Podcast

Theory

Everyday we are surrounded by waves but rarely do we stop and think what they are. At its basic it a transfer of energy through a medium which can occur in two forms.

Transverse waves consist of particles which oscillate perpendicular to the direction of travel of the wave. Water waves at the surface are an example of this. On the other hand, longitudinal waves are caused by particles which oscillate parallel to direction of wave travel. Sound waves are examples of this.

By causing rapid vibrations in the air, it is possible to cause particles to “push” particles in a certain direction. As they in turn push other particles along the same line, energy is transferred and hence a wave is formed.

The speed at which sound travels at, is dependent on various factors such as the density or temperature.

If this speed is known, we can send out a sound pulse and record the time for it to return. Using this, we can calculate the distance between the pulse receiver component and the object (Equation?).

JACOPO

Commercial ultrasound distance meters are easy to set up and use. However, we decided to take this a step further and map the surrounding area in 3D.

If the orientation of the sensor is known, then we can project a measured distance into 3D space and therefore create a model of the surroundings. In order to do this we needed one more component...a gyroscope.

The brains of our setup is an Arduino Uno, a small programmable computer useful for electronic projects. Every cycle, the Arduino begins by sending out a trigger pulse which to the ultrasound sensor. This in turn causes it to send out a burst of ultrasound. It measures the time delay of the echo and sends this data back to the Arduino as a pulse. In the mean time the Arduino sends a request to the MPU-6050, a gyroscope/accelerometer chip. The chip send back the last measured angle and acceleration as it is moved. The Arduino processes this data and streams it in real time onto a computer through a serial connection.

Once the data is received, a python script is used to convert distances and angles to points in 3D space, which are then plotted in real time using matplotlib.