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# EXHIBIT E

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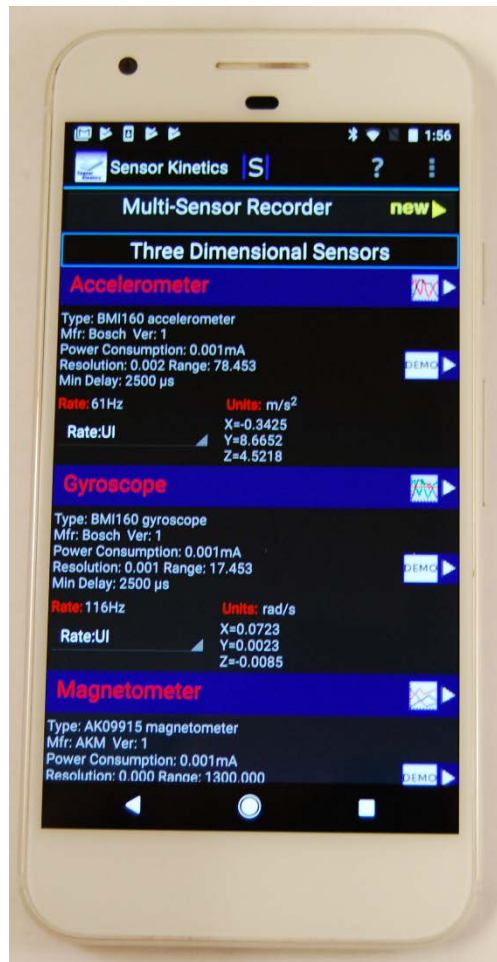
# **U.S. Patent No. 8,552,978**

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**Google Pixel**

Claim 10

A method for compensating rotations of a 3D pointing device, comprising:



Google Pixel

Claim 10

generating an **orientation output** associated with an orientation of the 3D pointing device associated with three coordinates in a **global reference frame associated with Earth**;

When the orientation sensor is software-based, the **orientation output** is the attitude of the device that can be represented by azimuth, pitch, and roll angles relative to the magnetic North Pole associated with a **global reference frame associated with Earth**;

### Rotation vector

Underlying physical sensors: Accelerometer, Magnetometer, and Gyroscope

Reporting-mode: *Continuous*

`getDefaultSensor(SENSOR_TYPE_ROTATION_VECTOR)` returns a non-wake-up sensor

A rotation vector sensor reports the orientation of the device relative to the East-North-Up coordinates frame, obtained by integration of accelerometer, gyroscope, and magnetometer readings. The East-North-Up coordinate system is defined as a direct orthonormal basis where:

- X points east and is tangential to the ground.
- Y points north and is tangential to the ground.
- Z points towards the sky and is perpendicular to the ground.

The orientation of the phone is represented by the rotation necessary to align the East-North-Up coordinates with the phone's coordinates. That is, applying the rotation to the world frame (X,Y,Z) would align them with the phone's coordinates (x,y,z).

Claim 10

generating a **first signal set** comprising axial accelerations associated with movements and rotations of the 3D pointing **spatial reference frame**;

### Accelerometer

Reporting-mode: *Continuous*

`getDefaultSensor(SENSOR_TYPE_ACCELEROMETER)` returns a non-wake-up sensor

An accelerometer sensor reports the acceleration of the device along the 3 sensor axes. The measured acceleration includes both the physical acceleration (change of velocity) and the gravity. The measurement is reported in the x, y and z fields of `sensors_event_t.acceleration`.

All values are in SI units ( $m/s^2$ ) and measure the acceleration of the device minus the force of gravity along the 3 sensor axes.

Source: <https://source.android.com/devices/sensors/sensor-types#accelerometer>

### Sensor Coordinate System

In general, the sensor framework uses a standard 3-axis coordinate system to express data values. For most sensors, the coordinate system is defined relative to the device's screen when the device is held in its default orientation (see figure 1). When a device is held in its default orientation, the X axis is horizontal and points to the right, the Y axis is vertical and points up, and the Z axis points toward the outside of the screen face. In this system, coordinates behind the screen have negative Z values. This coordinate system is used by the following sensors:

- [Acceleration sensor](#)
- Gravity sensor
- Gyroscope
- Linear acceleration sensor
- Geomagnetic field sensor

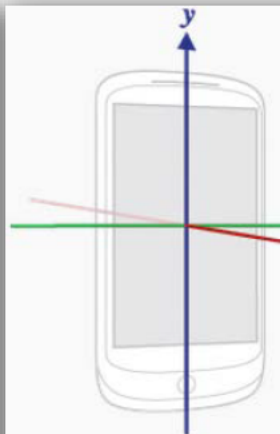


Figure 1. Coordinate system (device) that's used by th

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