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SENSORS

MOTION/ACCELERATION

CONCEPT Motion and acceleration sensors allow robots to perceive and respond to changes in their environment and adjust the rate of their movements accordingly. By providing information about a robot's speed, direction, and orientation, these sensors enable precise and accurate control of a robot's movements, which is essential for tasks ranging from simple navigation to complex manipulation and interaction with the environment.

BACKGROUND

The first sensor used in robotics was the potentiometer, which was used to measure the rotation of a joint in a robotic arm.

In the 1960s, the development of solid-state sensors led to the invention of the first accelerometers and gyroscopes. These early sensors were large and expensive, and their accuracy was limited.

In the 1970s, advancements in microelectronics led to the development of smaller and more accurate sensors. These sensors were used in early mobile robots, such as the Shakey robot developed at the Stanford Research Institute.

During the 1980s and 1990s, the development of MEMS (Microelectromechanical Systems) technology led to the production of even smaller and more affordable sensors. This led to a boom in the use of motion/acceleration sensors in robotics applications, including navigation, control, and manipulation.

EXAMPLES

GYROSCOPE: measures angular motion and orientation changes in a robotic system.

ACCELEROMETER: measures the acceleration of a robotic system in a particular direction.

INERTIAL MEASUREMENT UNIT (IMU): A combination of gyroscopes and accelerometers that can measure both angular and linear motion.

MAGNETOMETER: measures the magnetic field in the environment, which can help to determine the robot's orientation with respect to the Earth's magnetic field.

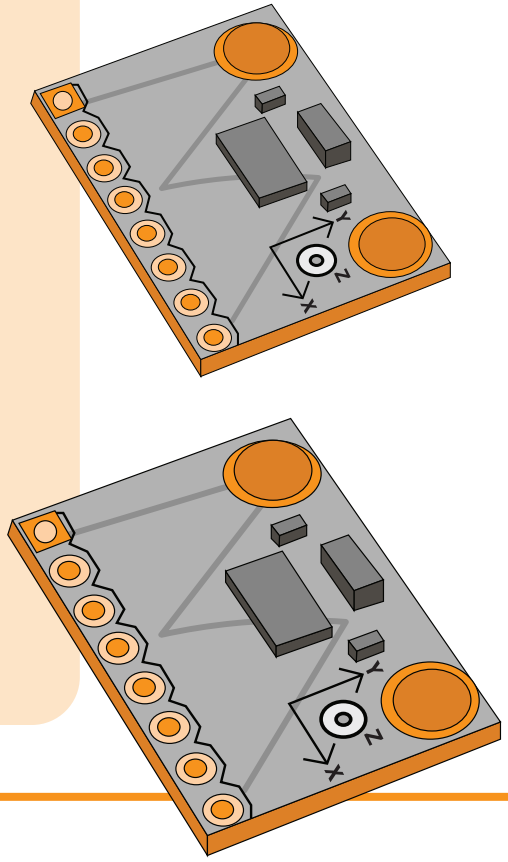
Make sure it measures up

DATA

ACCELERATION: Rate at which a robotic system's velocity changes over time. Accelerometers provide data on the acceleration in a particular direction.

VELOCITY: Rate at which a robotic system's position changes over time. Velocity can be calculated from acceleration data.

ORIENTATION: Position of a robotic system relative to a reference frame. Gyroscopes and other orientation sensors provide data on a robot's angular velocity, which can be used to calculate its orientation.



REAL WORLD CONNECTIONS

IMUs are used in agricultural robots to provide accurate motion sensing and control. A robot equipped with an IMU can accurately navigate through a field and avoid obstacles while performing tasks such as planting or harvesting crops.

Accelerometers and gyroscopes are used in drones for agricultural purposes in Nebraska. These sensors provide information about the drone's motion and orientation, which is critical for accurate flight control and navigation.

APPLICATION

Exoskeletons are wearable robots that aid individuals with mobility impairments, and they often use motion/acceleration sensors to detect and respond to the user's movements.

The H2 exoskeleton developed by the Japanese company Cyberdyne uses multiple sensors, including gyroscopes and accelerometers, to detect the user's movements and provide assistance with walking and other activities. The exoskeleton's sensors can adjust the level of assistance provided in real time, based on factors such as speed, direction, and orientation.

Similar exoskeletons equipped with motion/acceleration sensors have been developed to assist stroke patients with walking. The exoskeleton is able to detect changes in the patient's gait and adjust the level of assistance provided to help the patient walk more naturally and efficiently.

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