Industrial Operating File for The Robotic Arm Project

1. Operations:

Manufacturing a Robotic Arm and a moving base under it with a specific design which is programmed to participate and win in the Robotic Arms competition. The concept of the competition is putting two Robotic Arms in the ring with a moving base under each Arm and a balloon behind each of them. Each Robotic Arm will try to destroy the balloon of the other Arm while protecting its balloon. All the parts of the project including the parts of the Arm, and the parts of the moving Base will be designed and printed by a Mechanical Engineer. After that, an Electronics Engineer will build up two Electrical Circuits one will be a battery charge circuit, and the other one will move the motors, also he will connect between them. The next stage will be managed by a Software Engineer who will build up a control panel interface which controls both of the Arm and the moving Base with a data base for each of them and he will connect between the panel and the data base to remote control the Arm and the moving Base. The final stage is to add an artificial intelligence acting to the Arm and its moving Base by Implementing the Robotic Arm on the Simulation program (ROS) to control the motors by simulation, then using (Turtlebot3) program with (SLAM approach) to create and save a map for the moving Base which will be done by an Artificial Intelligence Engineer.

Dimensions:

The dimensions of the moving Base will be as following: The Length and the width will be 250 mm, and the height will be 107 mm + 521 mm for the height of the Arm. These dimensions are based on the Mechanical Engineer designs + counting and measuring all the parts that has to be on and inside the Base including the Battery which has 65 mm length, 240 width, and 97 mm height and also the Arm which will be on top. The Ring will be square shaped because the competition is considered to be similar to a fight, we want to make sure that the two Robots will keep facing each other and no Robot can run away or avoid the other. So, the length will be 1 m, and the width will be 1 m to make sure that each Robot can take a complete roll on the other Robot to reach its Balloon.

Operating Rules:

- Before starting the competition every competitor and the audience will have to stay in the area prepared for their stay and no one is allowed to stay near to the Ring except the referee.

- After everyone goes to the specific place for him the referee will count from one to five then he will give the starting signal to the competitors.

- After everyone hears the starting signal, the competition will start immediately so everyone must be ready.

The Control Panel:

The control Panel will contain 5 Buttons for controlling the moving Base. One will be for stopping and the rest will be for directions. It will also contain a Joystick and another button. The Joystick will be to move the Arm in multiple directions, and the button will be for attacking the opponent.

Control System Structure:

The Structure of the control system will contain three parts. The first part is the electrical circuits part that will move the Arm and its Base. It will contain an Arduino which will be connected to the Robotic Arm and the moving Base to control their movements. The second part which will be done by the Software Engineer will contain the control panel that will remote control the Arm by using the Browser on the user's computer. The third part is the Artificial Intelligence part which will be done by (ROS), and using (Turtlebot3) program with (SLAM approach) to create a map for the range of motion of the moving Base.

2. Testing:

a. Functional Testing:

- Units Testing Progress:

Unit	Pass	Fail
Motor 1		
Motor 2		
Motor 3		
Motor 4		
Motor 5		
Motor 6		
Motor 7 (End Effector)		
Sensor 1		
Sensor 2		
Sensor 3		
Web Control Page		

- Integration Testing Progress:

Integrated Units	**Pass**	**Fail**
Motor 1 + Motor 2 + Motor 3 + Motor 4 (Base Motors)		
Motor 5 + Motor 6 + Motor 7 (Arm Motors)		
(Base Motors) + (Arm Motors)		
Sensor 1 + Sensor 2 + Sensor 3 (Sensors)		
(Web Control Page) + (Base Motors)		
(Web Control Page) + (Arm Motors)		

- System Testing Progress:

All system Parts Together	**Pass**	**Fail**
(Web Control Page) + (Base Motors) + (Arm Motors) + (Sensors)		

B. Nonfunctional Testing:

Test	**Condition**	**Yes**	**No**	**If No, what is the recommended Solution?**
Performance Testing Progress:	Does the Robot perform well with all of its Motors under the expected workload?			
Usability Testing Progress:	The Control System can be used in a proper way			
Compatibility Testing Progress:	Does the Control panel in the browser works and react well with the Robot?			

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3. Playback Tolerance:

Unit	Expected Faults	Check
Web Interface	Internet disconnection – System dawn due to large number of users	
Web Server	Internet disconnection – System dawn due to large number of users – LAN Interference – Defective cables – Wrong configuration of server devices	
Data Base	Internal transaction failure – System error – Data loss error	
Raspberry PI	Boot errors - NOOBS OS stuck on splash screen – Unable to access PI over SSH – Board goes off intermittently – Raspberry PI camera doesn't work	
Arduino	Arduino board is not recognized – The board not in Sync – Launch error – Serial port is already in use – Sketch is too large	
Arm Joints	Error in one Joint – Error in all Joints – Error in sensors	
Motors	Error in drive motor – Error in the motors – Error in motors installation	

4. User Manual

- User Manual:

A. Safety Recommendations:

- Device is only allowed to be used by 18+ years old, due to all electrical connections and devices which may cause harm.

- Device cannot be used before reading the User Manual.

- Device contains too many electrical connections, IOT, and AI devices so make sure to be careful before starting.

- Cannot run near to water or any liquid substance.

- Make sure to call the company if anything wrong happens while running the device.

B. How to get started:

- Attach the Arm to the Moving Base, make sure It has been attached properly.

- Charge the Battery, you will find it under the Moving Base. It may take 3 hours to be fully charged.

- While charging the Battery attach the 4 wheels of the moving Base under it.

- After charging the Battery take it back to its place under the Base and attach it properly.

- The device is now ready to get started, if it doesn't run it means there is a technical problem, please contact the company to solve it.

- After turning the Robot on, upload the user interface given with the device to your computer.

- install the program to your computer

- You will see the Control Panel on the screen which controls the movement of the Robot

Now you can enjoy using the Robot, please if you have any issues contact our company.

- Competitor Manual:

A. Safety Recommendations:

- Device is only allowed to be used by the competitors who will participate in the Robotic Arm competition, due to all electrical connections and devices which may cause harm.

- Device cannot be used before reading the User Manual.

- Device contains too many electrical connections, IOT, and AI devices so make sure to be careful before starting.

- Cannot run near to water or any liquid substance.

- Make sure to call the company if anything wrong happens while running the device.

B. How to get started:

- Attach the Arm to the Moving Base, make sure It has been attached properly.

- The Battery will be fully charged and attached under the Base, the company's team did that to save more time for the competitors.

- Attach the 4 wheels of the moving Base in their places under it.

- The device is now ready to get started, if it doesn’t run it means there is a technical problem, please contact the company to solve it.

- After turning the Robot on, upload the user interface given with the device to your computer.

- install the program to your computer

- You will see the Control Panel on the screen which controls the movement of the Robot

Now you can participate and win in the Robotic Arm competition, please if you have any issues contact our company, ENJOY.

5. Warranty

There will be no Warranty on this Robotic Device because it has been designed to go through battles and competitions, so any damage happens to the device due to the participation in competitions only the competitor will take the responsibility.

The free services offered by the company will be fixing any manufacturer's defects the competitor finds in the device after starting it immediately. The company offers paid maintenance services on any other technical issue in the Robotic Device.