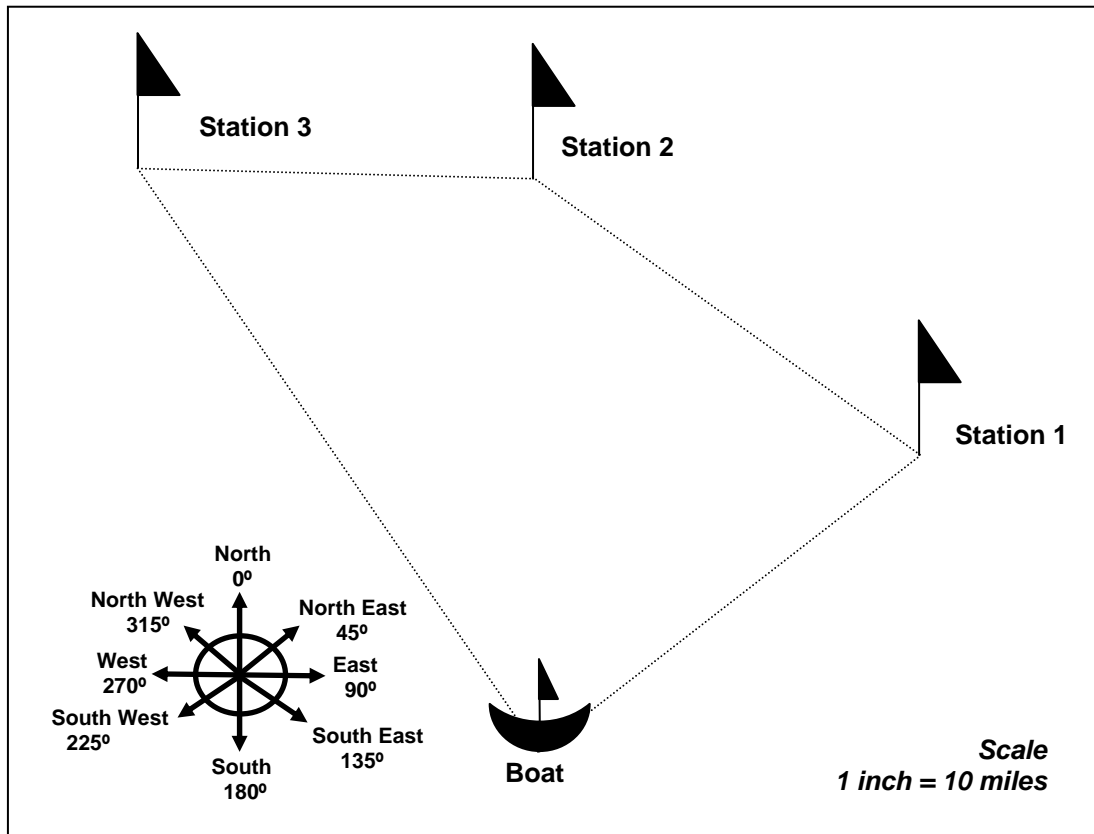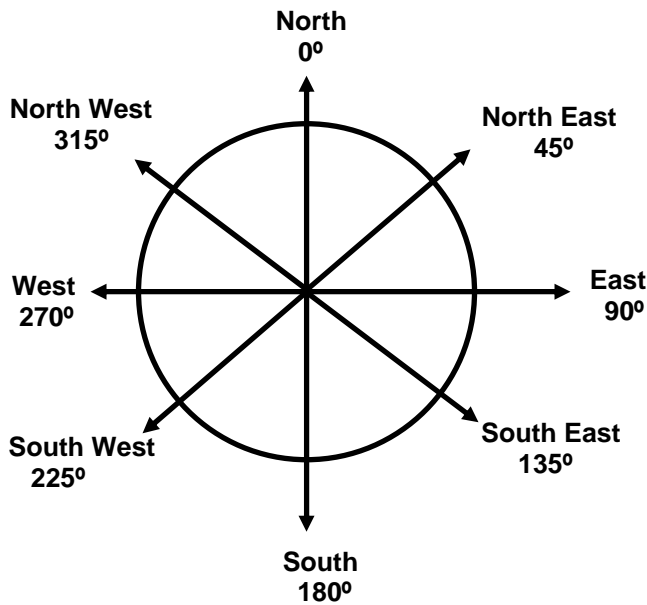# Robot Navigation

Robotics is one of the fastest growing engineering fields of today. Millions of dollars have been spent in the developments of robots to be used in all sorts of field. Many agricultural operations, like field scouting, soil sampling, fertilizing and spraying, selective harvesting and transporting could be routinely performed by robots. Use of a scout robot to visually record and map the details of the orchard before work begins. Having an accessible view of the plants will save time walking the farm and will also help optimize the use of the harvesting machines.

Explorer's Guide

Before You Start

Paul is in a boat trying to get to station 1, 2 and 3 in the order as shown in the figure below. Find the distance from the start point of the boat to station 1, station 1 to station 2, station 2 to station 3 and station 3 back to the start point. Assuming travel speed is 10 m/h .How long was the entire boat trip? Use the table provided below. Using the compass, can you navigate the boat to the different stations?

From	To	Distance in inches	Distance in miles	Direction
Boat	Station 1			
Station 1	Station 2			
Station 2	Station 3			
Station 3	Boat			
	Total distance in miles =			

Learning by Doing

1. Use GPS receiver to record geographic coordinates at 3 different locations. The three locations should be more than 20 ft but less than 100 ft apart. The geographic coordinates could be written down using the satellite page as shown in figure A or by marking waypoints as shown in Figure B.
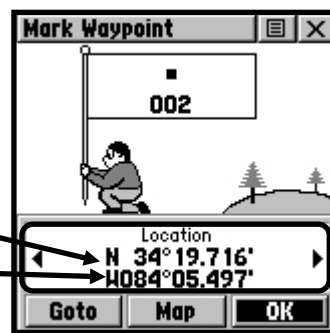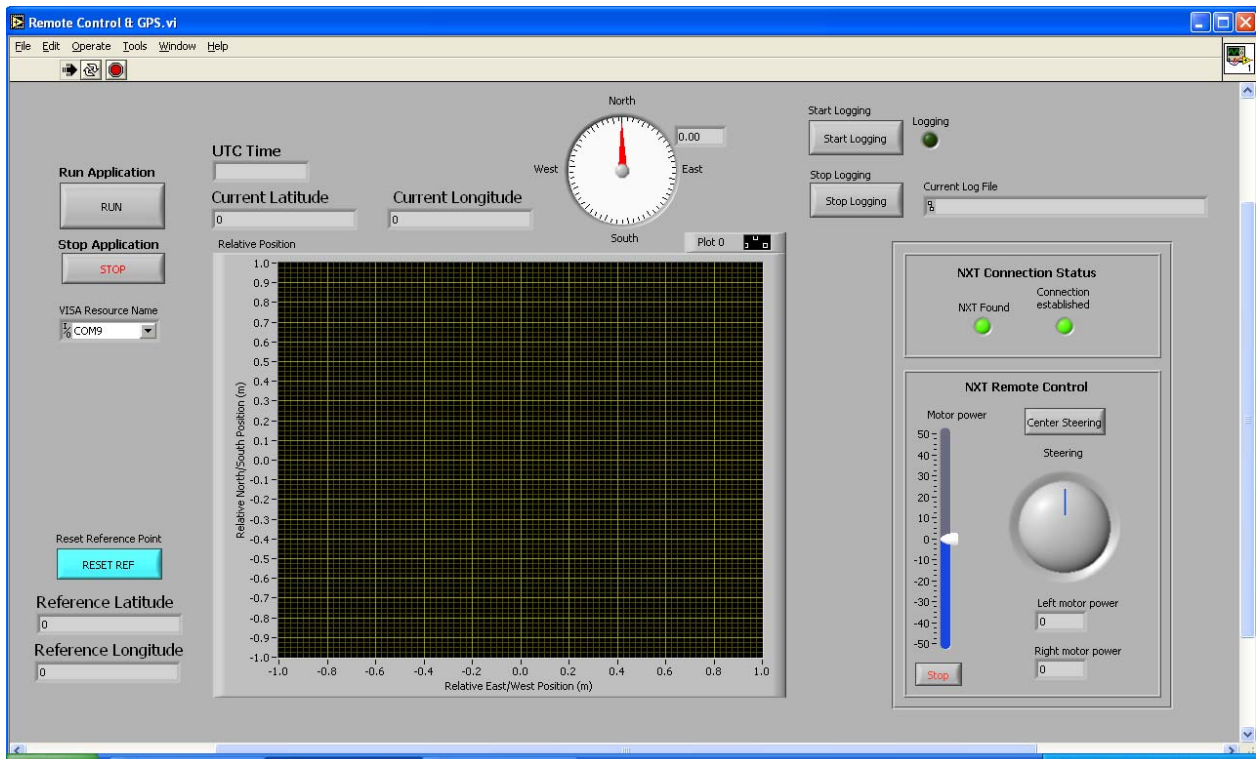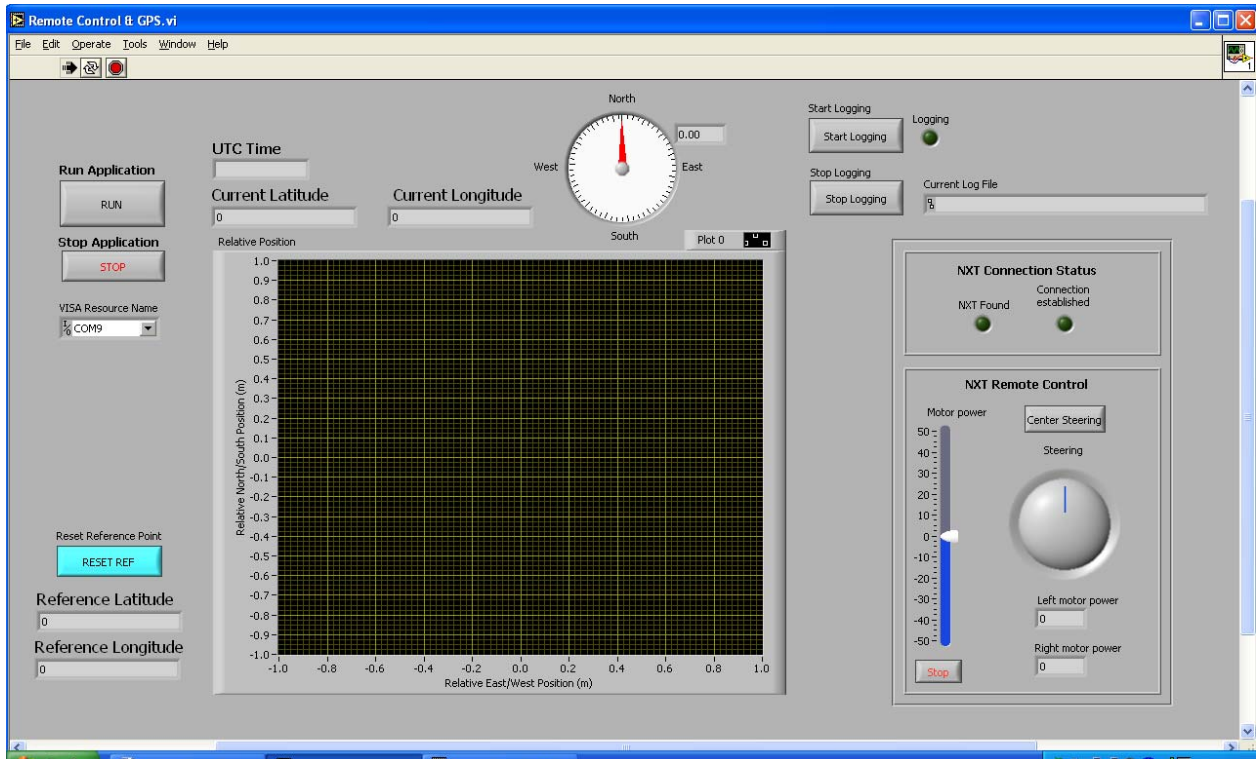

Figure A   **Figure B**

2. Now enter the geographic coordinates (longitude and latitude) in the software manually.
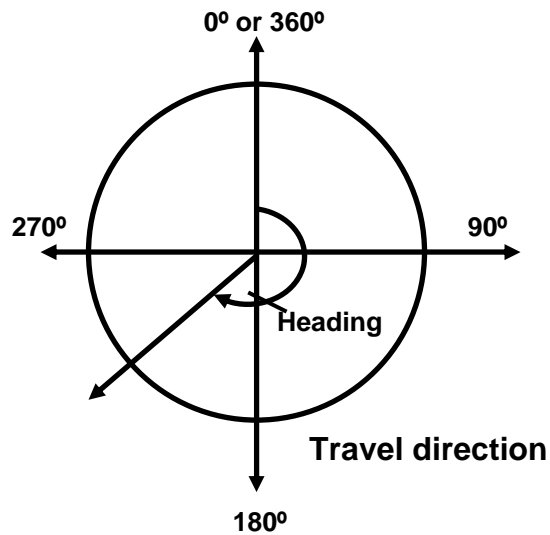
3. Set up robot and computer to maintain constant communication by placing the robot around the perimeter. The distance between the computer and the robot should be less than 40 ft. Navigate the robot to each coordinates.
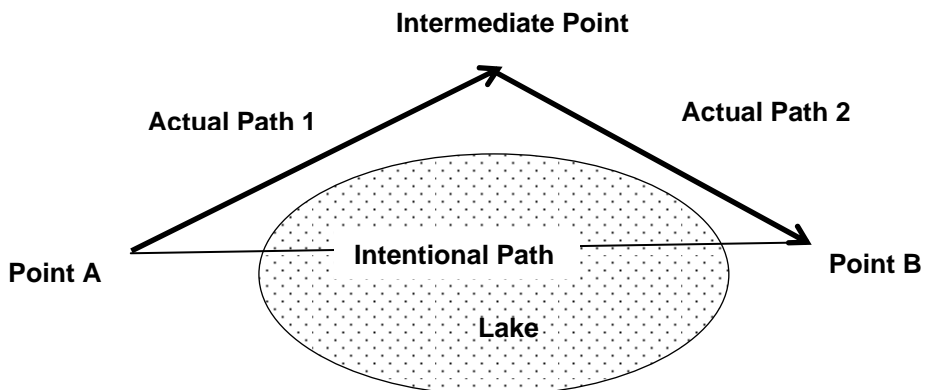4. Measure how close robot gets to each location.

How Does It Work

In navigation, course of travel is the intended path of a vehicle on the surface of the Earth. Example-The flight path of an aircraft, the path of a ship, the intended path of a vehicle.

In navigation, it is also important to understand the difference between Bearing and Heading.Bearing is the direction to the destination or target while Heading is the direction you are traveling or facing. Both are measured in degrees of a circle with 0° being toward the magnetic north pole, 180° is south, 90° is East and 270° is West (see figure below).Once you know the bearing, you can use a compass and a map to make sure you are heading at the right direction.

0° or 360°

270°   **90°**

Heading

Travel direction

180°

Suppose you are traveling from point A to point B as shown in the figure below.

Intermediate Point

Actual Path 1   **Actual Path 2**

Intentional Path

Point A   **Point B**

Lake

If you are at point A, ready to start your course of travel, the bearing of point B, directly east of you is 90°. There is a lake between point A and point B. So to avoid the obstacle you use logic and navigate to the north side of the lake always maintaining the minimal distance to the lake.

This heading/actual path 1 will take you to an intermediate location north of the lake. Once there, you can follow a new heading/actual path 2 to get to point B.

Additional Challenge

Navigate the robot from any location, point A to point B. Now place an obstacle in between the two points and try to navigate the robot from point A to point B. Use logic to navigate the robot get around the obstacle.

Interesting to know

It is the same distance south, east, north and west to this point. Could you name the point?

Vocabulary

- ***Direction*** or ***Heading*** *is the information contained in the relative position of one point with respect to another point expressed in words (cardinal and intercardinal directions) or angular measurements (degrees).*

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