

**e-Yantra Robotics Competition - 2018**

**Theme and Implementation Analysis – Ant Bot**

**<2268>**

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| **Date** |  |

**Scope and Preparing the Arena**

**Q1. a. State the scope of the theme assigned to you.**

**(5)**

< Team should briefly explain in their own words the theme assigned. What in your opinion is the purpose of such an application?

Answer format: Text, Word - limit: 100 words>

As our theme is ant bot, we are developing a robot which completes tasks similar to the ant. We know how the ant collects food for themselves and store in ant-hill. So, in this theme, we study a few concepts, and develop a bot which will do tasks similar to ant.

**b. Upload the Final Arena Images.**

**(20)**

< Prepare the arena according to the steps given in Section 4: Arena, of the Rulebook. Please follow the sample SIM Placement Document (provided in Task 2) and example Supply Placement Table and Trash Placement Table in section 3: Theme Description of arena. Your final arena should look like as shown in Figure 7 of Rulebook.

**Take 4 photos** of the completed arena from different angles such that the entire arena along with its components such as SIMs, Supply Blocks, Trash Blocks, AH Walls, etc., are clearly visible in the photos.

Answer Format: The four image files should be uploaded as **.jpg** along with this document as per instructions in Read Me for Task 3. >

**Building Modules**

**Q2. Identify the major components required for designing the robotic system for the theme assigned to you.**

**(5)**

< Team should classify the components into various categories: mechanical systems, electronic systems etc. and mention how these units will be used in the theme. You may draw diagrams/figures to illustrate your answer.

Answer format: Bulleted form

**Electronic system:-**

* Raspberry Pi:
* Arduino Nano:
* Line following sensor: For completion of theme, the motion of the AB by following the provided path correctly, the Line following sensor is used
* PiCamera: To identify the objects like stacks, trash, SIM, etc. by color detection, the piCamera is used.
* Buzzer: When the theme has been successfully accomplished, the buzzer is blown to give the signal that the theme is completed
* 12V Battery(Lithium Ion): To give power supply to DC motors required for locomotion, the LI-ion Battery is used.
* RGB LED's: The rgb led's are used to show the color of block detected.

**Mechanical System:**

* Standard Servo Motor:

3. Component ….etc. >

**Power Management**

**Q3. a. Explain the power management system required for a robot in general and for the theme assigned to you in particular.**

**(5)**

< Team should mention the power requirement of their system with current rating and voltage requirement. You can also draw some diagrams/figures to illustrate your answer.

Please provide the answer in your own words.

Answer format: Text, Word-limit: 100 words>

|  |  |  |  |
| --- | --- | --- | --- |
| Specifications | **Rpi** | **DC Motors** | **Standard Servo** |
| **Voltage** | 5V | 12V | 4.8V – 6V |
| **Current (min)** | 2.0A | 0.8A | 0.25A |
| **Current (max)** | 2.5A | 9.5A | 2.2A |
| **Required** | 2.1A | 2A | 1A |

We will be using 3 different Voltages for overall theme implementation. For Raspberry pi, and servo motors we are using 5V voltage, and the Current it will consume is 2.0A to 2.5A, necessary is 2.1A. And, standard servo will consume anywhere between 0.25 to 2.2Amps, but 1 amp will work.

For DC motors to run, minimum 12V are required. The current consumed by it is 0.8 to 2.5Amps. We run DC motors at 2Amps.

**b. Can there be a single power supply for your robot? - Yes/No/Don’t know. Please elaborate/justify your answer choice.**

**(5)**

< Support your answer.

Answer format: Text, Word - limit: 200 words >

No, we have to give two power supplies. Because for working of some electronic components like rPi, Nano, servo motors, and other sensors, we require a 5 Volt supply. The main reason behind this is, if we give such components a 12V supply, the components will get damaged. And for locomotion i.e. DC motors, we need a 12 volt supply. So, we will use power bank for RPi, and the LI-ion battery for DC motors.

**Design Analysis**

**Q4.** **Team have to design a robot which traverses the arena following a given path.**

**a. How will you design a robot to traverse the arena given in the rulebook?**

**(5)**

    < Explain your path planning technique(s). Clearly specifying the hardware components, inputs and outputs for your technique. You can explain multiple techniques.

Word-limit: 500 words. >

**b. How many actuators do you feel are sufficient for designing a pick and place mechanism? If you are going to use additional actuators (apart from those provided in the kit), how and for what purpose do you plan to use them?**

**(5)**

< Justify your answer by stating the advantage(s) of the chosen actuator(s) over others.

Answer format: Text, Word - limit: 200 words>

**Environment Sensing**

**Q5. a. Explain how you will use the Line Sensor to decide the course of traversal (identifying line and nodes).**

**(5)**

< Team should explain in detail how they will use the Line Sensor to traverse between two points/nodes in the arena.

Answer format: Text, Word - limit: 300 words>

**b. Would the webcam be a better choice of camera over the PiCam? Explain.**

**(5)**

< Think which a better option is: using a webcam or Picam? Support your answer by listing pros and cons of choosing each option.

Answer format: Text, Word - limit: 200 words >

**c. What other sensors will the robot require to complete its task successfully?**

**(5)**

< Answer format: Bulleted form

1. Sensor 1

2. Sensor 2

3. Sensor 3 ….etc. >

**d. Explain the strategy you will follow to detect and indicate the SIM placed around the Central Node (This includes traversing strategy to reach different SIMs).**

**(4)**

< Answer format: Bulleted form

1. Step 1

2. Step 2

3. Step 3 ….etc. >

**Testing your Understanding (Theme Analysis and Rulebook-related)**

**Q6. a. If at a given SIM location ArUco ID is found to be 76 (Decimal), what is the Ant Hill Number and type (Regular Ant Hill or Queen Ant Hill) and what are the Service Requirements of this Ant Hill?**

**(3)**

< Explain in your own words. Answer format: Bulleted form, word-limit: 30 words

Ant Hill Number:

Ant Hill type:

Service Requirements:

>

76 in Binary: 0 10 01 11 0

Bit 7 is 0, so Ant hill type is Regular Ant Hill.

We get the AH number from Bit 6 and bit 5: As they are 00,

the Ant Hill Number is AH0.

The Bit 2 & Bit 1 is 11, Service requirement is WOOD.

Bit 4 & Bit 3 are 01, so the requirement is Honey dew.

And the Zeroth bit is 0, so it means, no need of TR.

**b. Is SIM0: 25, SIM1: 60, SIM2: 217, SIM3: 226, a possible combination of SIMs to be placed on the arena? If not explain with reasons.**

**(3)**

< Explain in your own words. Answer format: Bulleted form, word-limit: 300 words

Reason 1:

Reason 2:

Reason 3:…etc. >

**SIM0**: 25; 0 00 11 00 1

This means, Trash removal of Wood is required at AH0 as Regular AH during service 2. And no service required during service 1. So, the 7th condition is satisfied.

**SIM1**: 60; 0 01 11 10 0

There is supply requirement of Leaves at AH1 as an RAH in service 1 and supply of Wood in service 2.

**SIM2**: 217; 1 10 11 00 1

TR of Wood at AH2 as a QAH in service 2, whereas no supply required in service 1.

**SIM3:** 226; 1 11 00 01 0

SR of honey dew at AH3 as a QAH in service 1 and no SR in service 2.

* This set of SIMs is not possible due to some reasons. They are;
* More than 1 QAH is not possible.

**c. What are the different conditions that indicate end of a run?**

**(3)**

< Explain in your own words. Answer format: Bulleted form, word-limit: 300 words

Condition 1:

Condition 2:

Condition 3:…etc. >

The buzzer will ring for 5 seconds to indicate the end of a run.

* When we finish the complete theme,
* When our both the repositions are taken place,
* When the maximum alloted time finishes i.e. 10 minutes

**Algorithm Analysis**

**Q7. Draw a flowchart illustrating the algorithm you propose to use for theme implementation.      (10)**

< The flowchart should elaborate on every possible function that you will be using for completing

all the tasks in the assigned theme. Follow the standard pictorial representation used to draw a

flowchart.

Answer format: Text, Word-limit: 1000 words >

**Q8. Suppose for a given arena configuration, it takes 20 seconds more to execute the task while keeping the Queen Ant Hill in priority. What will be your logic to traverse the arena in order to secure maximum marks i.e. you will serve Queen Ant Hill first by taking 20 seconds more or complete the run faster by not serving Queen Ant Hill first (Assuming, points scored for all other parameters in Total Score in both the cases remain same). Please explain and justify your logic and strategy.**

**(4)**

< Answer format: Text, Word-limit: 450 words >

Rather than moving fast by not giving service to QAH, I'll consume more time and go to serve the QAH.

The reason for this is, when we'll move faster by 20 seconds, we get 20 points as a time bonus. Whereas, if we chose to serve the QAH, though we will get less 20 points due to time bonus, but we'll get those 100 points for serving QAH.

So, overall by choosing toserve QAH instead of finishing fast, we are ahead by 80 points.

**Challenges**

**Q9. What are the major challenges that you can anticipate in addressing this theme and how do you propose to tackle them?**

**(8)**

< Answer format: Bulleted form

1. Challenge 1

2. Challenge 2

3. Challenge 3, etc. >