Robotics Association of Nepal[RAN]

Talchikhel
Lalitpur, Nepal

Yantra International Robotics Competition 2023: Creating Robotics Industry of Nepal by 2030

Yantra 9.0: Yantra Autonomous Industries [Yantra AI]

Theme

In this century, as Nepal grapples with recurring earthquakes and the increasing vulnerability of its industrial infrastructure, it is crucial to harness technological advancements, especially in the realm of artificial intelligence (AI). While many countries have already integrated AI into their industries, Nepal faces challenges in this regard. To bridge this gap and address the unique needs arising from seismic activities, we are actively promoting AI adoption in Nepal. Consider an industrial scenario in the aftermath of a devastating earthquake where the factory floor is cluttered with disassembled goods. The daunting task at hand is to reposition these items to their designated locations. If entrusted to human labor, this endeavor would be both labor-intensive and time-consuming, requiring a substantial workforce. However, by introducing AI-powered robots, we can efficiently and effortlessly streamline this post-earthquake recovery process, making the restoration of industries in Nepal more resilient and resource-efficient.

Introduction and Background

An **autonomous robot** is a robot that acts without recourse to human control. The first autonomous robot environments were known as Elmer and Elsie, which were constructed in the late 1940s by W. Grey Walter. They were the first robots in history that were programmed to "think" the way biological brains do and meant to have free will. Elmer and Elsie were often labeled as tortoises because of how they were shaped and the manner in which they moved. They were capable of photo taxis which is the movement that occurs in response to light stimulus.

Historic examples include space probes. Modern examples include self-driving vacuums and cars. Industrial robot arms that work on assembly lines inside factories may also be considered autonomous robots, though their autonomy is restricted due to a highly structured environment and their inability to locomote.(Wikipedia)

So autonomous robots are highly demanded in the future. Robotic Association of Nepal(RAN) is on a mission of creating robotic industries by 2030. With this mission RAN focuses on providing an industrial level of Robot and organizes similar types of events to increase participation. Thus RAN is organizing YANTRA continuous robotic competition with manual control and automation that helps to contribute to the country or the whole world in the robotic sector. So autonomous robots are necessary to design and implement. This year also RAN is going to organize YANTRA 9.0 in which automatic robotic competition is also a part of that program where a robot has to solve the task with image processing.

Objective:

i) To align with RAN's mission of creating a thriving robotic industry by 2030.

ii) The competition aligns with the theme of "Climate Change & Future for Work" by focusing on automation, encouraging participants to design and build robots that can perform tasks autonomously without human intervention and work on Climate Robotics.
iii) By engaging participants at various levels, including students, teachers, and professors, the competition serves as an inspiration for future career paths in robotics and automation.
iv)To provide a platform for interdisciplinary collaboration, bringing together students, teachers, and professionals from diverse fields to work on robotics projects. This encourages the exchange of knowledge and expertise.

Concept and Task of Competition

In the context of a competition, the challenge comprises navigating obstacles and handling items within an arena. At the start of the game, two distinct items or goods are placed within the arena, and two more items will be added during the course of the game. Each item is characterized by a unique shape and color, with their respective corners color-coded to match. The robot's objective is to accurately place these items in corners that correspond to their color. The robot can drag or by pick and drop mechanism can be used. The game unfolds over a 10-minute duration, and at the 8-minute mark, an organizer introduces a potential hazard by releasing LPG gas from one point of a side of the arena. The robot must promptly detect this gas leakage within the next two minutes and raise an alert by sounding the buzzer. Throughout the game, all data collected by the robot should be transmitted wirelessly to a laptop for monitoring and analysis.

The critical aspect of this competition is the concept that the arena represents an industrial workspace with various items scattered on the floor. The robot or machine's task is to autonomously and efficiently place these items in their designated locations as soon as they appear, without human intervention. Furthermore, in the event of a gas leak, the robot must promptly sound a buzzer to signal the potential danger. Detecting gas leakage serves as a crucial safety measure in identifying hazardous situations within the industrial setting. By framing the competition in this manner, participants are challenged to design and develop AI-powered robots capable of enhancing efficiency and safety in industrial environments. This not only showcases the potential of AI in industry but also underscores its significance in addressing real-world challenges, including safety concerns.

Dimension and Fabrications of robot

1. Any microcontrollers, microprocessor, sensors and actuators can be used for designing a robot with a robotic arm which has ability to pick and drop the object but the robots should be autonomous with image processing and it cannot control manually either wired or wirelessly..
2. Image processing is compulsory for processing the data like color detection.

3. The robot should fit within a box of dimension 45 X 45 X 45cm to 60 x 60 x 60 cm when the extender(robotics arm if used) is in an extended state . Thus the robotic arm could be any length when expanded.
4. Each Team should have a single robot.
5. The robot should not weigh more than 4 to 10 KG.
6. Use of readymade toys is not allowed, but one can use the readymade circuits.
7. Robots should not be manually controlled. It should be completely automatic.
8. The robotic arm could be any design, could print with a 3D machine, could use any driver, motor and controller. But ready-made products cannot be used.
9. Any camera and sensors are allowed.
10. The robot cannot use more than 12V battery and cannot use more than 2 batteries at a time.
11. The robot must have a wireless data transmitter module.
12. In wireless communication the bot should send the data of completion of placing each item in their respective position and the data of gas detection with ppm of gas.
13. Participants have the flexibility to select their preferred data communication software medium, with the condition that it must operate wirelessly. This choice allows for versatility in how data is transferred, adapting to individual preferences and requirements. Regardless of the software medium chosen, a key requirement is that the data must be displayed on a laptop, ensuring accessibility and compatibility for monitoring and analysis.

Team Specifications

1. Maximum 5 members are allowed per team.
2. Any level of participants can participate in this competition.i.e students, teachers, professors all can participate(open).

Specification of Arena and items placed in arena.

1. The arena will have dimensions of 25 feet by 25 feet of Plywood.
2. The arena is surrounded by a boundary with a height of 60cm.
3. The color of the arena will be white.
4. The obstacles will have dimension of 30cm*30cm *60cm. 10-15 obstacles will be in the arena. And the color of the obstacle will be black.
5. The gap between two obstacles will be at least 80 cm.
6. The goods/items will have dimensions of not more than 10 cm . The items will be of color RED, BLUE, GREEN and YELLOW.
7. The weight of all items will be not more than 100 grams.
8. The gas will leak with 300-1000 ppm.

9. The obstacle will be anywhere in the arena and the goods will be also anywhere in the arena.
10. Each corner of the arena is colored with four different colors like RED,BLUE, GREEN and YELLOW.
11. The arena will be set up in an enclosed room where light intensity will be of 60W LED bulb. The temperature and other environmental parameters as it is in normal condition in that weather.

Bot verification

1. The designed robot by participants will be verified by the organizer member one week or 2/3 days before competition.
2. So a team must come to the office of the Robotics Association of Nepal[RAN] to verify the bot(flexible for those participants who are far from the valley).
3. If the bot is not verified by the organizer then the team cannot participate in the competition.
4. After verification the design of the bot cannot not change.

Gameplay

1. Competition Objective:
    - Navigating obstacles and handling items within an arena using a robot.
2. Initial Setup:
    - Two distinct items/goods are placed in the arena after 3 minutes of game start.
    - Additional two items will be added during the game.
    - Each item has a unique shape and color.
    - Corners of the items are color-coded to match their respective items.
3. Robot's Task:
    - Accurately place items in corners corresponding to their color.
    - Two mechanisms allowed: dragging and pick-and-drop.
4. Game Duration:
    - 10-minute game duration.
5. Hazard Introduction:
    - At the 8-minute mark, an organizer releases LPG gas from one point on the side of the arena.
6. Gas Leakage Detection:
    - Robot must promptly detect gas leakage within the next two minutes.
    - Alert to be raised by sounding a buzzer.

7. Data Transmission:
    - Throughout the game, all data collected by the robot is transmitted wirelessly to a laptop.
    - Data is used for real-time monitoring and post-game analysis.

Game Rule and marking strategy

1. The competition is worth a total of 100 points.
2. If the robot drags the items into their respective positions, they earn 10 points for each successfully placed item. If the robot carries the items and places them in their respective positions, they earn a higher score of 15 points for each successfully placed item.
3. Detecting and alerting the gas leakage promptly earns the robot 20 points.
4. Sending data regarding item placement after completion yields 4 points for each item. Transmitting data about gas leakage with ppm (parts per million) also earns the robot 4 points.
5. Touching any obstacle or the boundary of the arena results in a deduction of 1 point for each touch.
6. The team with the highest total points will be declared the winner. In the case of a tie, the winner will be determined based on the time taken to complete the tasks.
7. The decision made by the referee will be considered binding and final.
8. The organizing committee reserves the right to modify the game rules at any time if deemed necessary.

Registration charge

Early Bird Registration: 8000
Normal Registration: 10000
Late Registration: 12000

Prize:

First Prize: 1 Lakh Worth
Runner Up Prize: 50000 Worth
Pool Prize :1.5 Lakh

**** Some of the rules and regulations, and minor gameplay are subject to change as required in future ****

Note: Prizes are subject to applicable government taxes.