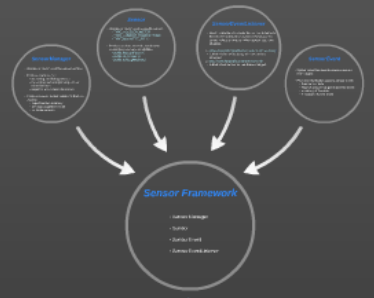

Android Sensors

Presented by: Dean Laganiere
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An Overview of Android Sensors

- What is a Sensor?
- Classes of Sensors
- Platform Support
- Sensor Framework
- Code Examples
- Demo Sensor App

What is a Sensor?

- Sensor: any device that converts energy into a useable signal
- Provides real time data from devices to help meet the needs of today's and tomorrow's end users
- Increases the overall usability of apps

Classes of Sensors

- Active: use energy from the environment to power the measurement
- Passive: inject energy into the environment in a particular manner and measure the reaction

Types of Sensors

- Proprioceptive: measure the internal state of the physical
  - Battery status
  - Hardware temperature
  - Hardware speedy
  - Any internal aspect of device
- Exteroceptive: measure information from the physical environment
  - Object proximity
  - GPS
  - Ambient light
  - Any external aspect of device

Platform Support

Sensor	Android 4.x (API Level 14)	Android 5.x (API Level 21)	Android 6.x (API Level 23)	Android 7.x (API Level 25)
TYPE_ACCELEROMETER	Yes	Yes	Yes	Yes
TYPE_AMBIENT_TEMPERATURE	Yes	n/a	n/a	n/a
TYPE_GRAVITY	Yes	Yes	n/a	n/a
TYPE_GYROSCOPE	Yes	Yes	n/a	n/a
TYPE_LIGHT	Yes	Yes	n/a	n/a
TYPE_LINEAR_ACCELERATION	Yes	Yes	n/a	n/a
TYPE_MAGNETIC_FIELD	Yes	Yes	n/a	n/a
TYPE_ORIENTATION	Yes	Yes	n/a	n/a
TYPE_PRESSURE	Yes	Yes	n/a	n/a
TYPE_PROXIMITY	Yes	Yes	n/a	n/a
TYPE_RELATIVE_HUMIDITY	Yes	Yes	n/a	n/a
TYPE_ROTATION_VECTOR	Yes	Yes	n/a	n/a
TYPE_TEMPERATURE	Yes	Yes	n/a	n/a

Code Examples

References

- http://developer.android.com/guide/topics/sensors/sensors_overview.html
- http://developer.android.com/reference/android/hardware/SensorManager.html
- http://developer.android.com/reference/android/hardware/Sensor.html
- http://developer.android.com/reference/android/hardware/SensorEvent.html
- http://developer.android.com/reference/android/hardware/SensorEventListener.html
- J. McGough. *Python Robotics.Rapid City: Class Notes, 2013.*

If you want to graph sensor data check out: http://android-graphview.org/

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  - GPS
  - Ambient light
  - Any external aspect of device

Android Device Sensors

- Device has built-in sensors that measure motion, orientation, and various environmental conditions
- Provides raw data with high precision and accuracy
- Three broad categories: Motion, Environment, Position

Motion

- Measures acceleration forces and rotational forces along three axes
- Includes accelerometers, gravity sensors, gyroscopes, and rotational vector sensors.

Environment

- Measures ambient air temperature and pressure, illumination, and humidity
- Includes barometers, photometers, and thermometers.

Position

- Measures the physical position of a device
- Includes orientation sensors and magnetometers

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Environment

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Position

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Platform Support

Sensor	Android 4.0 (API Level 14)	Android 2.3 (API Level 9)	Android 2.2 (API Level 8)	Android 1.5 (API Level 3)
TYPE_ACCELEROMETER	Yes	Yes	Yes	Yes
TYPE_AMBIENT_TEMPERATURE	Yes	n/a	n/a	n/a
TYPE_GRAVITY	Yes	Yes	n/a	n/a
TYPE_GYROSCOPE	Yes	Yes	n/a[1]	n/a[1]
TYPE_LIGHT	Yes	Yes	Yes	Yes
TYPE_LINEAR_ACCELERATION	Yes	Yes	n/a	n/a
TYPE_MAGNETIC_FIELD	Yes	Yes	Yes	Yes
TYPE_ORIENTATION	Yes[2]	Yes[2]	Yes[2]	Yes
TYPE_PRESSURE	Yes	Yes	n/a[1]	n/a[1]
TYPE_PROXIMITY	Yes	Yes	Yes	Yes
TYPE_RELATIVE_HUMIDITY	Yes	n/a	n/a	n/a
TYPE_ROTATION_VECTOR	Yes	Yes	n/a	n/a
TYPE_TEMPERATURE	Yes[2]	Yes	Yes	Yes

Platform Support

Sensor	Android 4.0 (API Level 14)	Android 2.3 (API Level 9)	Android 2.2 (API Level 8)	Android 1.5 (API Level 3)
TYPE_ACCELEROMETER	Yes	Yes	Yes	Yes
TYPE_AMBIENT_TEMPERATURE	Yes	n/a	n/a	n/a
TYPE_GRAVITY	Yes	Yes	n/a	n/a
TYPE_GYROSCOPE	Yes	Yes	n/a[1]	n/a[1]
TYPE_LIGHT	Yes	Yes	Yes	Yes
TYPE_LINEAR_ACCELERATION	Yes	Yes	n/a	n/a
TYPE_MAGNETIC_FIELD	Yes	Yes	Yes	Yes
TYPE_ORIENTATION	Yes[2]	Yes[2]	Yes[2]	Yes
TYPE_PRESSURE	Yes	Yes	n/a[1]	n/a[1]
TYPE_PROXIMITY	Yes	Yes	Yes	Yes
TYPE_RELATIVE_HUMIDITY	Yes	n/a	n/a	n/a
TYPE_ROTATION_VECTOR	Yes	Yes	n/a	n/a
TYPE_TEMPERATURE	Yes[2]	Yes	Yes	Yes

Sensor Framework

- SensorManager
- Sensor
- SensorEvent
- SensorEventListener

SensorManager

- Creates an instance of the sensor service.
- Provides methods for:
  - accessing and listing sensors
  - registering and unregistering sensor event listeners
  - acquiring orientation information
- Provides several sensor constants that are used to:
  - report sensor accuracy
  - set data acquisition rates
  - calibrate sensors

Sensor

- Creates an instance of a specific sensor.
  - TYPE_ACCELEROMETER
  - TYPE_AMBIENT_TEMPERATURE
  - TYPE_MAGNETIC_FIELD
- Provides various methods that let you determine a sensor's capabilities.
  - *public float getPower ()*
  - *public int getType ()*
  - *public String getName ()*

SensorEventListener

- Use this interface to create two callback methods that receive notifications (sensor events) when sensor values change or when sensor accuracy changes.

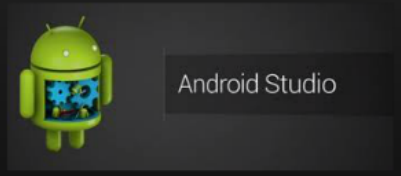
1. *onAccuracyChanged(Sensor sensor, int accuracy)*
   - Called when the accuracy of a sensor has changed.
2. *onSensorChanged(SensorEvent event)*
   - Called when sensor values have changed.

racy)

SensorEvent

- System uses this class to create a sensor event object
- Provides information about a sensor event:
  - Raw sensor data
  - Type of sensor that generated the event
  - Accuracy of the data
  - Timestamp for the event

Code Examples



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