hardware or firmware of the Product.

-abuse, misuse or improper storage of the Product.