

Siantou University
Software Engineering
Bachelor's Degree
Mobile Development

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TOPIC: SENSORS

Overview of the topic,

- Definition of sensors
- Types of Sensors
- Usage of Sensors/Application of mobile sensors
- App using Sensors elaboration
- Challenges faced with mobile sensors.
- Conclusion

A. Definition of mobile sensors .

Mobile sensors are sensors that are designed to move around, usually while in operation. This can be accomplished with different methods, such as being integrated into a vehicle, or with the help of robotics. Examples of mobile sensors include GPS sensors, cameras, lasers and infrared sensors. Mobile sensors can be used to detect objects and allow for automated data collection and analysis.

B. Overview of why mobile sensors are important.

Mobile sensors are important because they enable a variety of functions on smartphones, tablets, and wearable devices. Sensors enable the detection of motion, temperature, light, sound, distance, and other environmental information. They are used in navigation, fitness tracking, and medical applications. Sensors make it possible for devices to have augmented reality, facial recognition, and voice recognition capabilities. They can help with disaster management, as well as providing customization options for the user. Sensors also enable a longer battery life by managing how the device interacts with its environment.

II. Types of Mobile Sensors .

1. Accelerometers: These are miniature machines that measure acceleration forces and vibrations. Accelerometers are used to detect the orientation of a device (portrait or landscape) and are also used in gaming consoles to measure movement.
2. Gyroscopes: A gyroscope measures angular rotation and rate of change in a device's orientation. It is an essential technology in modern GPS systems, drone guidance systems and virtual reality headsets.
3. Proximity sensors: These detect the presence of physical objects in a defined area around the device. Proximity sensors can detect items such as a user's hand or finger, enabling a device to respond to touch.
4. Ambient light sensors: Ambient light sensors measure the amount of light in the environment and use this data to dynamically adjust the brightness of a device's display. This improves battery life and usability by avoiding over- or under-lighting a device.
5. Cameras: Modern mobile devices are increasingly equipped with high-resolution cameras, enabling augmented reality and other sophisticated applications.

6. Barometers: Barometers measure atmospheric pressure and can be used to estimate an approximate altitude. This data can be used to support outdoor navigation systems,

A. Location Sensors .

Location sensors are used to determine the physical location of something, such as a person or object. Examples of commonly used location sensors are GPS receivers, infrared sensors, radio-frequency identification (RFID) tags, and Wi-Fi enabled devices. They are used in a variety of applications, including asset tracking, surveillance, navigation, and consumer electronics.

B. Proximity Sensors .

Proximity sensors are devices used to detect the presence and movement of nearby objects without any physical contact. They work by emitting a beam of electromagnetic radiation or sound, and then measure the reflection or echo of this beam in order to identify objects. Proximity sensors can be used in a wide range of applications, including robotics, industrial manufacturing, and medical instrumentation.

C. Motion Sensors.

Motion sensors are used to detect movement of an object or person in its field of vision. They are commonly used for security systems and for home automation to detect movement in an area. Motion sensors typically use infrared (IR) technology to detect movement, which is then converted into an electrical signal that can be used to trigger an alarm or other response.

III. Applications of Mobile Sensors.

1. Location Tracking: Mobile sensors can be used to track the location of a person or object. This data can be used for a variety of applications, including navigation, safety, and transportation optimization.

2. Human Activity Recognition: Mobile sensors can detect and recognize physical activities such as walking, running, and exercising. This data can be used to monitor physical activity and provide personalized health advice.

3. Environmental Monitoring: Mobile sensors can measure atmospheric and environmental data, such as air quality, temperature, humidity, light, and sound levels. This information can be used for climate monitoring and air pollution control.

4. Agriculture: Mobile sensors can measure soil moisture, temperature, and nutrient levels. This data can be used to optimize crop yield and improve food production.

5. Smart Home Monitoring: Mobile sensors can be used to detect and monitor security, energy, and water usage in the home. This information can be used to improve home energy efficiency and provide enhanced security.

IV. Seven ways sensors are used in automation industries is as following:

- Automated industrial processes – Most automated industrial processes use sensors to measure temperature, pressure, flow rate etc... for monitoring the progress of production process.
- Robotic control – Robotic machines use various types of sensors for sensing their environment and maintaining their desired action trajectory/trail.
- Intelligent building automation – Automated Building systems use many different types of sensors for controlling energy usage by monitoring occupancy or movement within a given space.
- Automated Transport Systems – Autonomous vehicles use sensor data to navigate the roadway safely while avoiding obstacles along their route.
- Inspection Processes– Various types of industrial sensors help automate inspection processes by examining details that would be too difficult for manual observation alone.
- Quality Control Applications - Sensors can also be used in quality control applications to ensure that finished products meet quality standards before they are shipped out to customers.
- Connected home appliances - Home appliance makers now integrate multiple sensors into home appliances like air conditioners, washing machines, refrigerators etc., to make them more efficient and user friendly

A. Mobile Gaming .

Mobile gaming is a form of online gaming that is done on mobile devices such as smartphones, tablets, and handheld gaming consoles. Games can be downloaded from app stores or played online in a browser. Mobile gaming has become increasingly popular as more people are utilizing their mobile devices for gaming on the go. Mobile games typically come in the form of either single or multiplayer games, or a combination of both. Popular genres include puzzle,

arcade, racing, sports, and adventure games. Some examples of popular mobile games include Clash of Clans, Pokémon Go, and Candy Crush Saga.

B. Augmented Reality .

Augmented Reality (AR) is a technology that overlays computer-generated content on the real world environment with the purpose of enhancing the user's perception of the real world. The technology allows for live and direct manipulation of virtual objects in the real world. It can be used in both indoor and outdoor scenarios and is currently used in a variety of applications such as navigation, gaming, education, and medical applications. AR typically requires an external input device such as a smartphone, tablet PC, or wearable device that can interact with the virtual objects. Examples of AR systems include Microsoft HoloLens, Google Glass, and Magic Leap One.

C. Health & Fitness Tracking.

Health and fitness tracking is the monitoring of various physical and mental health indicators, including physical activity, exercise, weight, sleep, mental health, and eating habits. By tracking these metrics, individuals can identify areas where they need to improve their health and make lifestyle changes accordingly. This type of tracking is becoming increasingly popular, as more people are becoming aware of the importance of maintaining a healthy lifestyle. Fitness trackers, apps, and wearable devices are all great tools to help people monitor their progress and stay motivated.

V. Sensors API

- Sensor Manager: provides access to the device's sensor
- Sensor: Represents a single sensor and provides its properties
- SensorEvent: Contains sensors data and materials
- Sensors Fusion: Combines data from multiple sensors to provide more accurate information.

VI . Challenges Faced with Mobile Sensors.

1. Limited battery life: Mobile sensors are limited by the short battery life of the device they are used on, which can be a major obstacle to the use of mobile sensors in certain applications.

2. Limited transmission capabilities: Mobile sensors often have limited onward transmission capabilities, which can hinder their usefulness and limit the applications they can be used in.

3. Data sampling rate: The sampling rate of mobile sensors is often lower than that of stationary sensors, which can lead to distorted, inaccurate data.

4. Interference: Mobile sensors are susceptible to interference from other signal sources, including cellular towers, wifi routers, and other electronic devices.

Conclusion

Android sensors are very powerful tools for providing information about the device's physical environment to apps. By following the best practices and using the appropriate sensors for your app's functionality, you can create apps that provide a more immersive and useful experience for your users.