CS378 - Mobile Computing

Sensing and Sensors
Part 2

Using Sensors

- Recall basics for using a Sensor:
  - Obtain the *SensorManager* object
  - create a *SensorEventListener* for *SensorEvents*
  - logic that responds to sensor event
  - Register the sensor listener with a *Sensor* via the SensorManager

Sensor Best Practices

- Unregister sensor listeners
  - when done with Sensor or activity using sensor paused (onPause method)
  - sensorManager. unregisterListener(sensorListener)
  - otherwise data still sent and battery resources continue to be used

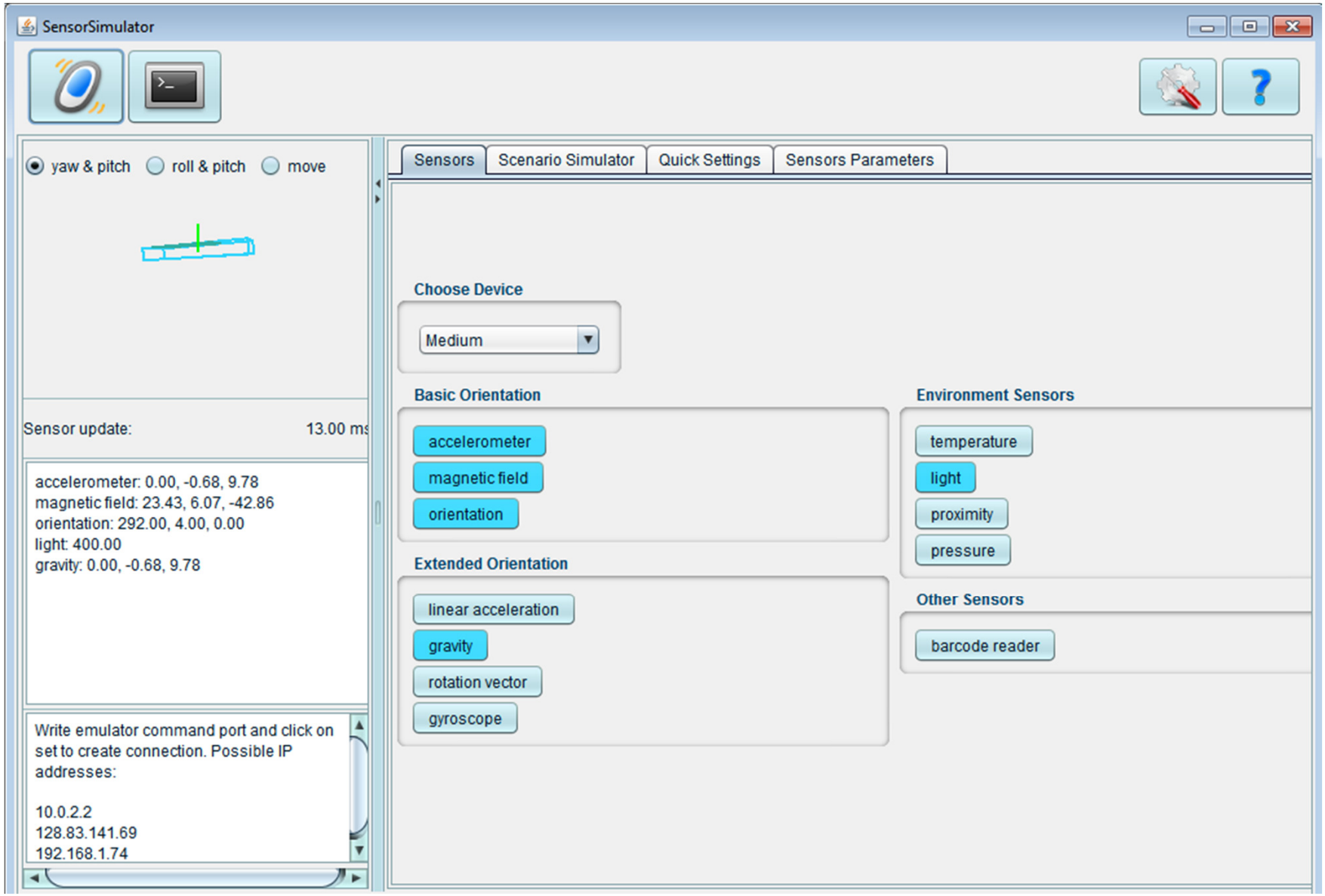
Sensor Best Practices

- Testing on the emulator
- Android SDK doesn't provide any simulated sensors
- 3rd party sensor emulator
- http://code.google.com/p/openintents/wiki/SensorSimulator

SensorSimulator

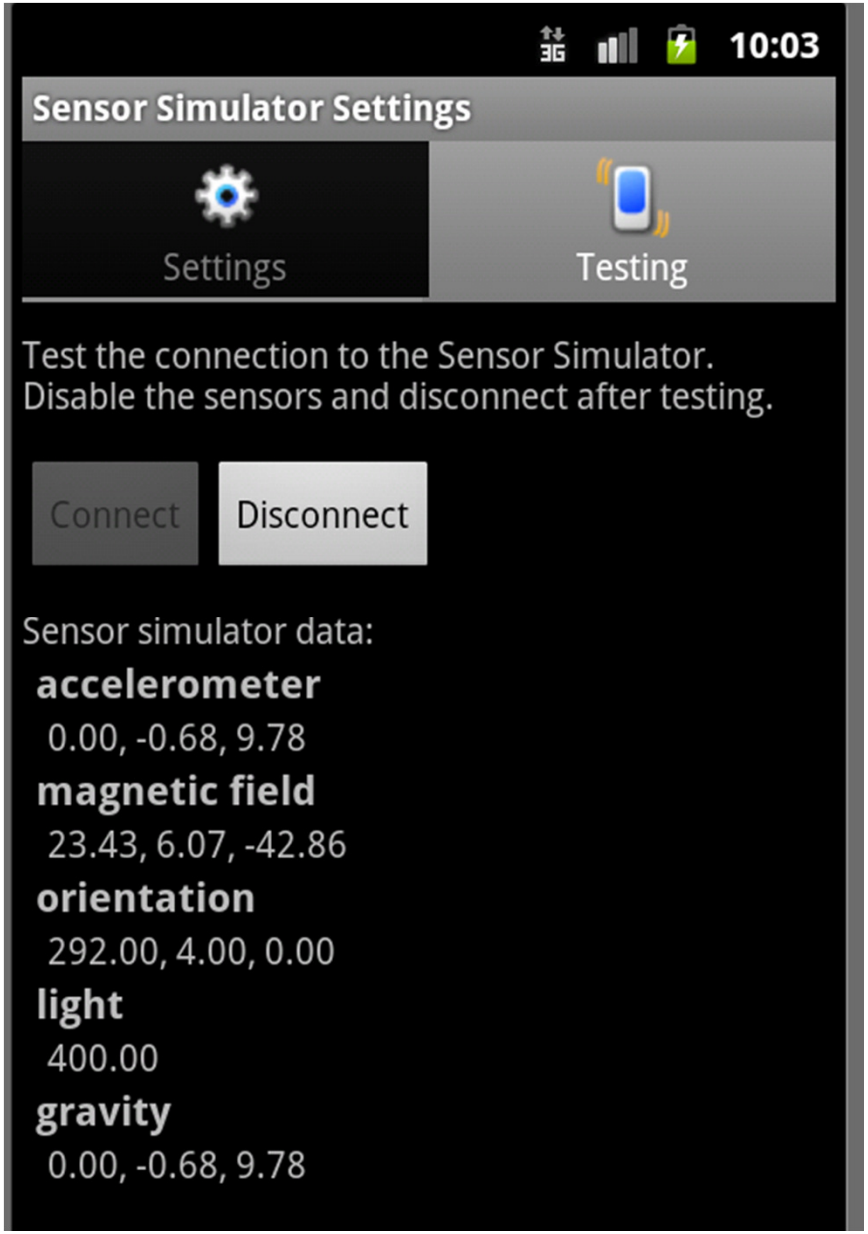
- Download the Sensor Simulator tool
- Start Sensor Simulator program
- Install SensorSimulator apk on the emulator
- Start app, connect simulator to emulator, start app that requires sensor data

Sensor Simulator



Sensor Simulator

- Mouse in Sensor Simulator controls phone, feeds sensor data to emulator
- Can also record sensor data from device and play back on emulator



Sensors Best Practices

- Don't block the onSensorChanged() method
  - recall the resolution on sensors
  - 50 updates a second for onSensorChange method not uncommon
  - when registering listener update is only a hint and may be ignored
  - if necessary save event and do work in another thread or asynch task

Sensors Best Practices

- verify sensor available before using it
- use getSensorList method and type
- ensure list is not empty before trying to register a listener with a sensor

Sensors Best Practices

- Avoid deprecated sensors and methods
- TYPE_ORIENTATION and TYPE_TEMPERATURE are deprecated as of Ice Cream Sandwich

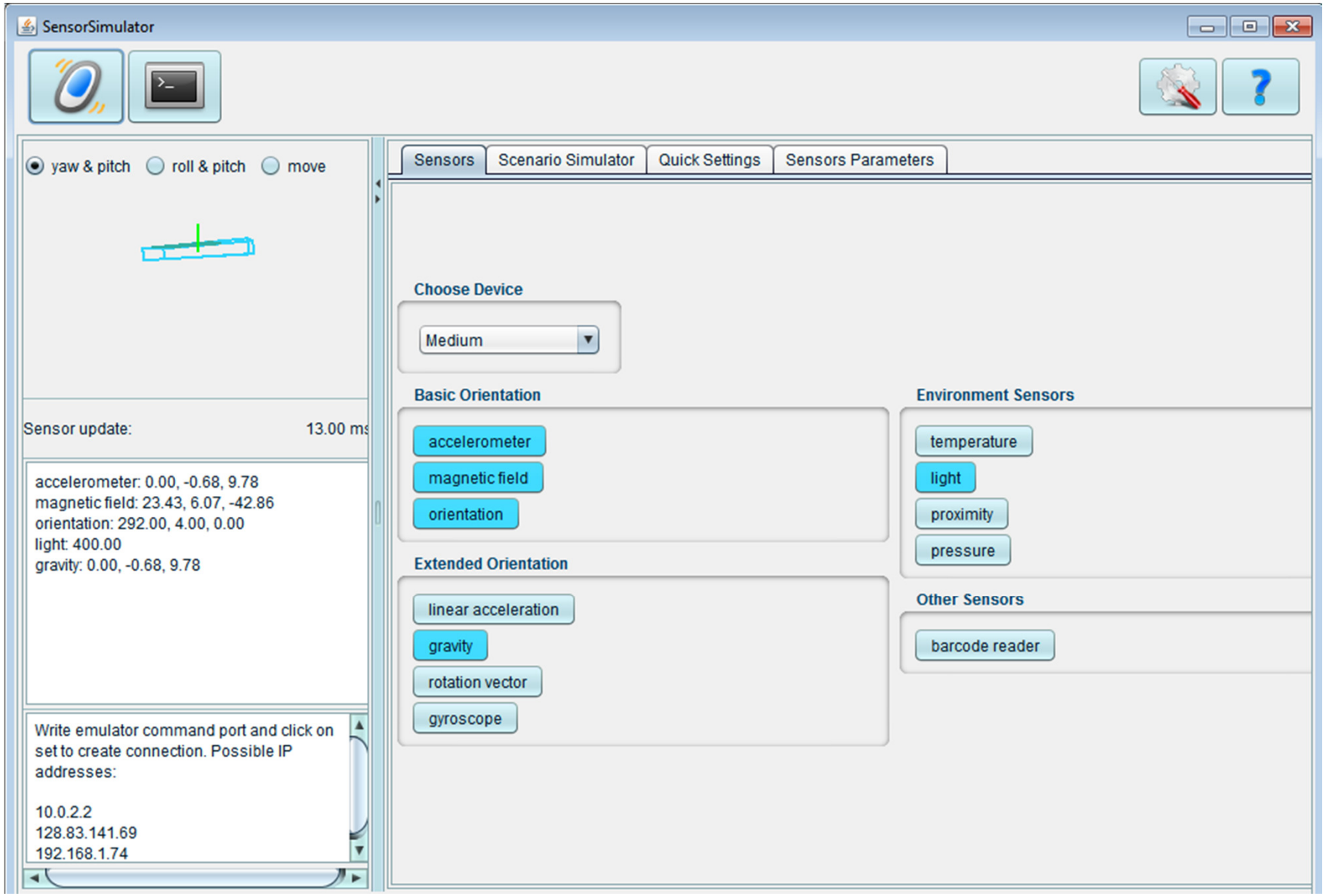
Sensor Best Practices

- Testing on the emulator
- Android SDK doesn't provide any simulated sensors
- 3rd party sensor emulator
- http://code.google.com/p/openintents/wiki/SensorSimulator

SensorSimulator

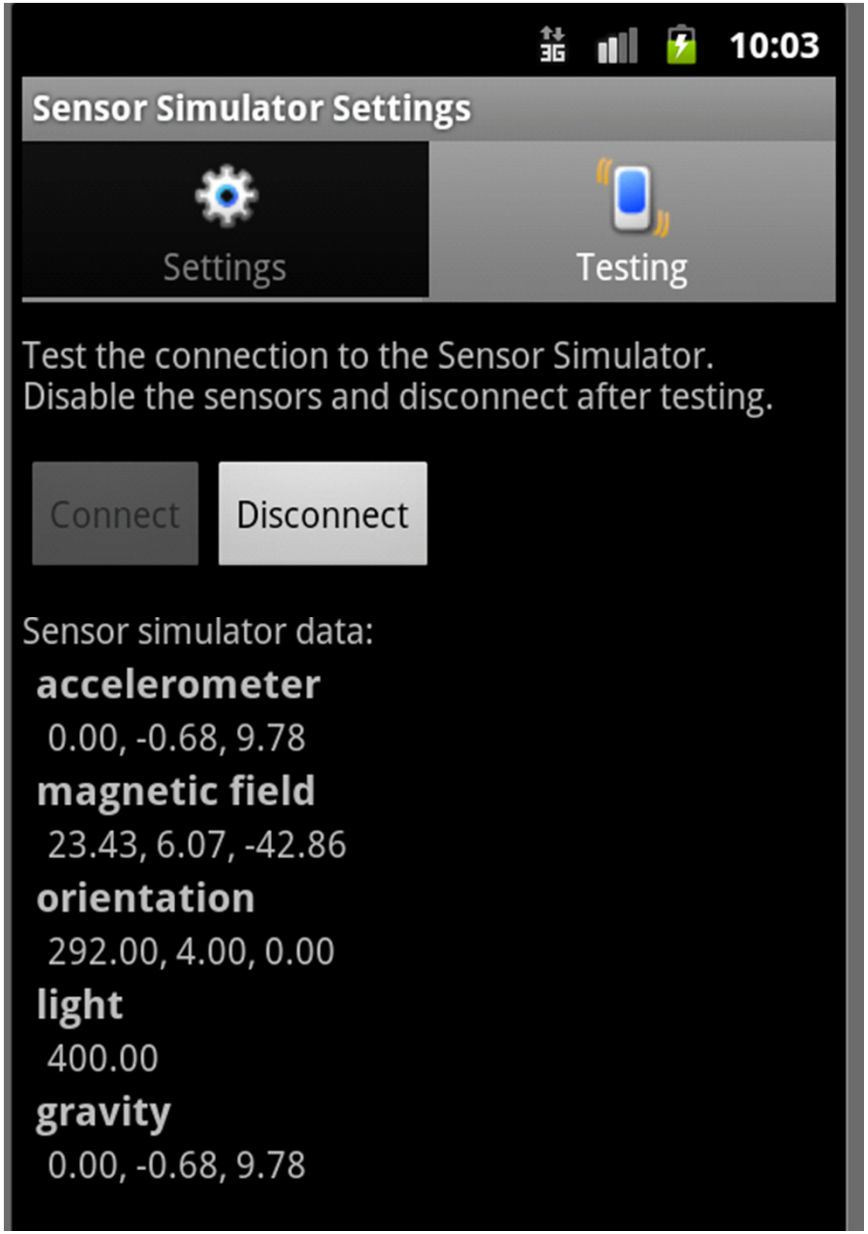
- Download the Sensor Simulator tool
- Start Sensor Simulator program
- Install SensorSimulator apk on the emulator
- Start app, connect simulator to emulator, start app that requires sensor data

Sensor Simulator



Sensor Simulator

- Mouse in Sensor Simulator controls phone, feeds sensor data to emulator
- Can also record sensor data from device and play back on emulator



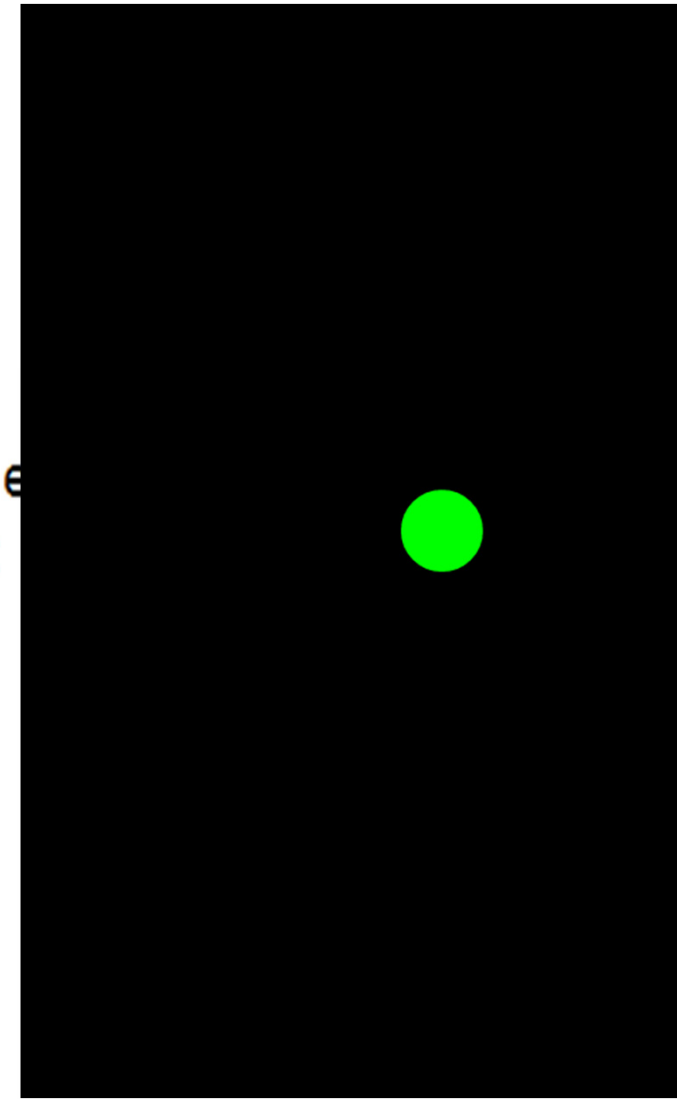
Sensor Sample - Moving Ball

- Place ball in middle of screen
- Ball has position, velocity, and acceleration
- acceleration based on linear acceleration sensor
- update over time, based on equations of motion, but fudged to suit application

Sensor Sample - Moving Ball

- Gross Simplification
- velocity set equal to acceleration

```
public void onSensorChanged(SensorEvent e
    //set ball speed based on phone tilt
    // speed set equal to acceleration
    mBallVelocity.x = -event.values[0];
    mBallVelocity.y = event.values[1];
```



Sensor Sample - Moving Ball

- Alternate Implementation

```
// try more realistic movement
float xA = -event.values[0];
float yA = event.values[1];
float aveXA = (xA + mPrevXAcc) / 2;
float aveYA = (yA + mPrevYAcc) / 2;
long currentTime = System.currentTimeMillis();
long elapsedTime = currentTime - mPrevTime;
mBallVelocity.x += aveXA * elapsedTime / 1000 / ACC_FUDGE_FACTOR;
mBallVelocity.y += aveYA * elapsedTime / 1000 / ACC_FUDGE_FACTOR;

mPrevXAcc = xA;
mPrevYAcc = yA;
mPrevTime = currentTime;
```

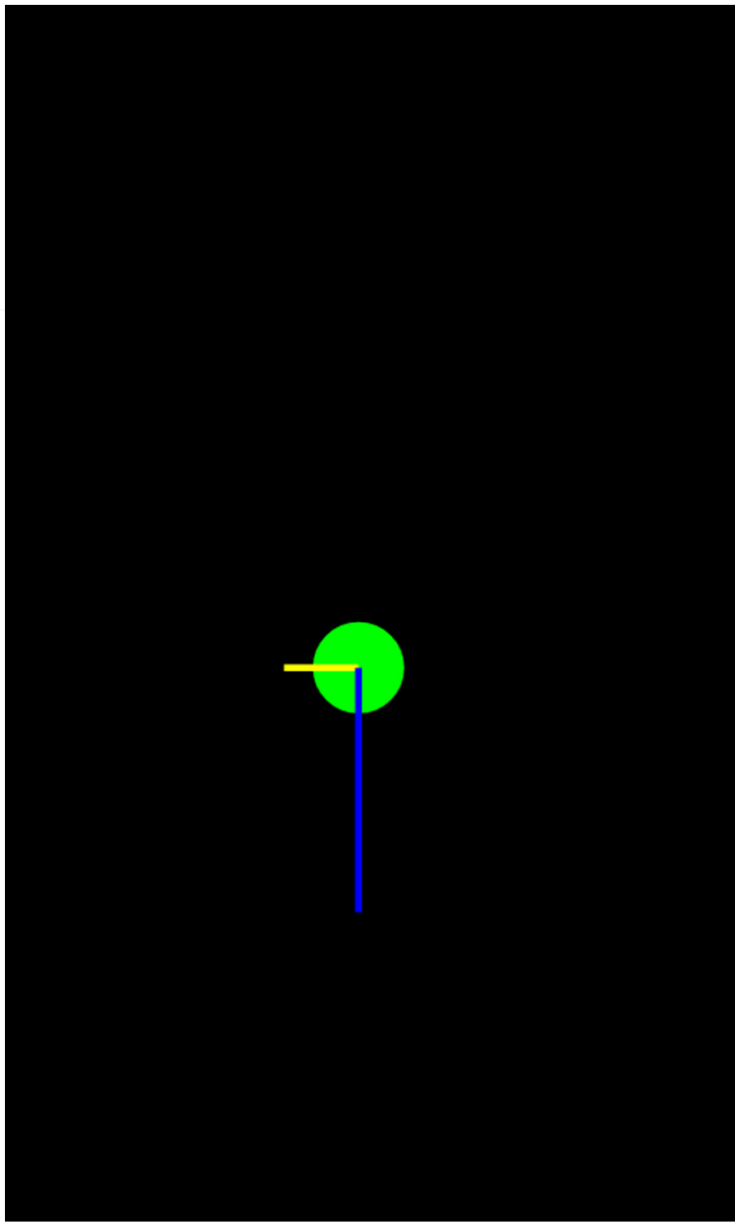
- position updated in separate thread which redraws the view

Sensor Sample

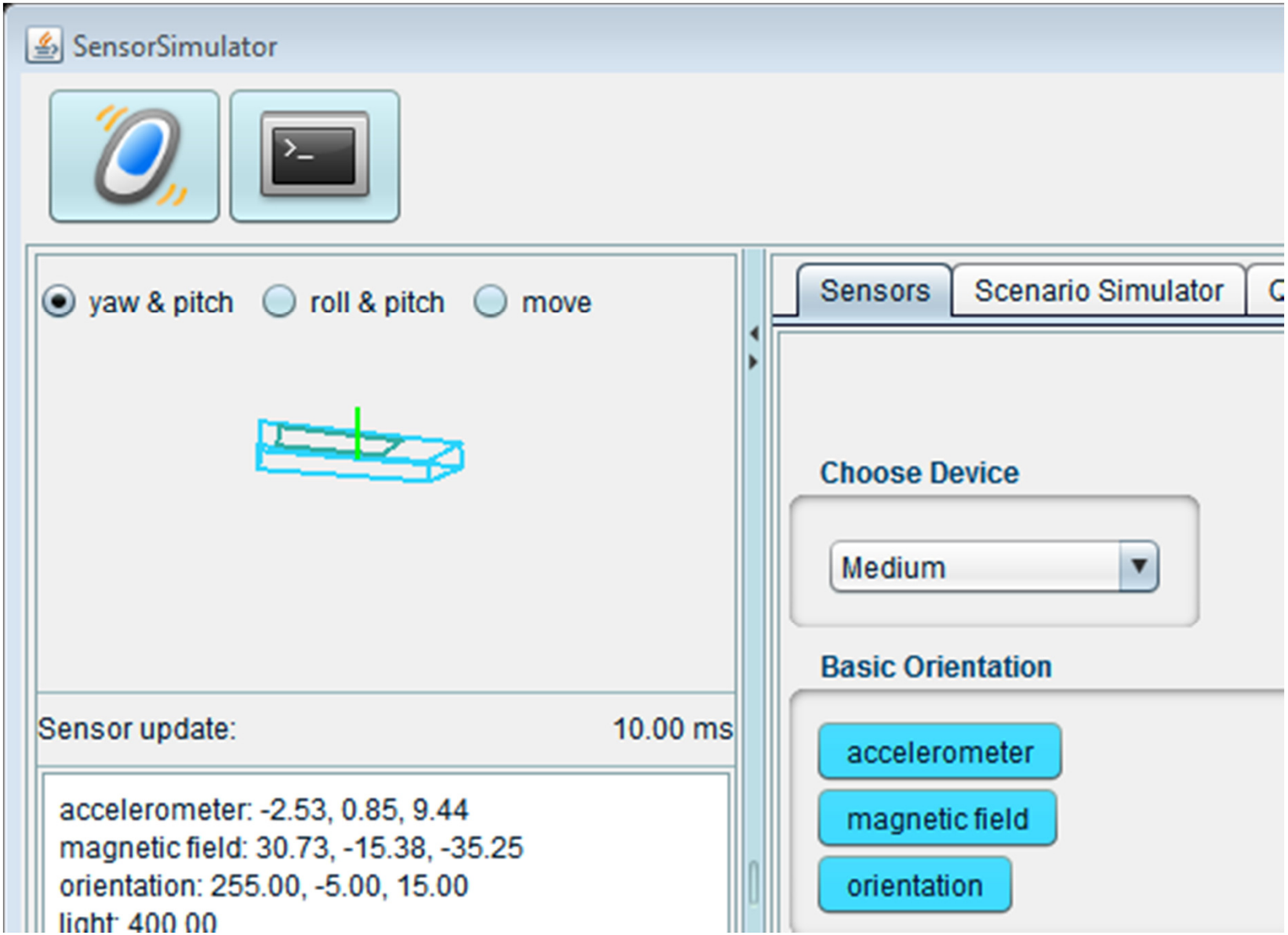
- Draw lines for x and y velocities

```
//called by invalidate()
@Override
protected void onDraw(Canvas canvas) {
    super.onDraw(canvas);
    mPaint.setStrokeWidth(1);
    mPaint.setColor(0xFF00FF00);
    canvas.drawCircle(mX, mY, mR, mPaint);

    mPaint.setStrokeWidth(3);
    mPaint.setColor(0xFFFFFF00);
    canvas.drawLine(mX, mY,
            mX + vX * 15, mY, mPaint);
    mPaint.setColor(0xFF0000FF);
    canvas.drawLine(mX, mY,
            mX, mY + vY * 15, mPaint);
```



Demo Using SensorSimulator



Sensor Sample - TBBT

- Inspired by http://tinyurl.com/7rnbgy5 and http://tinyurl.com/6nhvnnv

TBBT Sound Effect App

Responding to Events

```
private class LinAccListener implements SensorEventListener {
    public void onSensorChanged(SensorEvent event) {
        if(event.sensor.getType() == Sensor.TYPE_LINEAR_ACCELERATION) {
            float x = event.values[0];
            float y = event.values[1];
            float z = event.values[2];
            float acc = (float)Math.sqrt( x * x + y * y);
            // Log.d("BBT", "" + acc);
            if(acc > 31) {
                Log.d("BBT", "" + acc);

                if(soundPlayer != null && !soundPlayer.isPlaying()) {
                    soundPlayer.start();
                    picture.setImageResource(R.drawable.crack);
                }
            }
        }
    }
```

Changing Images

- Use of an Image View
- Initial Image set in onCreate
- new image set in onSensorChange
- register listener with MediaPlayer
- on completion reset image

```
@Override
public void onCompletion(MediaPlayer mp) {
    picture.setImageResource(R.drawable.shake);
}
```