Final

CSE - 461

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Section: 06

Anstothe Q NO: 02

(a) we know that overshot = |actual value - required value|

~~= |1.5 - 1|~~ |1.95 - 1|

~~= 0.5~~ = 0.95

Rise time of 10% of required value = 10% of 1

= 0.1 x 1

= 0.1

" " 90% of " " = 90% of 1

= 0.9 x 1

= 0.9

$t_1 = 0.2$ t From the Graph]

$t_2 = 0.95$ t " " " "

5% stabiling time 0.05 x 1

= 0.05

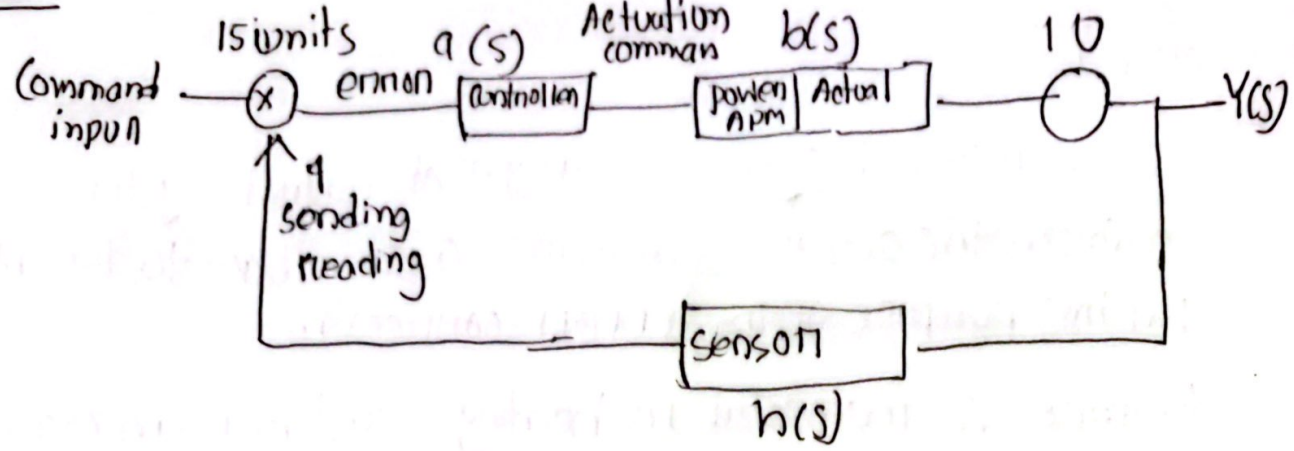
req + d = 1 + 0.05

= 1.05

req + d = 1 - 0.05

= 0.95

(b)



$$\frac{Y(s)}{X(s)} = \frac{a(s) \times b(s)}{1 + a(s) \times b(s) \times h(s)}$$

(c) An open loop control system is a type of control system in which the output has no influence on effect on the control action

Example: A washing machine with a time is an example of an open loop controll system., you set the washing time, and the machine operate for the duration without considering the actual

cleanness of the cloth.

Close loop:

close loop control system is a type of control system in which the output is measure and fedback to the input for the purpose of the error connection.

Example: A themostal in heating system is an example of close loopsystem. it compare current temperature with the desire temperatu and adjust continously.

Ans to the Q NO: 3

(a) let's consider a case study of robotic solution for autonomous navigation in an indoor environment.

Component including (1) Senson
(2) mapping
(3) Path planing
(4) control system

① Senson: liDAR, camera, ultrasonic sensons
senson collect the data from the robot so surrnoonding including obstacle and other feature

② mapping:: simultaneous localization and mapping
simultaneously estimitated the robot position twith the map

③ Path planning: :applying path planning algorithms accordi
to the mapping

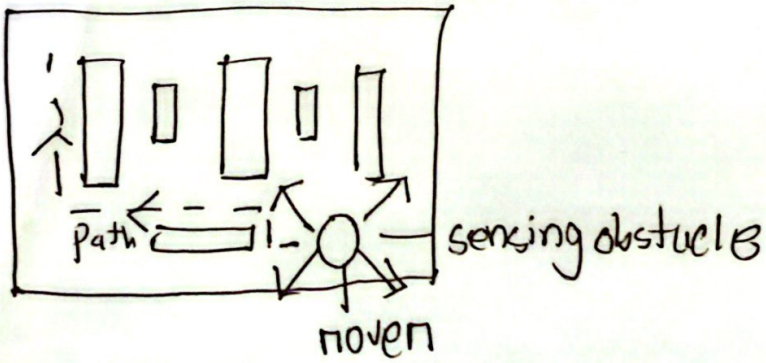
④ Control: PID use to control
the controllen translate the planned path into commane
For the robot actuation.

by combining thesg component, the robotie system.
achive a comprehensive solution.

⑤ The occupancy grid algorithm used for the mapping it basically present two dimensional grid.
here each cell in the gride is assigned a probability value indicating the likelihood of that cell being occopied by an obstacle.

so here in the picture black blocks are occupied space and my robert indicating the red circle.

here, as the robert move, it senson detect obstacle. The corresponding cell in the grid are marked as occupied (black blockmention in question)



The rovert's positing is continously updated the grid ce as it move.

The grid update dynamically, create real time

map of the environment

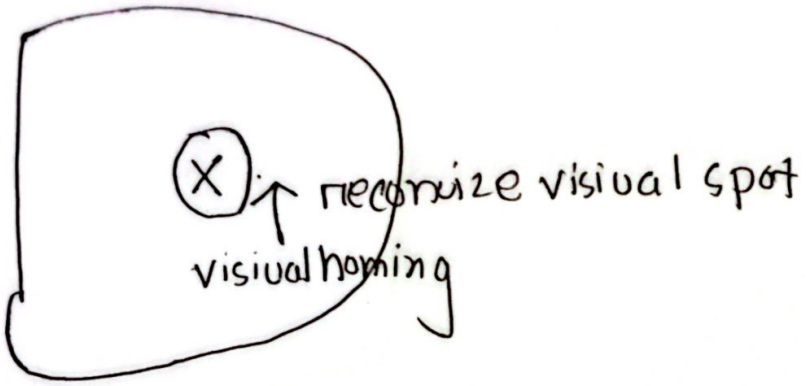
The iterative process allow the rover to build a map of the environment, incorporating information about obstacle and free space.. The occupancy grid provide a structure representation that can be used for navigation, path planning and decision make.

(c) bug based algorithm use for the mobile robot(autonomus or semi autonousms robot)

Bug algorithms work by having the robot move towards it goal untill it reach/encounter an obstacle.

so in this scenario, the bug based algorithms can be employed to navigate around obstacle on the cricket ground while moving toward GPS location as it cricket ground and has clean goal, it will be effective

here visual homing can help by recongnize visual landmark on mention patten of the "x" mark spot here water bottal need to be dropped



Deadrocking : Deadrocking involve esstimiting the robot position based on previous position.

it is soitable ton short distance

landmark : landmark-based localization involved using recog featone on landmark in the environment to determin robot position.

In the cricket ground there are distince teature. like the pitch, stamp. so lankmarking is best suitable for this senario

Ans to the Q NO: 04

(a) Convolutional Neural network (CNN)
and
Neural Network

- CNN are effective for image feature extraction and Preconnizing Pattern.
- neural network can capture temporal dependencise in gesture sequence allowing the robot to understand dynamic gesture made by player

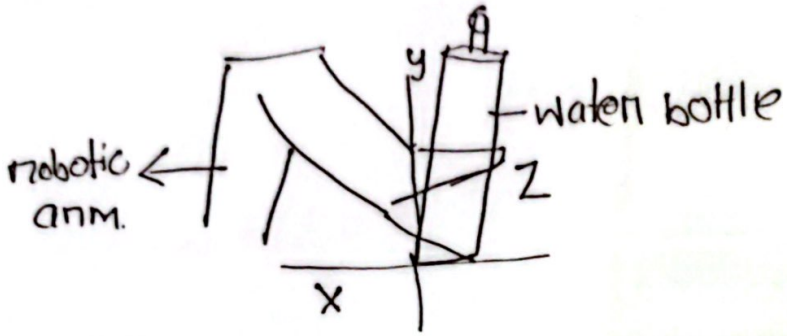
(b) For the rope detection we can use the computer vision with Edge Detection.

applying edge detection algo to highlight edge in the image.

. Detect the rope by finding the line segment and finally established a boundary that robot should not cross

(c) Number of DOF for arm

5 DOF allow movement in three dimension (x, y, z) for reaching the player



additional dof give the flexibility to adjusting the orientation the water bottle.

(d)

Robot type : a autonomus robot with manipulator arm

autonomus robot can navigate cricket ground effectively the manipulator arm provide the necessary dexterity for picking up and delivering items, so the 1st robot will be more preferable for this purpose

(e) additional sensor

- Inertial measurment unit (IMU)
- Proximity sensor
- GPS module
- Depth sensor (LiDAR)