Game App - Accelerometer Prototype

Detecting North

Revision 01

Graphical user interface, application

Description automatically generated

# Introduction

A landscape mode was added to code done for the running app to detect a tilt north for our game app.

Based on tests, using the code below, we see that the X coordinate moves by about 3 points when a north tilt is done in landscape mode (bottom of phone pointing to the east – see picture above). During an experiment of using this code, we see that the Z coordinate moves in a positive way during a North tilt also.

Similarly, one can expect a South tilt will move with a 3 point movement (that is a change in x value from say 9.0 to 6.0) and the Z coordinate value will be negative.

You need to do your own experiments to check this out for yourself.

For West and East movements, we see a much lower movement in the Y coordinate of about 0.3 points when tilting from east to west or vice versa.

What follows is the code for the XML and Java Main Activity to detect a north tilt with the emulator, when the phone is in landscape and the bottom of the phone is pointing east.

When adding this code, you need to generate a landscape view using the Landscape button in the XML Designer window.

# XML Code for Prototype (Portrait)

*<?***xml version="1.0" encoding="utf-8"***?>*<**androidx.constraintlayout.widget.ConstraintLayout xmlns:android="http://schemas.android.com/apk/res/android"  
 xmlns:app="http://schemas.android.com/apk/res-auto"  
 xmlns:tools="http://schemas.android.com/tools"  
 android:layout\_width="match\_parent"  
 android:layout\_height="match\_parent"  
 tools:context=".MainActivity"**>  
  
 <**TextView  
 android:id="@+id/tvLabel"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="X Coordinate"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.26"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"  
 app:layout\_constraintVertical\_bias="0.418"** />  
  
 <**TextView  
 android:id="@+id/tvLabel1"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Y Coordinate"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.26"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvLabel"  
 app:layout\_constraintVertical\_bias="0.258"** />  
  
 <**TextView  
 android:id="@+id/tvLabel2"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Z Coordinate"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.26"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvLabel1"  
 app:layout\_constraintVertical\_bias="0.402"** />  
  
 <**TextView  
 android:id="@+id/tvX"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="X Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.491"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"** />  
  
 <**TextView  
 android:id="@+id/tvY"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Y Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.498"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvX"  
 app:layout\_constraintVertical\_bias="0.294"** />  
  
 <**TextView  
 android:id="@+id/tvZ"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Z Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.494"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvY"** />  
  
 <**TextView  
 android:id="@+id/tvSteps"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="0"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textColor="#9C27B0"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvX"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"  
 app:layout\_constraintVertical\_bias="0.261"** />  
  
 <**TextView  
 android:id="@+id/tvMag"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="0"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textColor="#9C27B0"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvX"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvSteps"  
 app:layout\_constraintVertical\_bias="0.377"** />  
  
 <**TextView  
 android:id="@+id/tvLabelSteps"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Step Count"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvLabelSteps2"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.251"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"** />  
  
 <**TextView  
 android:id="@+id/tvLabelSteps2"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:layout\_marginTop="168dp"  
 android:text="Magnitude"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvLabel"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.251"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"  
 app:layout\_constraintVertical\_bias="0.018"** />  
  
</**androidx.constraintlayout.widget.ConstraintLayout**>

# XML Code for Prototype (Landscape)

*<?***xml version="1.0" encoding="utf-8"***?>*<**androidx.constraintlayout.widget.ConstraintLayout xmlns:android="http://schemas.android.com/apk/res/android"  
 xmlns:app="http://schemas.android.com/apk/res-auto"  
 xmlns:tools="http://schemas.android.com/tools"  
 android:layout\_width="match\_parent"  
 android:layout\_height="match\_parent"  
 tools:context=".MainActivity"**>  
  
 <**TextView  
 android:id="@+id/tvLabel1"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Y Coordinate"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvLabel2"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.22"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvLabel"  
 app:layout\_constraintVertical\_bias="0.32"** />  
  
 <**TextView  
 android:id="@+id/tvLabelSteps"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:layout\_marginTop="56dp"  
 android:text="North Count"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.218"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"** />  
  
 <**TextView  
 android:id="@+id/tvLabel"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="X Coordinate"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.22"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"  
 app:layout\_constraintVertical\_bias="0.397"** />  
  
 <**TextView  
 android:id="@+id/tvLabel2"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Z Coordinate"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.22"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvLabel1"  
 app:layout\_constraintVertical\_bias="0.504"** />  
  
 <**TextView  
 android:id="@+id/tvX"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="X Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvY"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.5"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvSteps"  
 app:layout\_constraintVertical\_bias="0.428"** />  
  
 <**TextView  
 android:id="@+id/tvY"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Y Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvZ"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.5"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvX"  
 app:layout\_constraintVertical\_bias="0.294"** />  
  
 <**TextView  
 android:id="@+id/tvZ"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="Z Value"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toBottomOf="parent"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintHorizontal\_bias="0.5"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toBottomOf="@+id/tvY"** />  
  
 <**TextView  
 android:id="@+id/tvSteps"  
 android:layout\_width="wrap\_content"  
 android:layout\_height="wrap\_content"  
 android:text="0"  
 android:textAppearance="@style/TextAppearance.AppCompat.Display1"  
 android:textColor="#9C27B0"  
 android:textStyle="bold"  
 app:layout\_constraintBottom\_toTopOf="@+id/tvX"  
 app:layout\_constraintEnd\_toEndOf="parent"  
 app:layout\_constraintStart\_toStartOf="parent"  
 app:layout\_constraintTop\_toTopOf="parent"  
 app:layout\_constraintVertical\_bias="0.355"** />  
  
</**androidx.constraintlayout.widget.ConstraintLayout**>

# Java Code for Prototype

**package** com.example.myaccelnsewproto;  
  
**import** androidx.appcompat.app.AppCompatActivity;  
  
**import** android.hardware.Sensor;  
**import** android.hardware.SensorEvent;  
**import** android.hardware.SensorEventListener;  
**import** android.hardware.SensorManager;  
**import** android.os.Bundle;  
**import** android.widget.TextView;  
  
**public class** MainActivity **extends** AppCompatActivity **implements** SensorEventListener {  
  
 *// experimental values for hi and lo magnitude limits* **private final double NORTH\_MOVE\_FORWARD** = 9.0; *// upper mag limit* **private final double NORTH\_MOVE\_BACKWARD** = 6.0; *// lower mag limit* **boolean highLimit** = **false**; *// detect high limit* **int counter** = 0; *// step counter* TextView **tvx**, **tvy**, **tvz**, **tvSteps**;  
 **private** SensorManager **mSensorManager**;  
 **private** Sensor **mSensor**;  
  
 @Override  
 **protected void** onCreate(Bundle savedInstanceState) {  
 **super**.onCreate(savedInstanceState);  
 setContentView(R.layout.***activity\_main***);  
  
 **tvx** = findViewById(R.id.***tvX***);  
 **tvy** = findViewById(R.id.***tvY***);  
 **tvz** = findViewById(R.id.***tvZ***);  
 **tvSteps** = findViewById(R.id.***tvSteps***);  
  
 *// we are going to use the sensor service* **mSensorManager** = (SensorManager) getSystemService(***SENSOR\_SERVICE***);  
 **mSensor** = **mSensorManager**.getDefaultSensor(Sensor.***TYPE\_ACCELEROMETER***);  
 }  
  
  
 */\*  
 \* When the app is brought to the foreground - using app on screen  
 \*/* **protected void** onResume() {  
 **super**.onResume();  
 *// turn on the sensor* **mSensorManager**.registerListener(**this**, **mSensor**,  
 SensorManager.***SENSOR\_DELAY\_NORMAL***);  
 }  
  
 */\*  
 \* App running but not on screen - in the background  
 \*/* **protected void** onPause() {  
 **super**.onPause();  
 **mSensorManager**.unregisterListener(**this**); *// turn off listener to save power* }  
  
  
 @Override  
 **public void** onSensorChanged(SensorEvent event) {  
  
 **float** x = event.**values**[0];  
 **float** y = event.**values**[1];  
 **float** z = event.**values**[2];  
  
 **tvx**.setText(String.*valueOf*(x));  
 **tvy**.setText(String.*valueOf*(y));  
 **tvz**.setText(String.*valueOf*(z));  
  
  
 *// Can we get a north movement  
 // you need to do your own mag calculating* **if** ((x > **NORTH\_MOVE\_FORWARD**) && (**highLimit** == **false**)) {  
 **highLimit** = **true**;  
 }  
 **if** ((x < **NORTH\_MOVE\_BACKWARD**) && (**highLimit** == **true**)) {  
 *// we have a tilt to the north* **counter**++;  
 **tvSteps**.setText(String.*valueOf*(**counter**));  
 **highLimit** = **false**;  
 }  
 }  
  
 @Override  
 **public void** onAccuracyChanged(Sensor sensor, **int** accuracy) {  
 *// not used* }  
  
 **public static double** round(**double** value, **int** places) {  
 **if** (places < 0) **throw new** IllegalArgumentException();  
  
 **long** factor = (**long**) Math.*pow*(10, places);  
 value = value \* factor;  
 **long** tmp = Math.*round*(value);  
 **return** (**double**) tmp / factor;  
 }  
}