



DESN2000 – Engineering Design 2

Workshop Material

Never Stand Still

Faculty of Engineering

Week 3:
Sensors

What is a sensor?

(Spend 5 minutes to try and answer this as a class!)

What is a sensor?

- Electronic device
- Receives input data from the environment
- Produces output data

How many sensors have you seen around you today?

Spend 10 minutes with your group thinking of as many sensors as possible that you've encountered today, and what they do. Use the below format.

e.g.

Sensor type: Pressure sensors

Where: In the bus tyres

What data input: Atmospheric pressure in PSI

What data output: A low-medium-heavy indication on TripView about whether my bus was full or not

Some examples of sensors

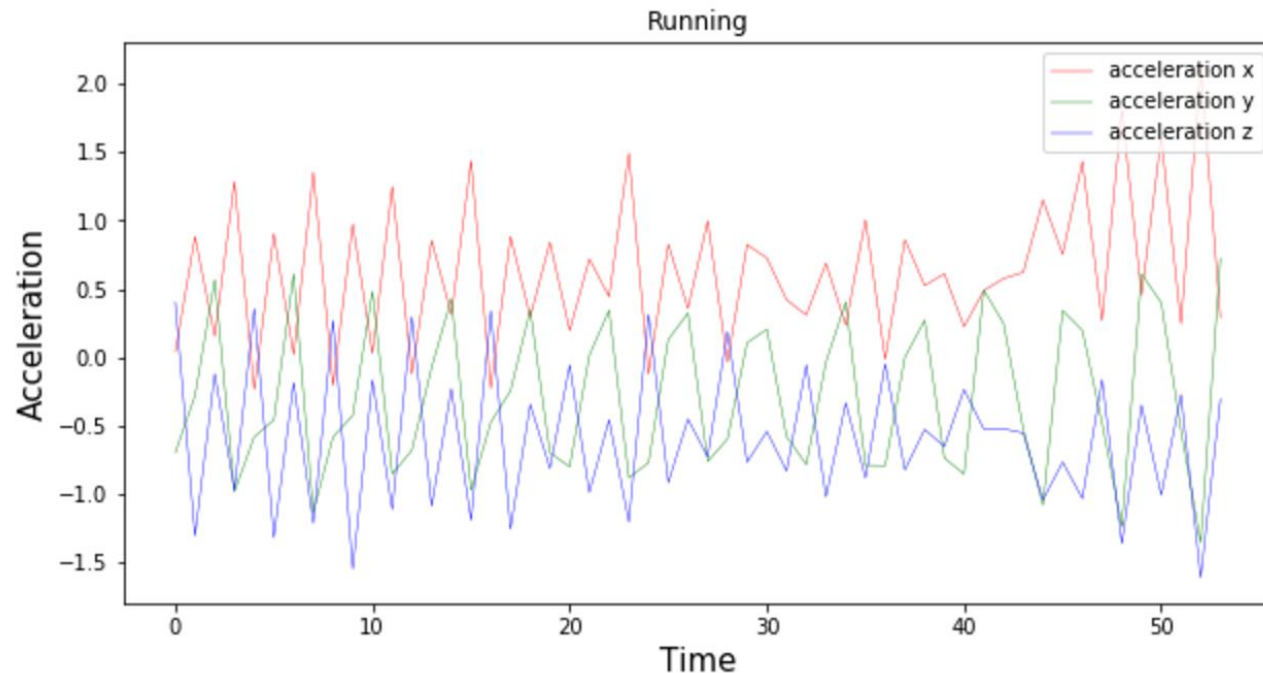
Accelerometers in your phone, recording acceleration in m/s^2 , to count your steps on Google Fit based on up/down oscillations.

Potentiometers on the wall, recording a numerical value within a range, to control the brightness of my bedroom lights.

Buttons on the tram, recording the on/off pressed state, to detect whether someone wants to open the tram door.

Hydrometers in the farm, recording water moisture content in the soil in water, to alert farmers when soil needs to be watered.

What data format do these sensors have?

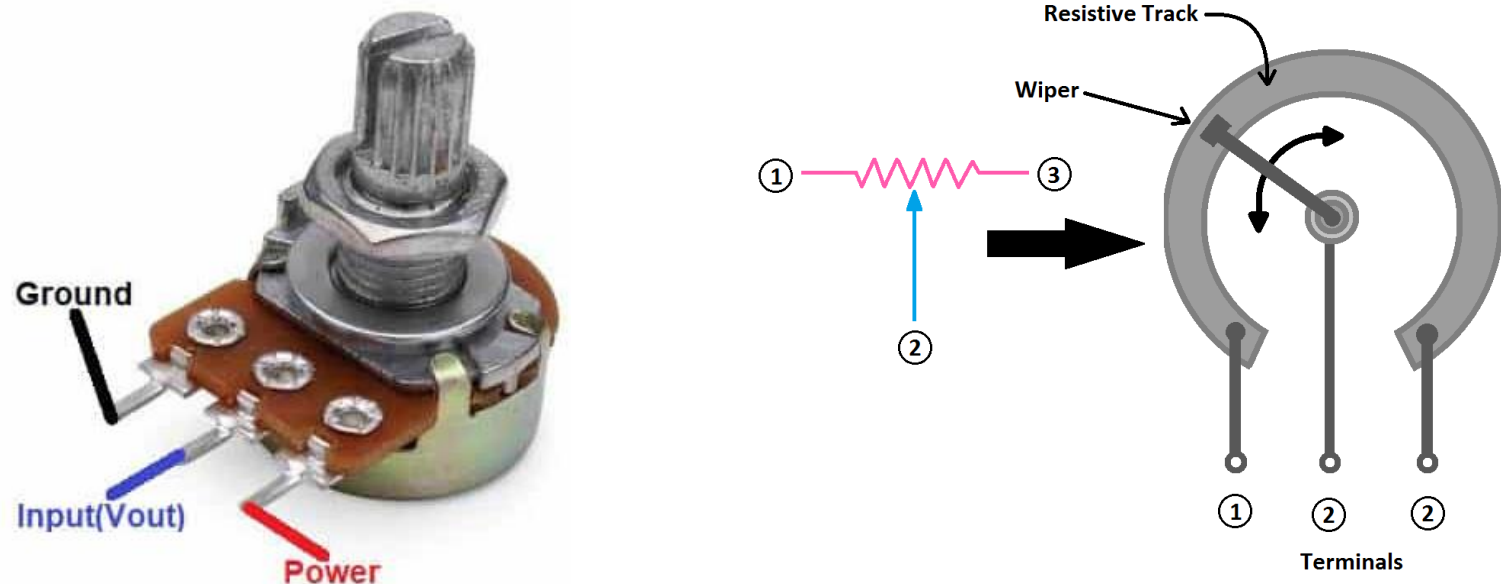


Accelerometers – acceleration in m/s^2 .

Acceleration on earth is $g = -9.8 \text{ m/s}^2$. Our movement would \pm a bit from this.

Is this analog or digital?

What data format do these sensors have?



Potentiometers – a numerical value within 0 to 255 (from min to max) based on resistance of circuit.

Is this analog or digital?

What data format do these sensors have?



Buttons – record on and off state (either 0 or 1).

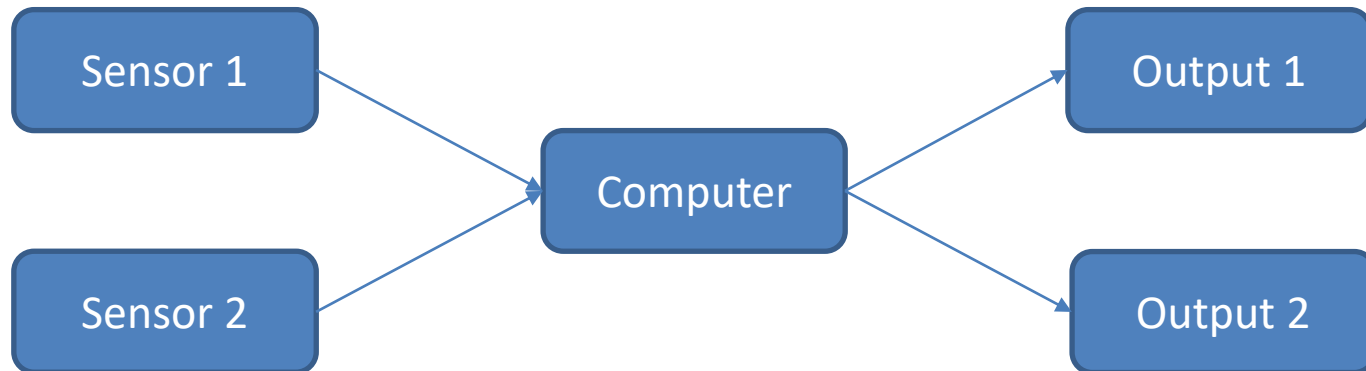
Is this analog or digital?

How can the sensor data be processed to be useful?

Algorithms!

You would need pseudocode in your report to describe the logic of how the sensor input leads to the desired output.

High-Level System Diagram Example



Pseudocode examples

Potentiometer to control brightness of a light

While the power is on:

Check if potentiometer is plugged in. If so:

Read value of potentiometer between 0 to 255.

Set light brightness to mapping of 0 to 255 and 0 to 100% brightness.

If potentiometer is not plugged in, then continue checking.

Pseudocode examples

Accelerometer to detect steps taken by a person

Assume a person takes a step once every second. Therefore, within one second, there should be an “up” and then “down” acceleration as the footstep goes up then down.

Begin by resetting the step counter to 0.

Check if accelerometer is plugged in. If so:

Request person stays still for calibration. Store this value as “resting” state.

While the power is on and repeating every 1 second:

Read value of accelerometer. Store this value as “before” state.

Wait 0.5 seconds.

Read value of accelerometer. Store this value as “after” state.

If “before” < “resting” and “after” > “resting”:

Increase the daily step counter by 1.

Else:

Continue with the loop.

Sensor activity

Transport for NSW has engaged your team to help them with their light rail stations.

Commuters are feeling unsafe both on the vehicle and also at platforms. These complaints are varied in certain demographics and at certain times of the day.

Prepare a 2 minute pitch convincing TfNSW to invest in your sensor solution. Include the type, where, input, output, data format, system diagram, and pseudocode.

