

Operations of Humanoid Interactive Robot

Robot's dimension

This robot contains 5 parts, each part will be provided with suggested dimensions limits including tolerance (minimum value ,targeted value ,maximum value):

1- Head parts (Table 1)

	Height (cm)	Width (cm)	Thickness (cm)
Total	(29.75 ,30 , 30.25)	(29.75, 30, 30.25)	(14.5, 15, 15.5)
Display Screen	(17.7, 18, 18.2)	(14.7, 25, 15.2)	(3, 3.5, 4)
Head's base	Circular shape with a diameter of (14.9, 15, 15.1)		

2- Upper body:

	Height (cm)	Width (cm)	Thickness (cm)
Total	(49 ,50 , 51)	(39.75, 40, 30.25)	(29.75, 30, 31.25)
Head's joining place	Circular shape with a diameter of (15.2, 15.3, 15.4)		
Arms' joining place	2 circular shapes (Right and left arm) with a diameter of (15.2, 15.3, 15.4). Positioned at the top of robot's sides.		
Upper body's base	Circular shape with a diameter of (40.8, 41, 41.2)		

3- Lower Body:

	Height (cm)	Width (cm)	Thickness (cm)
Total	(59 ,60 , 61)	(39.75, 40, 30.25)	(29.75, 30, 31.25)
Lower body's top	Circular shape with a diameter of (41.5, 41.7, 41.9)		
Lower body's base	Circular shape with a diameter of (43.6, 43.8, 44)		

4- Arms:

	Height (cm)	Width (cm)	Thickness (cm)
Total	(59 ,60 , 61)	(14, 15, 16)	(14, 15, 16)
First Part	(24.5, 25, 25.5)	(14,15,16)	(14,15,16)
Second Part	(34.5, 35, 35.5)	(9.10.11)	(12, 13, 14)

5- Base:

	Height (cm)	Width (cm)	Thickness (cm)
Total	(14, 15, 16)	(46, 47, 48)	(46, 47, 48)
Bases' top for joining lower body	Circular shape with a diameter of (44.1, 44.3, 44.5)		
Tires joining places	Circular shape with a diameter of (4.9, 5, 5.1)		

6- Tires:

	Diameter (cm)
Tires	Circular shape with a diameter of (19, 20, 21)

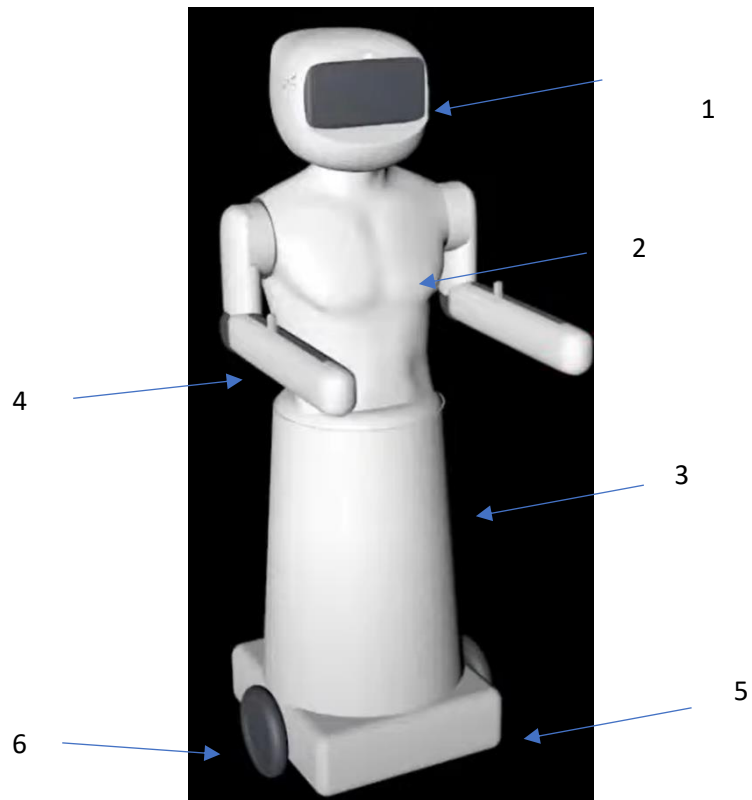


Figure 1, Initial Humanoid interactive robot design

Control Panel Description

The humanoid interactive robot's control panel will enable the user to control the following:

- 1- arms' movement
- 2- head's movement
- 3- Base's movement.

The control panel will be shown to the user like figure 2. The control panel will be linked with the robot by Wi-Fi.

The display screen will be controlled using a tablet's remoting application.

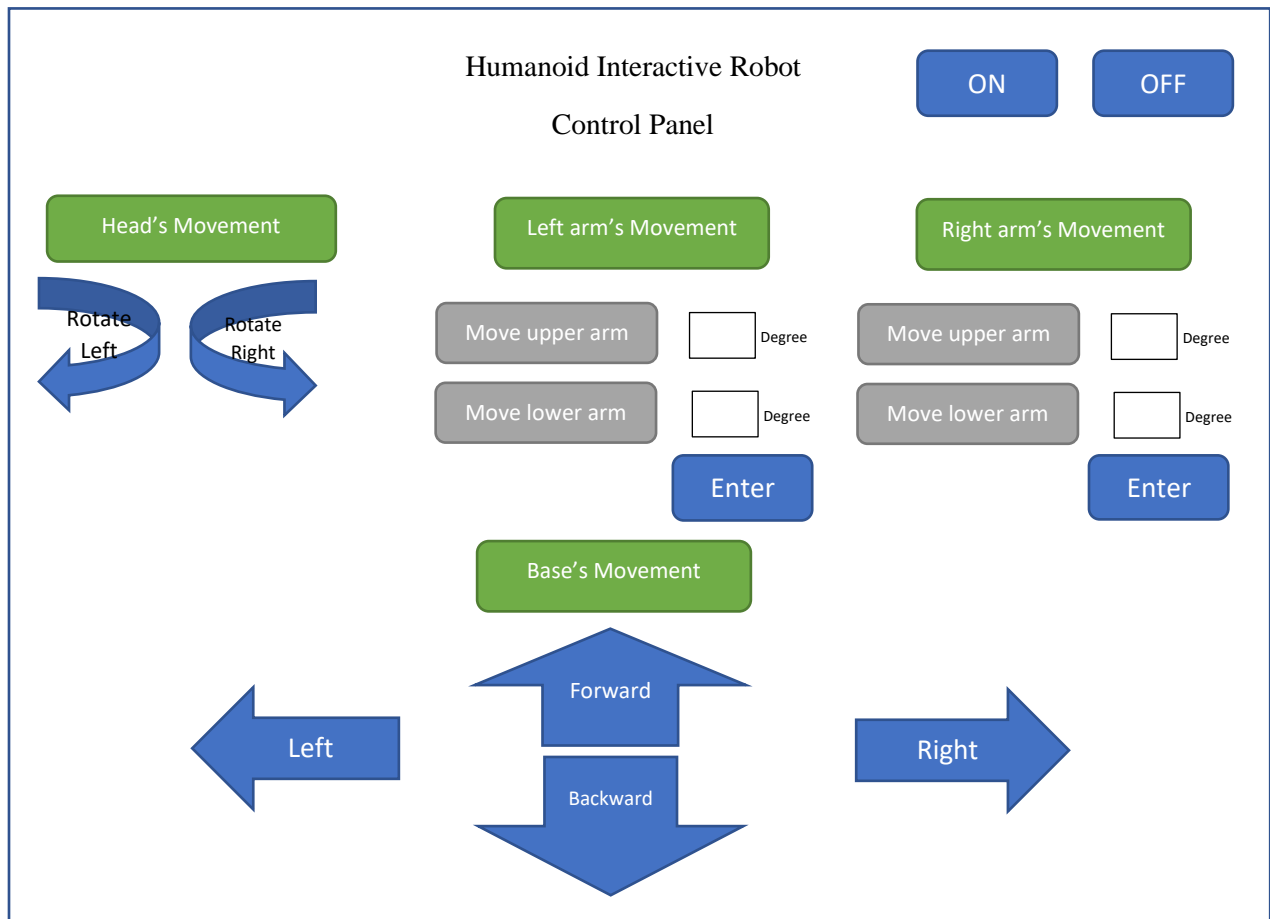
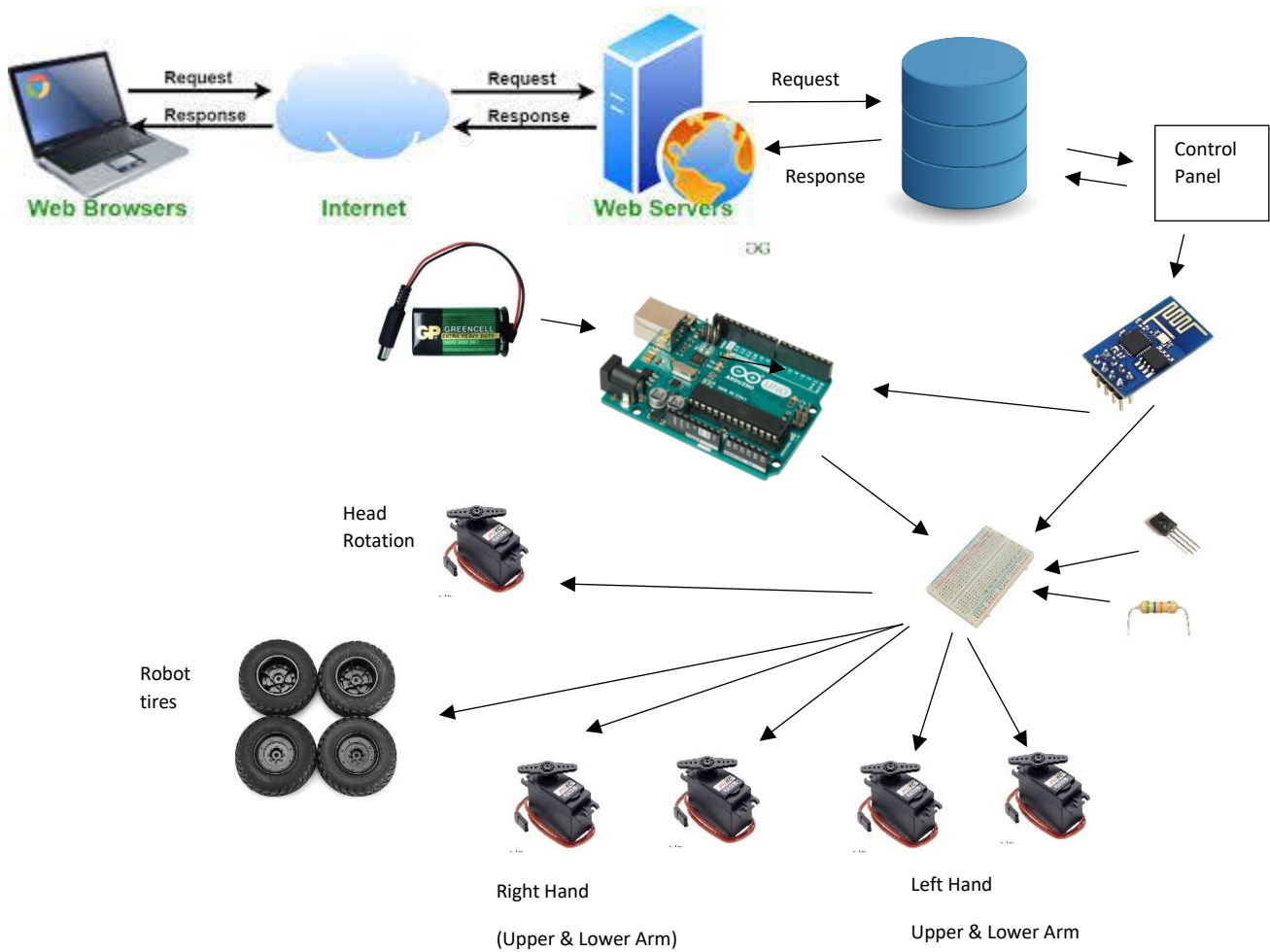


Figure 2, Robot's control panel

Operations details from a technical perspective



The controlling cycle starts with the web browser. In the web browser, the CSS page will be shown to the customer once it is connected to the internet. The CSS, JS and HTML pages will be linked to the database where the controlling codes and data is stored. To link the database with hardware parts, PHP pages will be used. Servomotors, Arduino, Battery and Tires will be controlled using the prepared CSS page.

Unit Testing		
Part	Objective	How to do?
Head	See if it will work after rotating for many times without being damaged.	Rotating the head to the maximum available rotating degree right and left for 150 times
	Detect any possible problems that may happened.	The display screen will be tested by examine the linking and unlinking with the control panel for 150 times
	Testing the amount of impact and vibration that the head can bear without affecting on the part's places inside the head including the display screen	<p>a- Transferring the head from a specific place to another specific place manually with different speeds (20-40 m/s).</p> <p>b- Transferring the head from a specific place to another specific place using shipping car with different speeds (20-80 km/hour).</p>
	Testing the ease of removing the cover to do the maintenance for the cables inside the head	Removing the cover and get it back 100 times.
Upper Body	Testing the endurance of the upper body to handle the head.	Exposing the upper body to (+5Kg) of the expected head's weight for 7 continuous days.
	Testing the endurance of the upper body to handle the arms.	Exposing the upper body to (+5Kg) of the expected arm's weight for 7 continuous days.
Lower Body	Testing the endurance of the lower body to handle (Upper Body, Head, and Arms).	Exposing the lower body to compression test (+5 Kg of the expected total weight of top parts) for 7 continuous days.
Arms	Testing the capability of rotating without being damaged	Rotating the 2 arms (Upper + Lower Arms) to the maximum rotating limit for 150 times.
	Testing the endurance of the 2 arms to handle objects.	Putting a 3 Kg object for 7 continuous days.
Base	Testing the endurance of the base to hold the robot's parts.	using compression test with (+5Kg) of the expected total robot's weight.
Tires	Testing the ease of movement of the tires.	Rotating the tires for 7 continuous days.

Integration Testing		
Integrated Parts	Question	Testing Method
Integrating (Head + Arms + Upper Body): If not: Design a process to finding the exact issue in the upper body, then design a process for repairing it. If yes: Approve the current situation of the parts.	Can the upper body handle the head and the arms?	1- Rotation the head in all degrees for 100 times. 2- Rotating the arms in all degrees for 100 times. 3- Transferring these parts from a specific place to another specific place manually with different speeds (20-40 m/s). 4- Transferring these parts from a specific place to another specific place using a shipping car with different speeds (20-80 km/hour).
Integrating (Upper body, Head, Arms with Lower Body).	Can the lower body endure the top parts?	1- Rotating the head in all degrees for 100 times. 2- Rotating the arms in all degrees for 100 times. 3-Transferring these parts from a specific place to another specific place manually with different speeds (20-40 m/s). 4- Transferring these parts from a specific place to another specific place using a shipping car with different speeds (20-80 km/hour).
Integrating (Head, Arms, Upper and lower parts with the base and the tires)	Can the base and tires endure all the parts?	1- Testing by rotating the head in all degrees for 100 times. 2- Testing by rotating the arms in all degrees for 100 times. 3- Testing by moving the robot for 2,000 meters in different directions.

System Testing	
Question	Testing Method
Does the robot's system work correctly and smoothly?	<p>1- Check all control panel's selections and use each button for at least 150 times.</p> <p>2- Turn on and off the robot for at least 150 times using the control panel.</p>

Performance Testing	
Question	Testing Method
Does the robot's speed affect by the battery's level?	Testing by moving the robot from 100% level to 0% level for 10 times.
Will the robot's Arms and head's rotating be affected by the battery's level?	Testing by rotating the robot's components with different battery levels.
What is the maximum object's weight that the robot can endure?	Testing by objects have a weight of (1Kg – 20 Kg).
Is it easy to remove the arms from their places?	Testing by tensile test.

Expected Errors

Internet disconnection:

Database's host is down.

Poor Electricity

Breaking the screen.

Broken cables with the Arduino.

Servo motor's stoppage.

Battery's level is going down quickly.

Web server is down.

Arms breakage.

Tires stoppage.

User Manual

Step	How to do it?
Connect the laptop to internet	Using any local WiFi.
Open the web browser and enter the control panel's link place	Using the computer's browser with the provided link with the robot.
Turn On the robot	Using the control panel (ON button) in the top right.
Control head's movement	Press "Rotate Right" or "Rotate Left" under head's movement band.
Control upper arms' movement	Enter the desired degree in the box next to "Move Upper Arm" button then press enter.
Control lower arms' movement	Enter the desired degree in the box next to "Move Lower Arm" button then press enter.
Control the movement of the robot	There are 4 directions for movement "Forward, Backward, Right, and Left" under base movement band. Press one of the options to move the robot to the desired direction
Turn Off the robot	Using "OFF" button in the top right.
Control Display Screen	It will be completely using a tablet's controlling app. The guidelines will be provided separately once the tablet's type and the app is determined.