

## 8. STEP COUNTER

Did you know that smart phones have accelerometers inside of them? Accelerometers are a device that measures acceleration, also known as the rate of change in velocity. This device aides the phone to detect changes in its orientation. This is why you are able to rotate your screen. The `//code.Node` also has an accelerometer. You can use this accelerometer to program your device to work as a step counter.

### Objectives

- Create clearly named variables that represent different data types and perform operations on their values.
- Design programs that include nested loops.
- Replicate and use existing code to create a new program.

### Materials and Equipment

- Data collection system
- `//code.Node` holder and strap
- `//code.Node`

### Safety

Follow these important safety procedures in addition to your regular classroom procedures:

- Make sure the floor is clear of obstacles and that you have plenty of space to walk freely.

### Procedure

#### *Part 1 – Investigating Acceleration*

Everyone has a gait, or pattern in which you walk. Before creating the Step Counter program, you will need to identify whether you wish to use Acceleration-x or Acceleration-y. You will also need to investigate your range in motion as well or how large of a step do you take when you normally walk.

1. Select Sensor Data in SPARKvue.
2. Connect your `//code.Node` to your device.
3. Select the Graph template and set the y-axis measurement to Acceleration - x.
4. Put the `//code.Node` into the holder and attach to your ankle.
5. Find an area where you can walk normally. Start recording data and walk for about 10 seconds.

- Stop collecting data and scale your graph to fit if needed. Analyze the data to determine a good range of motion. If you want to see your data using Acceleration-y click on the measurement for the y-axis and change to Acceleration-y. Make sure to note your axis preference and number.

For example, in Figure 1 we measured Acceleration-x and looked at the top portion of the graph and noted how many clean data points reached over a certain number. In my program, I will use any number greater than 10 m/s/s. Every step I make that is over 10 m/s/s will count as a step. When using Acceleration-x we will need to use absolute value in our program since we will want to work with positive integers. Figure 2 is the same Run but now showing Acceleration-y. Here I will use any number below 9 m/s/s in my program to count as a step. You are looking for clear data points that reflect a step you have taken. It may be helpful to count your steps while recording. You are only counting the step taken by the ankle with the `//code.Node` attached.

Figure 1: Acceleration-x over time sample data

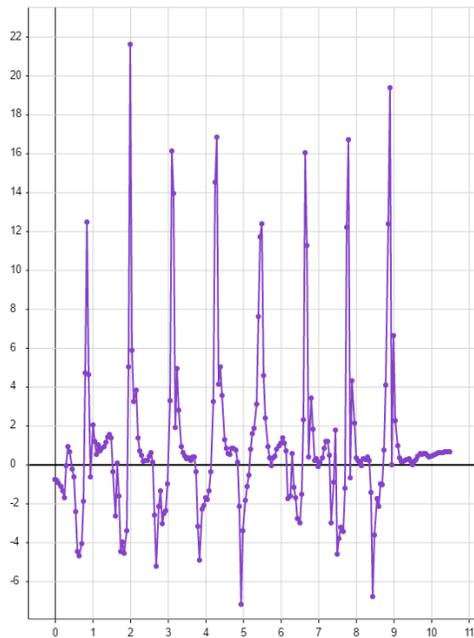
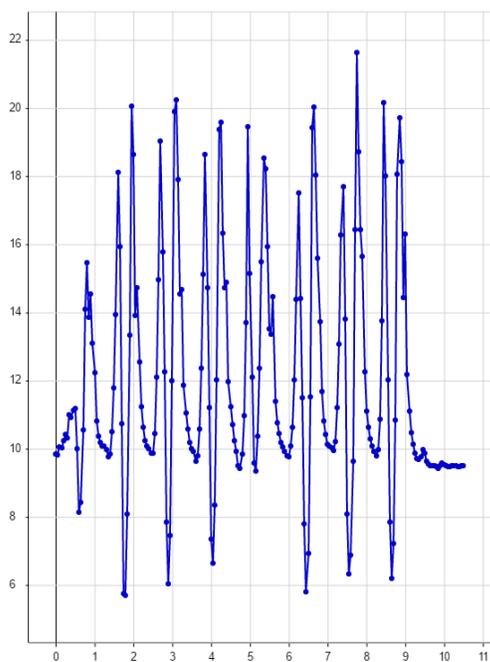


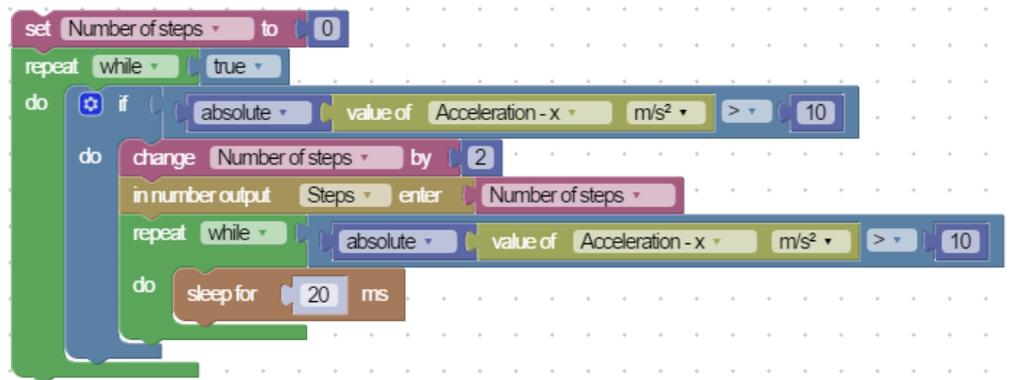
Figure 2: Acceleration-y over time sample data



### Part 2 – Writing the Initial Code

1. Click the menu tap and Start New Experiment.
2. Connect your //code.Node to your device.
3. Select the digits display and then click on the Code icon .
4. If using Acceleration-x, recreate the following program in Figure 3. If using Acceleration-y, recreate the code in Figure 4. Make sure to plug in your values determined in Part 1.

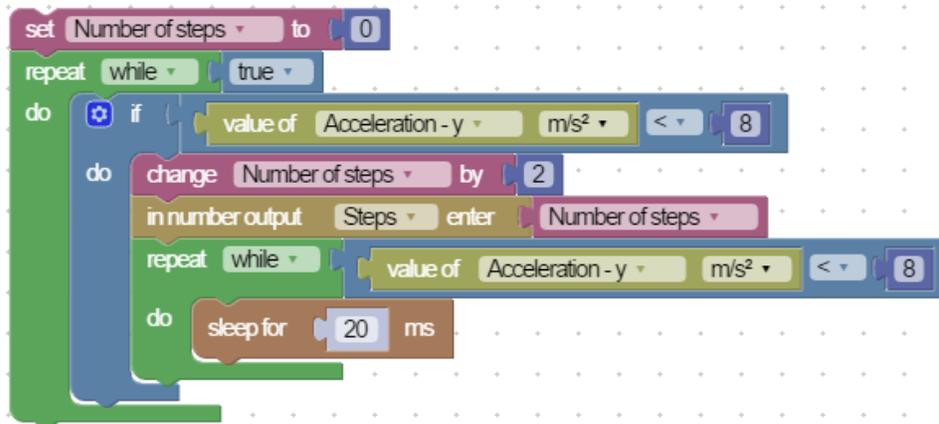
Figure 3: Acceleration-x program



```

set Number of steps to 0
repeat while true
do
  if absolute value of Acceleration - x m/s² > 10
  do
    change Number of steps by 2
    in number output Steps enter Number of steps
    repeat while absolute value of Acceleration - x m/s² > 10
    do
      sleep for 20 ms
  
```

Figure 4: Acceleration-y program



```

set Number of steps to 0
repeat while true
do
  if value of Acceleration - y m/s² < 8
  do
    change Number of steps by 2
    in number output Steps enter Number of steps
    repeat while value of Acceleration - y m/s² < 8
    do
      sleep for 20 ms
  
```

5. Click done, add a new page, select the 2-page layout.  On the left choose the Line Graph display and select the either Acceleration-x or Acceleration-y. On the left select the Digits display. Select Measurement, then User-Entered and Steps. This reflects the numerical output you created in your program.
6. If your program is correct, when you press start and walk at a normal pace, the Steps should go up by two. You created this variable to increase by 2 with each step taken.

