

PPG or photoplethysmography sensors use light-based technology to determine heart rate. As our hearts contract, oxygenated blood is pushed throughout our body causing an increased force and pressure within our arteries. When a light source is shone on the surface of the skin, the light reflected from the skin will vary due to changes in arterial force and pressure. This difference of the light shone relative to the light reflected is used to determine the heart rate of the user. Consequently, the PPG sensor contains a LED and light sensor to determine the heart rate.

As previously mentioned before, the accelerometer measures the acceleration the device experiences in the x, y, and z-direction. The way our accelerometer works is by sensing the change in capacitance. Capacitance is the quantitative measure of the amount of stored electrical charge. Capacitance is analogous to water flowing out of a water tank. The amount of water would be the charge while the tank storing the water would be the capacitance. The accelerometer contains microstructures that have a certain inherent capacitance. When a force or acceleration is applied to the device, the capacitance between the microstructures will change. This change in capacitance is used to determine the acceleration of the device experiences.

The FSR or force sensitive resistor changes its resistance as the force or pressure is applied. The device has two insulating or non-conductive materials on the exterior. Between the substrate, there is a sandwich of conductive material separated by a spacer. When there is no force or pressure applied to the FSR, the conductive materials do not touch each other because of the spacer. Consequently, the resistance of the FSR is high. When there is a force or pressure applied, the two conductive materials touch each other resulting in a lower resistance.

The GPS receiver uses the GPS satellites orbiting the earth to determine its location. The receiver gets a signal from the satellite with the time the signal was sent. The timestamp is used to determine the distance between the satellite and the receiver. This distance provides the receiver a large area where the receiver could be located. Consequently, the distance data from one satellite is not enough to determine the exact location of the receiver. When multiple satellites are used, the area where the receiver is located decreases to a specific location. A 2-dimensional representation would be a Venn diagram. Each satellite can be represented as a circle with its distance from the receiver. As the number of satellites increases, the number of circles increases leading to a smaller region or area where all the circles overlap. This overlapping area is the exact location of the receiver.