e-Yantra Robotics Competition – 2019-20
Implementation Analysis: Construct-O-Bot

⟨#3302⟩

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Email	
Date	15/01/2020

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

 Solution:

Scope

Construct-O-Bot theme is a theme in which robot that has been designed for the purpose of pick and place the construction material without any human interaction .Using these robot the task of reconstructing the area affected by any disaster ,will become easy , economic. It will also help in saving time . And it has the ability to supply medicals to whom who was injured and where the normal person can't reach.

 These theme has basically a scope in the area where any kind of destruction happened for supplying any thing or for picking any thing.
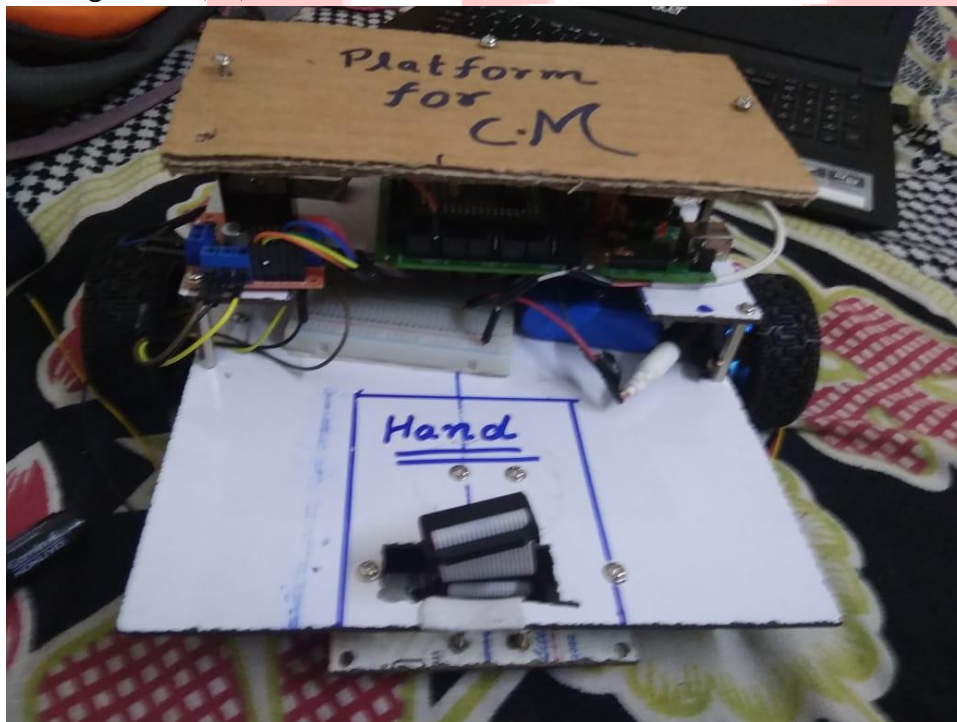
(5)

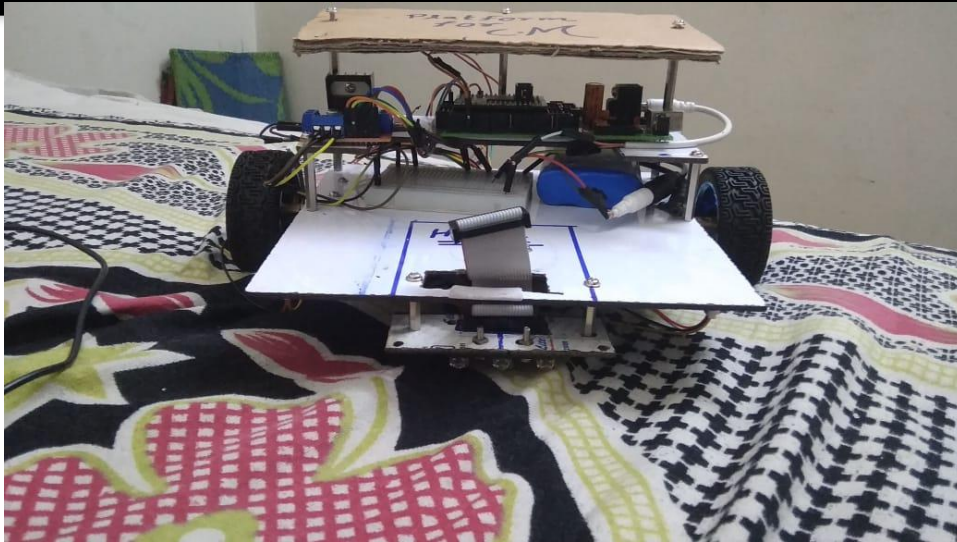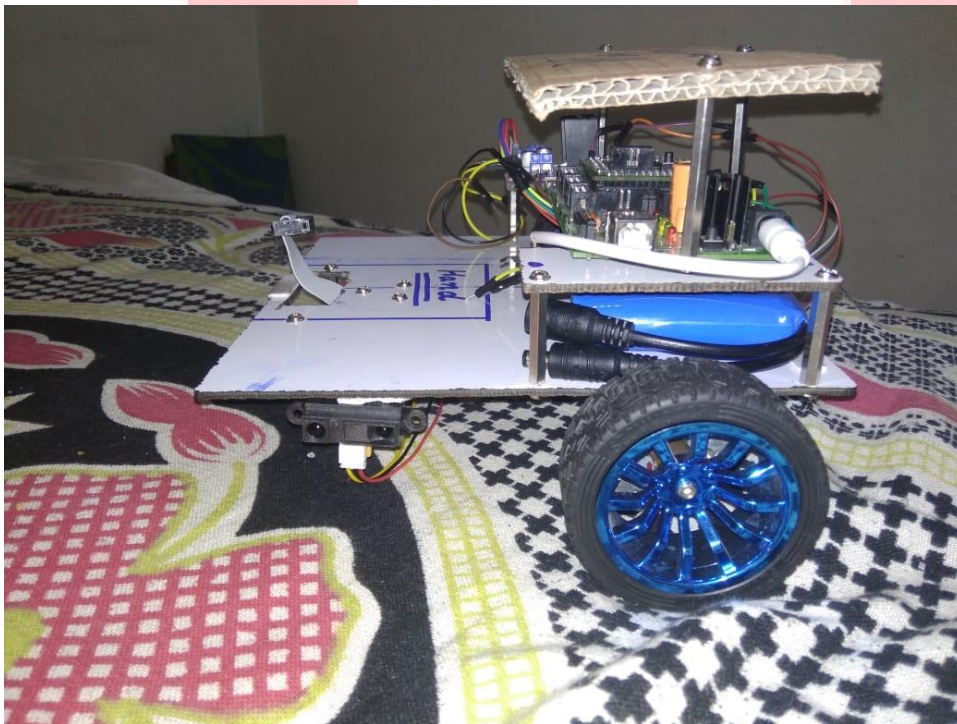b. Upload the Final Arena Images as per configuration given in the rulebook.

(5)

c. Team have to design a robot to solve the problem as mentioned in the rulebook. Attach the final robot design in the answer. Why have you come up with such a design?   (20)
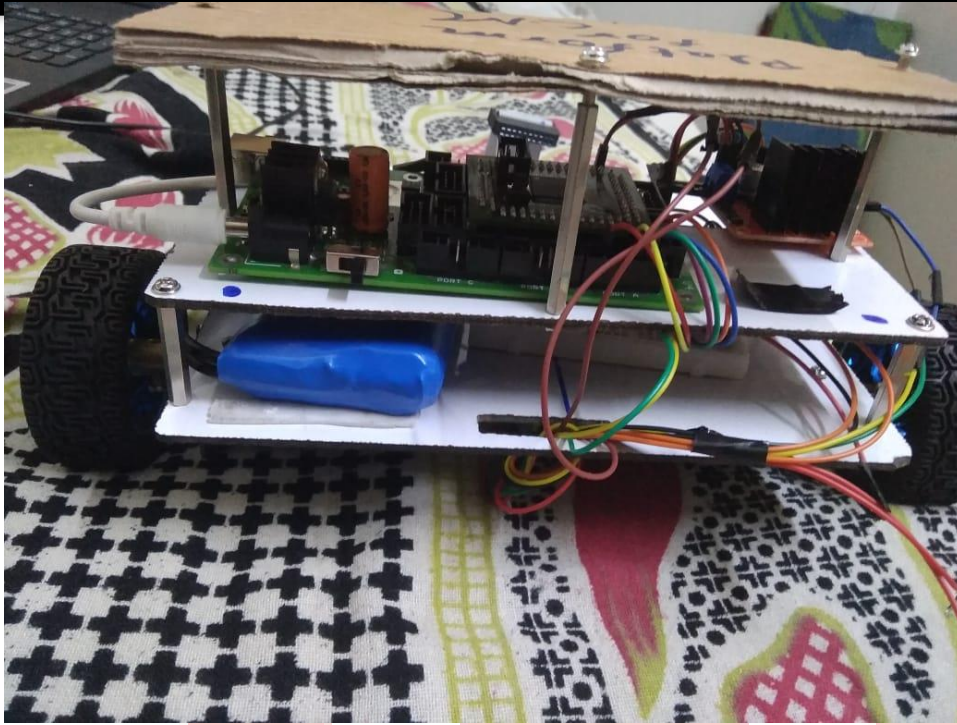

TOP VIEW

FRONT VIEW

RIGHT side view

BACK VIEW

Strategy

1. Sensors placement

White line sensor:

WE have placed them at forward most position at a very minimal height of 1.2cm from the bottom . So that we can get to know about our about our position early and accurately and can take decisions based white line sensor values.

Sharp sensor:

We have placed them at 90 degrees to our hand and nearby line sensor so on both sides (right and left) so that we can

A. Get to know that on which side there is construction material for picking from this node.

B. Can Decide whether there is Construction material or house in the present .

c. Can be also helpful in building a simple algorithm for wall following.

2. Battery, Motors, Microcontroller, motor driver, Material

They are placed behind so that their they can balance weight of hand and torque and also does not provide any hinderance to the arm rotation.

We have used Bakelite here for chassis of bot to make it stronger and light.

3. PLATFORM FOR CM

This platform can be used for decreasing the overall time taken by bot for the task.

As it allows the bot to take both construction material to house at a time while holding only one CM.

It will be not permanently fixed so that we can remove it whenever we require for ex.

for checking the connection of Microcontroller.
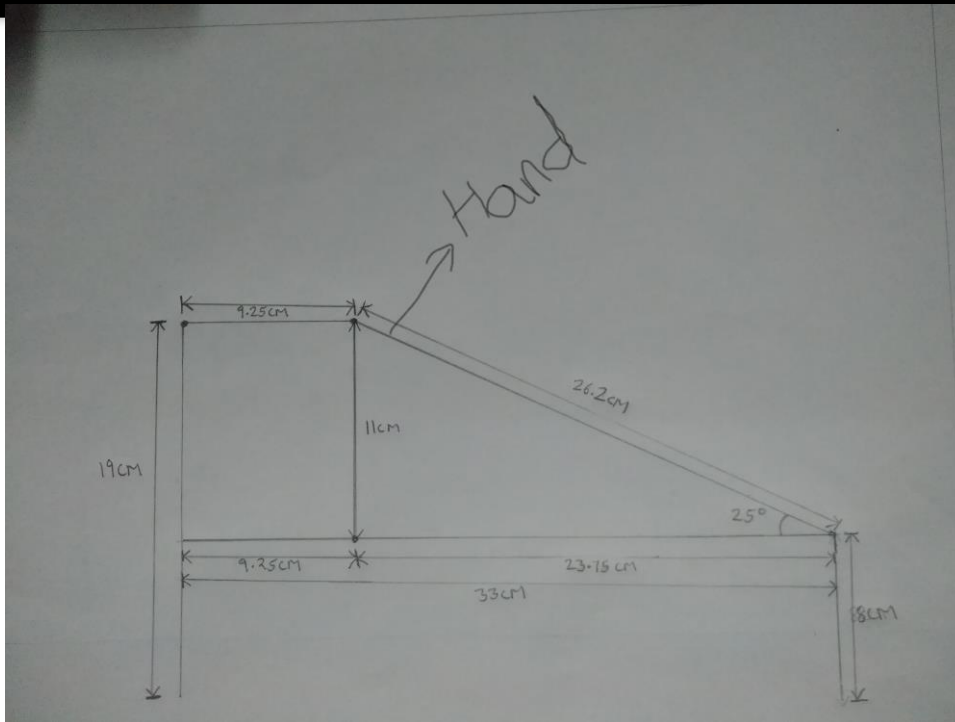
ARM

GRIPPER

BASE hand

Middle hand joint

Moving Base to which base hand will be attached

Mechanism for picking and placing

For picking and placing all the kinematics of our ARM will remain same only the kinematics of gripper will change.

FOR H5

for the house H5 we don't take our robot at the node instead of these we have taken it approximately 8.6 inch distance using ENCODERS from the node by which we can easily place the blocks in H5 by using same mechanism for houses H1, H2, H3 and H4.
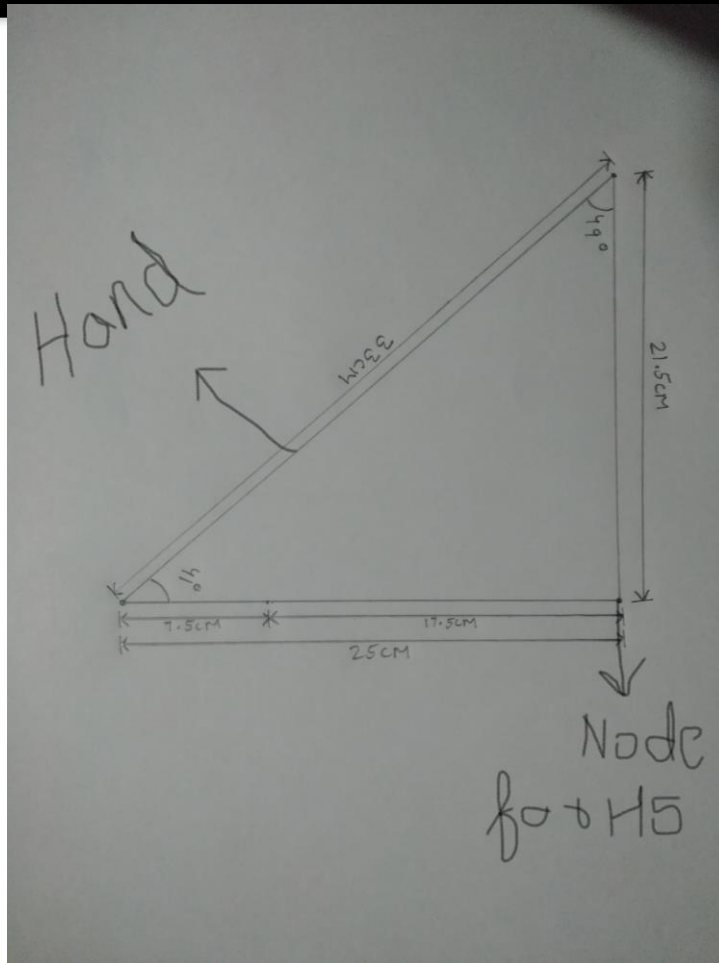
d. Using the designed robot, make it move by 10 cm forward, 10 cm right, 10 cm left and 10 cm backward.
        (15)

https://youtu.be/rNHDD3g0SKQe

e. Identify the major components provided to you and explain the role/purpose of each component that is required for designing the robot for the theme.

SOLUTION:
Mechanical system

Component1 .Wheels

For locomotion of bot .

Component2 .Studs and nuts

For giving height to any component to make bot design efficient .

For attaching the component and making a strong bot .

Studs can also be used as spacers.

Component3 .Motors

Motors will be used to make the bot in forward ,right ,left ,back direction.

Component4. Servo motors

Servo motors can be used to make the ARM as through servo motors we can make any part move a particular angle.

ELECTRONIC SYSTEM

Component1. White Line sensor

Can be used to traverse the path given in theme as they can detect the black line and white line.

COMPONENT2. Sharp sensor

Can be used to detect the object placed on   side of their mounting on the robot.

Can be used to find the distance of object from the bot hence is helpful in detecting picking material and also in following wall.

COMPONENT3.   Microcontroller

Used to control all components used in robots.

Will work as brain of bot and take decision according to reading from the sensor.

COMPONENT4.   ENCODER

Can be used to find the direction ,speed of motion.

Can also be used to make bot move a particular distance.

f. Explain the components that you will be using to design the robotic arms and its working for the theme. How the arm will be mounted on the robot (left, right, back, front) , also justify your mounting strategy.
SOLUTION:

In designing we have use 4 Servo motors, Gears and Acrylic sheet.
ELECTRONIC COMPONENTS
1. Servo motors = It is an electronic components. It is used at four positions.
-First at the gripper to pick and place blocks with the help of pair of a gears.
-Secondly at the middle hand to rotate it by 180° with the help of gears.
- Third at the base hand to rotate that hand by 180° for up and down the hand.
- Fourth at the base to rotate the whole hand so it can easily pick and place object from the node by just rotating the hand.

MECHANICAL SYSTEMS
COMPONENT1

Gears

- Firstly at the gripper to pick and place the blocks by one gear connected with servo motor and another gear with the gear which was connected with servo by which when servo rotated clockwise the another gear rotates anticlockwise by which hand closed and when servo rotates anticlockwise hand opens.

Secondly at the middle hand one gear is with servo and second one with hand so when servo rotates clockwise hand moves anticlockwise.

Third at the base hand works same as the middle hand.

MOUNTING STRATEGY

We have put the hand at the centre forward position means at the centre of the front side. Because from there when the white line sensor reads the value for the nodes it stops the robot immediately   the white line sensor is at the front so the robot starting point is at node and the houses and warehouses is exactly perpendicular for the robot than our hand rotated 90° and then easily pick the blocks.

(10)

g. What are the challenges would you expect to face while designing the robotic arms to pick and place the Construction Materials and how will you overcome them?

CHALLENGE1

Height of a low rise house is too much different from high rise house.

Solution:

For these challenge our team make a gripper of 19cm height by which we can easily put the object in both low rise house and high rise house and we have taken 1.5cm margin for gripper by which our hand can't touch the high rise house.

Challenge2

Distance between the node and houses is same for house H1, H2, H3, H4 and for house H5 is different.

Solution:

For these problem for the houses H1, H2, H3 and H4 we have taken our robot at the node but for the house H5 we didn't taken our robot at the node instead of these we have taken it at 8.6 inch distance from the node by which we can easily place the blocks in H5 by using same mechanism for houses H1, H2, H3 and H4.

Challenge 3

Distance between houses and nodes is different from distance between warehouses and nodes.

Solution:

For this problem we find out one thing that the distance between centre of houses and nodes is same for distance between warehouses and nodes so now we can easily pick and place the object.

Challenge4

Unbalancing of bot due to weight of ARM

Solution:

For this problem we have mounted the heavy materials like battery and motors at back so that high torque provided by length of ARM can be balanced due to heavy weight of Components on back of bot.

TO make it weight less we we have mounted both heavy sevo at base

.One for rotating whole ARM

.Another for moving base hand .

h. In this theme, we use the following formula as mentioned in Judging and Scoring section of Rulebook:

$$Total\ Score = (600-T) + (CP*30) + (CD1*80) + (CD2*100) + (WHB*100) + (B*100) - (P*50)$$

What will be your strategy to earn maximum points and Bonus points in a run (given the following Configuration Table)?

(10)

House		Construction Materials Required	
H1	low-rise	Brick	Sand
H2	high-rise	Gravel	
H3	high-rise	Cement	Brick
H4	low-rise	Electrical fittings	Sand

H5	high-rise	Gravel	Paint

⟨ Answer in not more than 100 words⟩

i. Explain your strategy in following
(10)
   I. Wall,
   II. Zig- Zag and
   III.   White line

⟨Answer in not more than 100 words⟩

j. Draw the complete flow chart of the algorithm used to solve the problem.
(15)
⟨Use proper flowchart methodology. You can use already available software/application for creating flowcharts.
Important functions should be clearly explained.⟩

Best of Luck!