

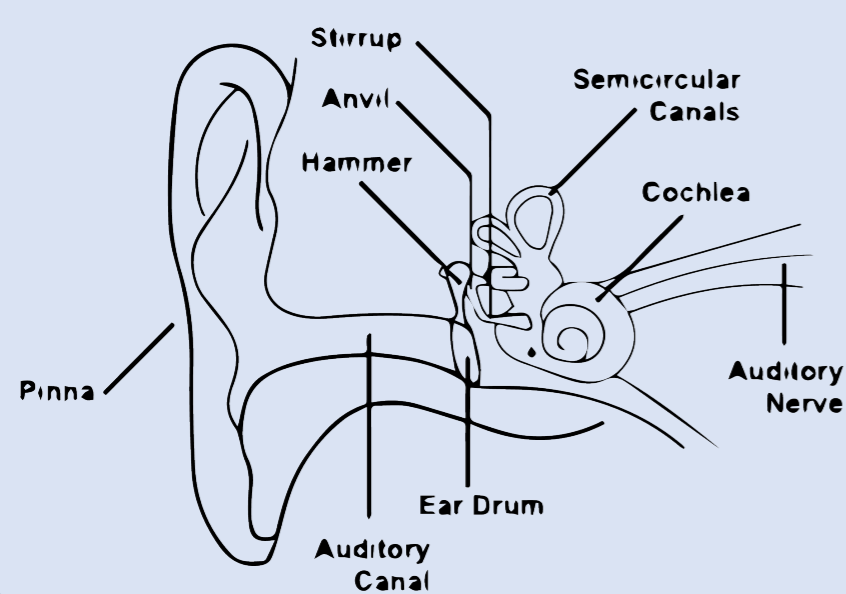
### DEVELOPMENT OF A SOFT INERTIAL MEASUREMENT UNIT FOR USE IN SOFT ROBOTICS

Soft Robotics is a relatively new concept in the field of robotics, where robots are made from compliant materials to withstand deformation. This provides an advantage over traditional robots as the compliance could allow for the soft robot to operate in harsh conditions, or to provide a safe working environment where humans and robots work together in close proximity.

An Inertial Measurement Unit (IMU) is used in robots for motion and control. A soft robot would work better with an IMU that is equally compliant, while providing accurate and reliable motion readings. Therefore, IPR was done to develop a Soft IMU.

#### IDEATE

##### Human Inner Ear: A Natural Soft IMU



Motion is detected through the movement of fluids in the semicircular canals.

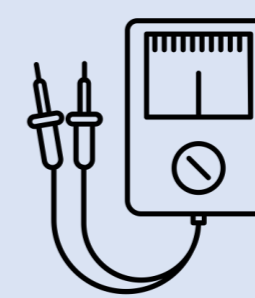
##### Methods To Detect Movement Of Fluid



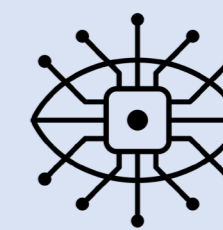
Using a Piezo Resistor



Thermal Measurement

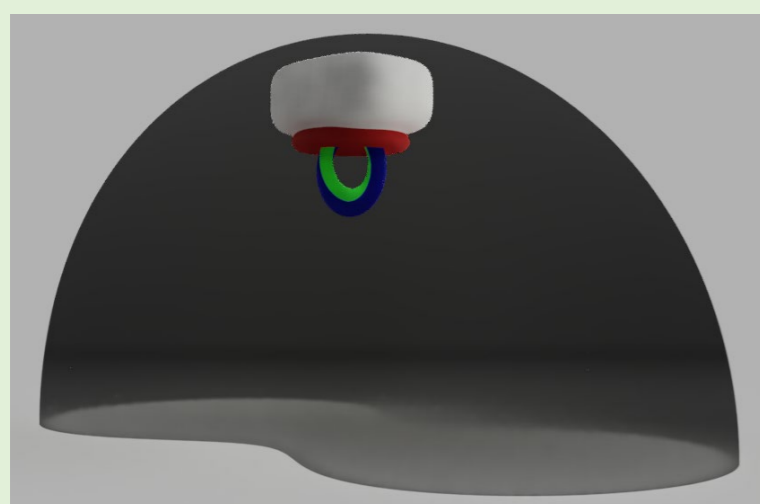


Potential Difference



Computer Vision

#### PROTOTYPE



CAD Model Of Sensor Position In Soft Robot Body

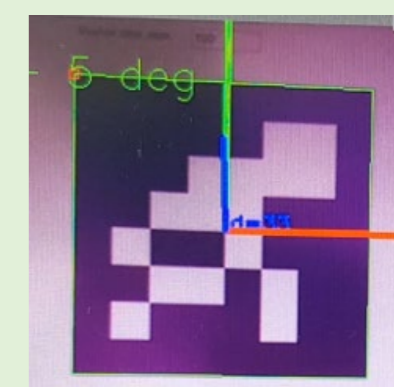
##### Using Computer Vision



Markers Made Up From Black And White Grids Can Be Detected By Computer Vision



Using A Raspberry Pi Board And Camera



To Give Position Estimates

#### REALIZE



Printing Of Marker Using PDMS Ink



Alternative Way Of Printing Via Injections

After printing the marker, it is left to cure into a piece of soft PDMS. The marker is placed in fluid to achieve buoyancy, such that any displacement of the soft robot will cause the PDMS marker to displace as well.

By placing the camera in line with the marker, Computer Vision can be utilised to detect the change in motion, and the information is processed by the Raspberry Pi to give the displacement of the soft robot.