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MINI-043

M.Tech. IN ADVANCED INFORMATION TECHNOLOGY – INTELLIGENT SYSTEMS AND ROBOTICS (MTECHSR)

00483

Term-End Examination

June, 2015

MINI-043 : MOBILE AUTONOMOUS ROBOTS

Time : 3 hours *Maximum Marks : 100*

Note : *(i) Section I is* ***compulsory.***

(ii) In Section II, answer any ***five*** *questions.*

(iii) Assume suitable data wherever required.

(iv) Draw suitable circuits wherever required.

(v) Italicized figures to the right indicate maximum marks.

(vi) Use of calculator is allowed.

SECTION I

1. An autonomous bot named 'xTerrain' has the ability to move around on different kinds of terrains. It also has the following functionalities :

(a) Mapping the surface with 3-D vision.

(b) Computing safe and unsafe areas on the surface within that field of vision.

(c) Computing optimal paths across the safe area towards the desired destination.

(d) Driving along the calculated route.

(e) Avoiding all obstacles on path.

(f) Repeating this cycle until either the destination is reached, or there is no known path to the destination.

Give the design details for xTerrain based on the following :

(a) Hardware Design 7

(b) Locomotion 7

(c) Sensors on Board 8

(d) Algorithm and Flow Chart of a fully functional xTerrain 8

Justify each of the design considerations with appropriate reason.

SECTION II

*(Answer any **five** questions)*

2. What are the different drive mechanisms available ? Explain any two of them with circuit diagram. *7+7*

3. Discuss about : *7+7*

(a) Swarm Robotics v/s Modular Robotics

(b) How would you estimate ADC size for an application ?

4. What is Localization ? Explain the different Localization Techniques. *14*

5. Explain the following : *7+7*

(a) Dead Reckoning

(b) Localization

6. Maze solving robots follow Maze Exploration Techniques to reach the center of the maze from the starting point. Explain two different Maze Exploration Techniques. *7+7*

7. Explain the working principle of the following motors. Give a suitable use for each of these motors with a suitable example. $4 \times 3\frac{1}{2} = 14$

(a) DC Motor

(b) Stepper Motor

(c) Servo Motor

(d) Brush-less DC Motor

8. Discuss about Adaptive Robotics. Take any example and explain Adaptive Robotics based on it. *14*