Industrial operation of the project

Written by: Haneen Alhajjiahmed

Smart Methods

Table of Contents

[Operation 2](#_Toc77180044)

[Testing 4](#_Toc77180045)

[Functional Testing 4](#_Toc77180046)

[Non-Functional Testing 7](#_Toc77180047)

[Tolerance 7](#_Toc77180048)

[User manual 8](#_Toc77180049)

[Warranty 8](#_Toc77180050)

[Figure 1 components within the base 2](#_Toc77179885)

[Figure 2 control interface 3](#_Toc77179886)

[Figure 3 project's sub tasks information 5](#_Toc77179887)

[Table 1 some tasks' test types 6](#_Toc77179898)

# Operation

1. The dimensions of the robot

The robot consists of four basic components that represent the structure. Wheels, base, balloon, and arm. The arm is installed above the base and in front of the balloon. To be able to move the entire arm without any obstacles. The length of the arm is approximately 497 millimeters. As for the base, its dimensions should be as follows. 102 mm in length for the base, 155 mm in width. Thus, you can comfortably fit the pieces in the first picture and give space for work and wires. Finally, tricycles are the best option, as we will include three wheels of 25 mm, two in the back and one in the front. That helps to balance the base for movement and bearing weights.

Diagram

Description automatically generated

Figure 1 components within the base

1. The dimensions of the ring

The specifications of the ring were determined by several reasons. First, a circular circuit, when hitting any part of the edge, it will be easy to break free from the collision, unlike other shapes. When colliding in the corners, it will require the competitor at least three movements to release and return to the circuit. This means faster losses and more obstacles. When hitting the circular ring, the competitor will still be able to move. Second, a ring with a fence, to prevent the contestants from escaping outside the ring, which could hinder the competition. Third, measure the ring. The size was chosen to be the diameter of the circle 600 mm. This will allow the contestants to move freely enough. In addition, the contestants can rotate around each other.

1. operating rules
   1. Both contestants can access the dashboard of the robot.
   2. Ensure that the robot is connected to the control panel.
   3. Installing the robots in the center of the arena, facing each other, with 200 mm between them.
   4. Count to five before starting.
   5. Each round lasts a maximum of 10 minutes.
2. control interface

This is the control panel as shown in the figure below. The top is labeled "Direction Degree Control". Helps competitors control the degree of rotation of the arm joints. As rotating the base or the end effect, for example. As for the second part, which defines the movement of the base. The contestant chooses the directional button to move the robot.

Graphical user interface

Description automatically generated

Figure 2 control interface

1. operation process

Technically, the bot is associated with a control interface. Initially, the admins of the bots must turn on the power button. To send the operating signal to the databases. When the database receives the playback button value as a valid value. Then Database will start accepting the values that were selected from the interface, storing them in the database, and then sending them to the robot. Then the robot starts executing the commands sent. On the other hand, the robot sends the data to the database and thus to the Interface. For example, when the power button is turned off, the Database will stop receiving any data from the Interface. A message will appear on the interface that the robot has been turned off.

# Testing

## Functional Testing

The project table below shows that there is a unit test after each task is completed. For example, in the sixth line, the beams needed to add the extra intelligence to move the robotic arm are created. Then in the seventh line, these packages are tested on an emulator to ensure that they work well. Then the integration test is applied. An example is lines 9 and 10. After combining two small tasks, the program, and the arm, they are tested. This test is done when any two tasks are added together. Finally, line 17 shows that the arm is fully tested in terms of software, interface, design, and more. It extends to 22 days.

Table

Description automatically generated

Figure 3 project's sub tasks information

|  |  |  |
| --- | --- | --- |
| Test name | Test type | Test description |
| Line 5 connect data with the database | Unit testing | Requires the database to receive and store data in a good manner. As it is declared in the specification. |
| Line 7 test ROS packages on a simulator | Unit testing | Requires a simulator environment like Gazebo or Rvis. To ensure that packages meet the requirements of the robot arm. |
| Line 10 test the arm | Integration testing | Test the packages and the arm at the same time. After inserting the programs into the arm. |
| Line 15 test circuits | Unit testing | Testing the circuit is very crucial for tolerance and warranty. Also, to ensure that circuits can operate well as required. |
| Line 17 test the complete project. | System testing | the arm is fully tested in terms of software, interface, design, and more. Which is the last phase before putting the product in the production line. |

Table 1 some tasks' test types

## Non-Functional Testing

Some tests are applied to the arm to measure performance. First when designing the arm in the mechanical section. The mechanical engineer performs a morphological analysis. Which helps to evaluate and test all possible possibilities. And in the end, we get the final form of the design. which must be effective in terms of implementation and performance. The design of the base, for example, should be of the appropriate shape and size (mentioned above). To contain and carry all necessary components. Also, any openings should be carefully thought out. Also, the size and type of wheels. For an indoor competition that does not include heat or environmental obstacles. There is no need to take thick and heavy tires. Also, the number of wheels needed to distribute the load.

Second in the IoT section. Programmers consider the following elements. Availability, portability, compatibility, reliability, translation, and ease of use. The site should be available in a very short time. It should also be available on all devices and browsers. Reliability is the ability of the site to provide services correctly and as expected in the requirements. The design and use must be clear and easy for the target group of users.

The third section is intelligence. The department of intelligence should combine the two previous sections, namely mechanics and IoT. The exchange of information between databases must be readily available and relatively fast. Database itself stores and exchanges information between the interface and thus the user. And when the design is run on a simulation program. The simulation software has options to make the conditions as if they were in the real world. Like a block simulation, for example. When designing all the pieces with the same mass, the arm will fall. Therefore, Non-Functional Testing is so important. Because without it the system will not be useful. And finally, the electronics department. It is the part that needs a certain amount of energy to move the arm effectively. It is important to test the performance of the arm on various energies to determine the appropriate amount of energy.

# Tolerance

In robotic arm design, how to customize the tolerances for parts in the manufacture and assembly of the robot too Important because this directly affects the quality of the product and manufacturing cost. The lower the tolerance, the higher the quality of the product. Because the amount of error becomes very low. To do this we can define one of the tolerance reduction algorithms. Not all algorithms give the same results, it depends greatly on the bot used and the components of that bot. Several algorithms must be tested before determining the best one.

# User manual

The robot is controlled by specialized robot operators. They are responsible for operating the robot from the source and placing it in its designated location on the circuit. In addition to installing the balloon. All the users must do is to open the browser page through any browser. And follows the laws stipulated for the competition mentioned above. It begins by determining the angles of rotation of the arm. Then press the Save and Play buttons. And if he wanted to move the base, he would press the directional buttons. Up, down, right, or left. And the stop button in case he wanted to stop the base.

# Warranty

The warranty is subject to the laws of the Saudi Ministry of Commerce:

* The warranty period for electrical goods shall not be less than two years.
* Extending the product warranty period equivalent to the delay in providing a spare part or starting or completing maintenance work.
* If a defect occurs on the product that is covered by the product warranty, and the agent does not deal with it with the necessary professionalism, the agent is responsible for providing the product warranty for this defect and its consequences, for an additional year following the expiry of the warranty period.
* In the event of a defect covered by the warranty, the consumer has the right to go to the shop from which he purchased it, and the shop is obligated to repair the defect or deliver it to the agent for repair.