

Design and Development of Applications for Mobile Devices

Sensors

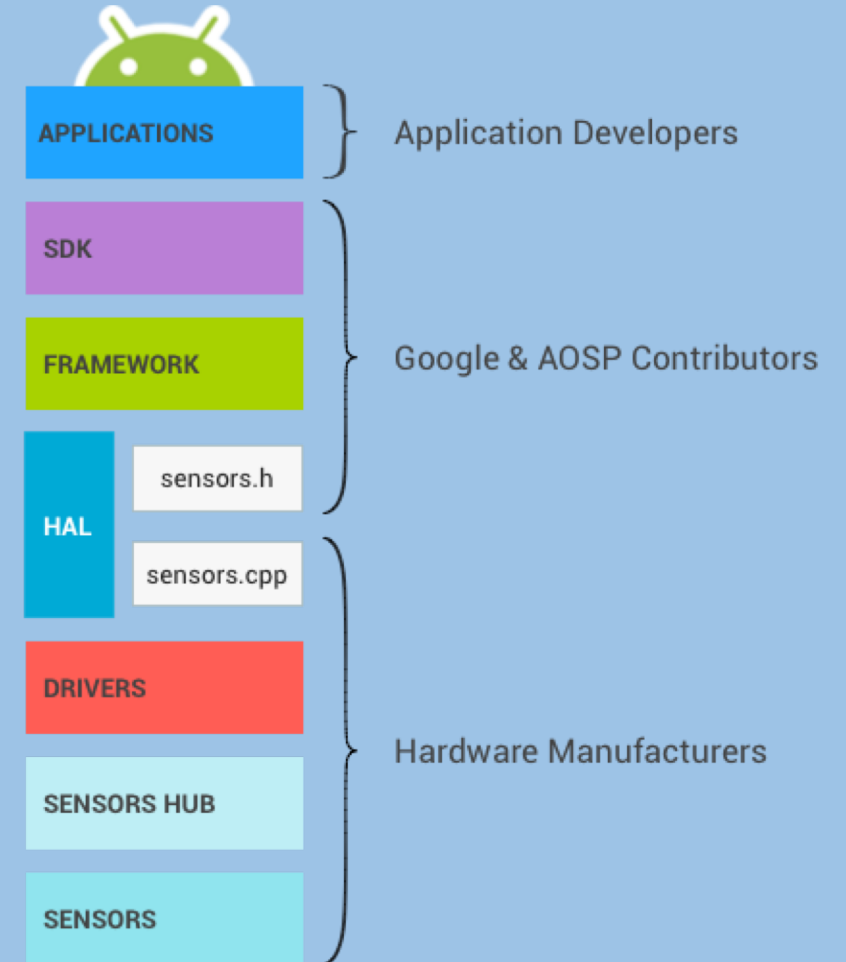
Semester 1, 2020

What are Android sensors?

- Measures motion, orientation, etc
- Provide high accuracy and precision
- Practical example would be calculating moisture in a room

Sensor stack

What are the components???



Sensor types

- Motion sensors
- Environmental sensors
- Position sensors
- Raw sensors vs Composite sensors

List of sensors

Sensor	Type	Description	Common Uses
TYPE_ACCELEROMETER	Hardware	Measures the acceleration force in m/s^2 that is applied to a device on all three physical axes (x, y, and z), including the force of gravity.	Motion detection (shake, tilt, etc.).
TYPE_AMBIENT_TEMPERATURE	Hardware	Measures the ambient room temperature in degrees Celsius ($^{\circ}\text{C}$). See note below.	Monitoring air temperatures.
TYPE_GRAVITY	Software or Hardware	Measures the force of gravity in m/s^2 that is applied to a device on all three physical axes (x, y, z).	Motion detection (shake, tilt, etc.).
TYPE_GYROSCOPE	Hardware	Measures a device's rate of rotation in rad/s around each of the three physical axes (x, y, and z).	Rotation detection (spin, turn, etc.).
TYPE_LIGHT	Hardware	Measures the ambient light level (illumination) in lx.	Controlling screen brightness.
TYPE_LINEAR_ACCELERATION	Software or Hardware	Measures the acceleration force in m/s^2 that is applied to a device on all three physical axes (x, y, and z), excluding the force of gravity.	Monitoring acceleration along a single axis.
TYPE_MAGNETIC_FIELD	Hardware	Measures the ambient geomagnetic field for all three physical axes (x, y, z) in μT .	Creating a compass.
TYPE_ORIENTATION	Software	Measures degrees of rotation that a device makes around all three physical axes (x, y, z). As of API level 3 you can obtain the inclination matrix and rotation matrix for a device by using the gravity sensor and the geomagnetic field sensor in conjunction with the getRotationMatrix() method.	Determining device position.
TYPE_PRESSURE	Hardware	Measures the ambient air pressure in hPa or mbar.	Monitoring air pressure changes.
TYPE_PROXIMITY	Hardware	Measures the proximity of an object in cm relative to the view screen of a device. This sensor is typically used to determine whether a handset is being held up to a person's ear.	Phone position during a call.
TYPE_RELATIVE_HUMIDITY	Hardware	Measures the relative ambient humidity in percent (%).	Monitoring dewpoint, absolute, and relative humidity.
TYPE_ROTATION_VECTOR	Software or Hardware	Measures the orientation of a device by providing the three elements of the device's rotation vector.	Motion detection and rotation detection.
TYPE_TEMPERATURE	Hardware	Measures the temperature of the device in degrees Celsius ($^{\circ}\text{C}$). This sensor implementation varies across devices and this sensor was replaced with the TYPE_AMBIENT_TEMPERATURE sensor in API Level 14	Monitoring temperatures.

Sensor Demo

LSM330DLC 3-axis Accelerometer
 AK8975C 3-axis Magnetic field sensor
 AK8975C Magnetic field Sensor
 UnCalibrated
 iNemoEngine Orientation sensor
 CM36651 Light sensor
 CM36651 Proximity sensor
 LSM330DLC Gyroscope sensor
 iNemoEngine Gravity sensor
 iNemoEngine Linear Acceleration sensor
 iNemoEngine Rotation_Vector sensor
 LPS331AP Pressure Sensor
 Auto Rotation Sensor
 Rotation Vector Sensor
 Gravity Sensor
 Linear Acceleration Sensor
 Game Rotation Vector Sensor
 Uncalibrated Gyroscope Sensor
 Orientation Sensor
 Corrected Gyroscope Sensor

Best practices for accessing and using sensors

There are five best practices that you should consider:

- Unregister sensor listeners
- Do not block the `onSensorChanged()` method
- Avoid using deprecated methods or sensor types
- Verify sensors before you use them
- Choose sensor delays carefully

Lab 1: Sensor Exploration – Optional (no marks)

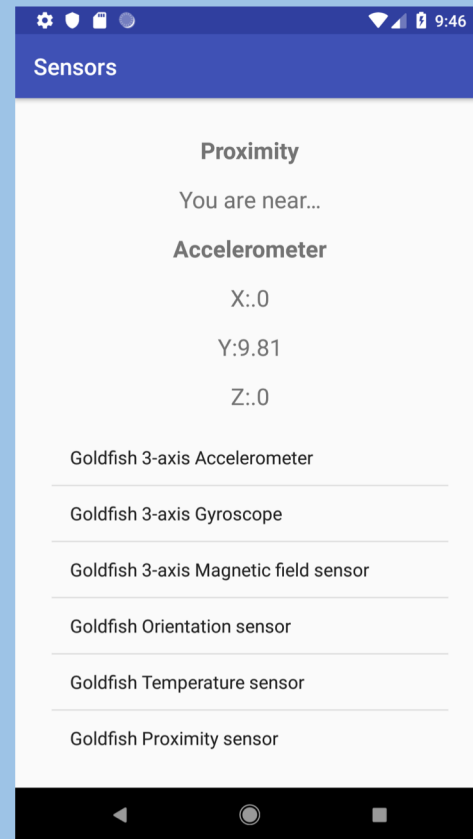
In lab 1, you will be explore the accelerometer, light and proximity sensors. Open up Android Studio and create a new application.

Lab 1: Sensor Exploration Continue

Implement the following functionality:

- List all the sensors on your phone
- Display the X, Y and Z tilt values using the accelerometer sensor
- If you have a light sensor, display the illumination level and values as you move your phone from light to dark
- If you have a proximity sensor, display “**Near**” when the phone is $< 5\text{cm}$ from a surface (e.g. your hand) and “**Far**” when the phone is $> 5\text{cm}$ from surface

Lab 1: Sensor Exploration Example



Lab 2: Sensor Animation – Optional (no marks)

Implement the following functionality:

- Create an animation that responds to tilting on the X and Y axis

Link to sensors overview

http://developer.android.com/guide/topics/sensors/sensors_overview.html

Please take note

There are examples online where the sensor event handlers are written as part of the activity. **Please do not do this.** Instead, implement your event handler as inner classes.

Provide correct handlers for the onPause() and onResume() methods. If you are unsure, refer to the code snippet on slide eight.