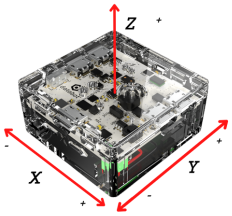
ACCELEROMETER

databot™ Sensor Starters



Grades: 6 & Up
Time: 15 Minutes - PDQ Sensor Basics
Subject: Physics, Technology
Topics: Acceleration, Speed, 3D Geometry

Meet the Accelerometer

The accelerometer senses motion and it is one of the most widely used sensors in the world. Think of all the devices that you know of that move. Cars, planes, trains, drones, game controllers, washing machines, and even your smart phone. How does your phone know to change orientation when you rotate it sideways? The accelerometer!

What Does it Measure?

The accelerometer measures acceleration, a change in speed or direction. You have no doubt experienced acceleration. For example, when a driver presses on the gas in a car it accelerates as it changes from zero to 10 mph to 20 mph and more. As the vehicle accelerates you will feel yourself pressed back into the seat. Acceleration is different than speed. Once a car reaches and holds a certain speed, say 60 mph, you are no longer accelerating as your speed is constant.

How Does it Work?

There are different types, but all accelerometers work through the use of a "mass" that moves when acceleration takes place. Just as your body is pressed back into the seat when you accelerate in a car, a mass within the accelerometer moves when accelerating. Using mechanical or electrical means to measure this movement, the sensor converts it to numbers that represent the force of acceleration.

What Are the Units for Acceleration?

Acceleration is a "change" in speed or direction over time. Speed is distance over time such as miles per hour (mph) or kilometers per hour (kph). In physics we frequently use the units meters per second (m/s). Now, for acceleration, we add in the rate of change, which is also in seconds, so we end up with meters per second "per second" to express acceleration. This is expressed as meters per second squared or m/s2 in the units shown in Vizeey™.

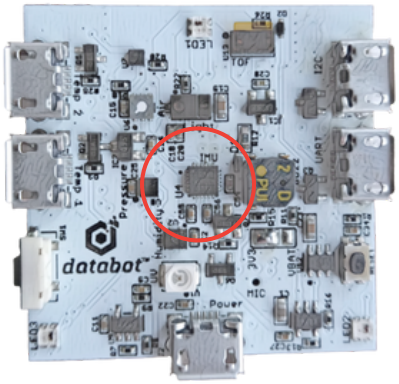
What You Will Need/Prep

- databot™ 2.0 & a smart device (iOS or Android).
- Read the Vizeey™ Fast Start Guide and install Vizeey™ if you haven't already.
- Scan the QR code for Linear Acceleration if you don't have it already.

Linear Acceleration
This experiment removes...

Where Does it Live?

The accelerometer is one sensor in a module called an intertial measurement unit (IMU) located in the center of the databot™ PCB. Look for the label IMU on your databot™!



Important Terms

Acceleration: The rate of change in speed or direction. An object moving at a constant speed and direction has zero **acceleration.**
Accelerometer: A sensor that detects **acceleration** - changes in speed and direction.
Speed: The rate of change of position of an object in any direction.
Cartesian Coordinates: Describes position in three dimensions (3D) using the **Cartesian coordinates** X, Y, and Z.

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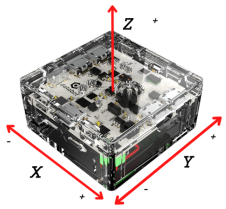
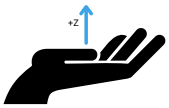


PDQ1 : 3D Thrills with databot™

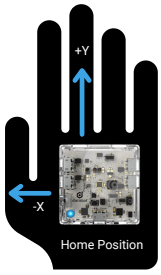
Using the databot™ **accelerometer** it is possible to read changes in speed and direction! First, in order to understand reading "direction" - familiarize yourself with the orientation of databot™ using the 3D **Cartesian Coordinate** system of X, Y, and Z axes. The **accelerometer** reads forces across these 3 axes. Depending on what direction you move, you will see the force of acceleration on a particular axis.

1. Tap on **Linear Acceleration** in Vizeey™ to load the experiment & use these icons to start and to pause the experiment in the Main View:

2. Hold databot™ in the palm of your hand in the "home" position shown. You should see close to 0.0 m/s² on each axis as you hold still. Shake it to equalize the scales on the three axes - your goal is a scale of -20 to +20 on each axis. Stop, erase your data, restart as you practice until you get it.



3. Next, move databot™ forward, backward, sideways and up and down. Move with fast, uneven movements that accelerate.



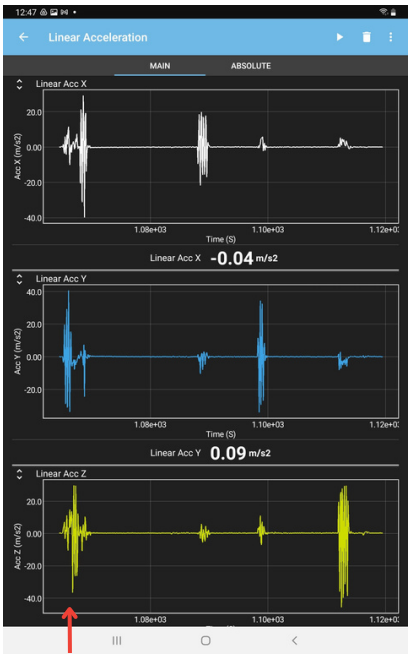
4. Watch the data visualization of acceleration and verbally say each axis as you move. Try to match the graph image shown to the right.

Shake it up!

Each axis "auto-scales based on the highest and lowest value of x, y, and z.

Start by shaking databot™ on each axis so that you get each axis to display an equal range of -20 to +20 m/s2.

This will match the 3 displays for easier comparison.



X

Y

Z

Shake | Movement on each axis.

PDQ2 : Hop, Skip, Run, Race or Jump

In this PDQ, acceleration from the x, y, and z axes is all combined into one awesome value that represents your total acceleration. With databot™ held tightly against your body, what is the highest rate of acceleration you can achieve?

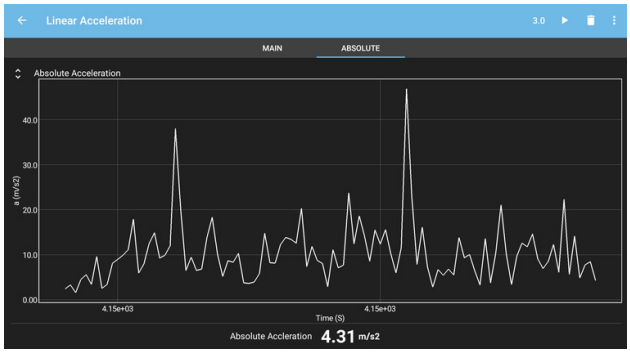
1. Tap on **Linear Acceleration** in Vizeey™ to load the experiment & use these icons to start and to pause the experiment:

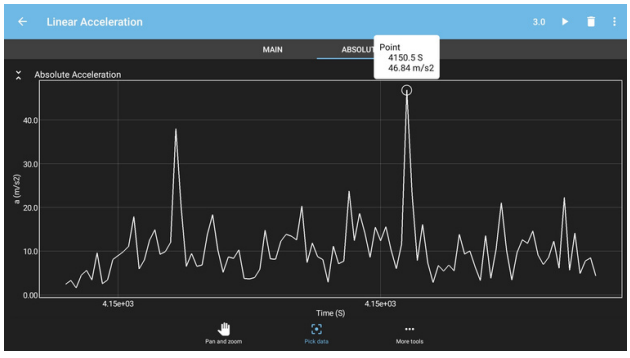
2. Swipe left to the Absolute View.

3. Set up a Vizeey™ "Timed Run" for 10 seconds.

4. Start the countdown!

5. Hold databot™ snugly against your body holding it in your hand and placing it over your heart.





6. Now leap, cavort, run and move in your best effort to achieve a high rate of acceleration. After your ten second recording use the Vizeey™ "Pick Data" tool to identify your peak acceleration!