

GPS Event Tracking

Speed and velocity are different physical terms. Speed describes how fast an object is moving while velocity is the rate at which an object changes its position. In other words velocity takes into account the information about direction of the object. This activity focuses on the travel velocity of the robot.

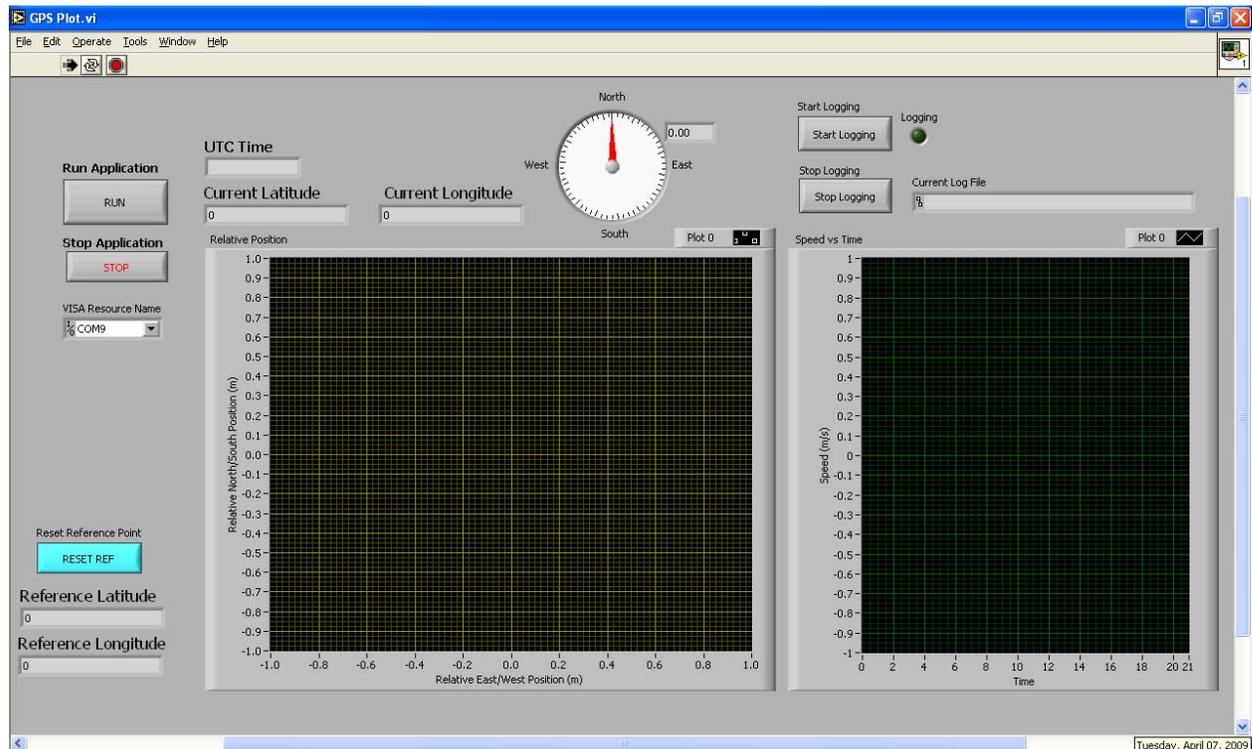
Explorer's Guide

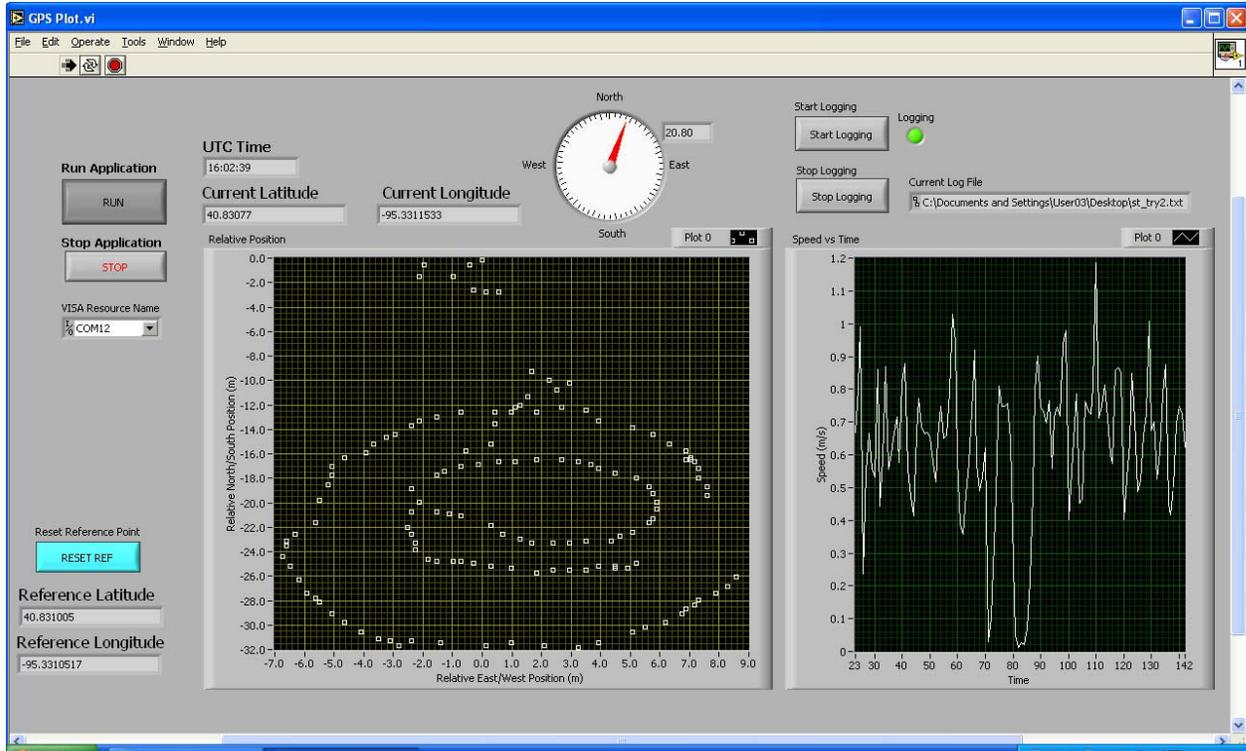
Before You Start

Julie is travelling by car to school. She travelled a distance of 5 miles in 12 minutes. What is her average speed? Next day, Julie faces road construction for a mile. So she travels at a speed of 10 miles per hour to school. How much more time did Julie take the next day?

Learning by Doing

1. Take GPS data logger and walk along a square 50x50 ft course.
2. Open the software as shown below. It shows GPS receiver output in real time. Record geographic position, travel speed and direction of the data logger.





3. Plot the recorded track as well as how travel velocity changes with time. Open Microsoft Excel software and create a plot of X vs. Y, Speed vs. Time and Heading vs. Time. Refer activity 31 for help with plotting in Excel. Comment on your observations.
4. You can use file “???” in case weather conditions and/or technical malfunctioning did not allow you collect the data.

How Does It Work

Speed is the distance travelled by an object in a certain amount of time. Speed is a scalar quantity. Speed has only magnitude. An object with high speed covers more distance in a short amount of time while an object with low speed covers smaller distance in a short amount of time.

$$\text{Speed} = \text{Distance} / \text{Time}$$

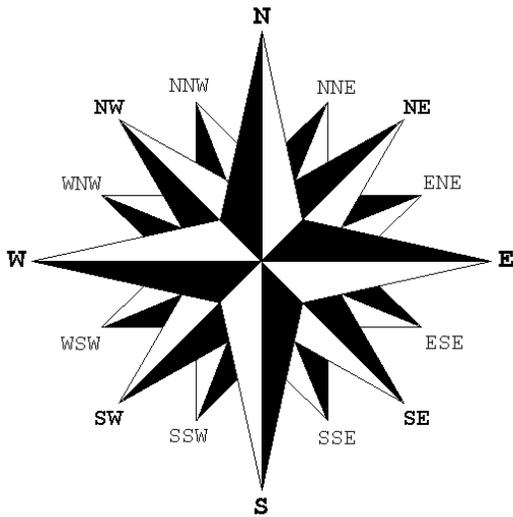
Velocity is a measurement of speed and direction. Velocity is a vector quantity. It has both magnitude and direction. Direction information should be included when describing the velocity of an object. Example: A train moving east with a speed of 55 mi/hr has a velocity of 55 mi/hr, east. In other words, velocity is speed with direction.

Velocity = Displacement/Time where displacement is the change in position of an object with respect to its previous position.

In GPS, the term heading is used to define direction. Heading or direction 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).

Heading (words)	Heading (°)
North (N)	0° or 360°
North North East (NNE)	22.5°
North East (NE)	45°

East North East (ENE)	67.5°
East (E)	90°
East South East (ESE)	112.5°
South East (SE)	135°
South South East (SSE)	157.5°
South (S)	180°
South South West (SSW)	202.5°
South West (SW)	225°
West South West (WSW)	247.5°
West (W)	270°
West North West (WNW)	292.5°
North West (NW)	315°
North North West (NNW)	337.5°



Additional Challenge

Create a pentagon or other simple shape using GPS data logger and create a plot of X vs. Y, Speed vs. Time and Heading vs. Time graph in Excel.

Vocabulary

Speed: Rate of motion or the distance travelled per unit time.

Velocity: Rate of change of position.

Displacement: Difference between the final and the initial position of an object.

Scalar quantity: Quantities described by a magnitude.

Vector quantity: Quantities described by a magnitude and a direction.

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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