RhaRham
Interactive Inc.

센서 / 카메라 / 위치정보 활용

공개 SW 개발자 대회

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Android Camera

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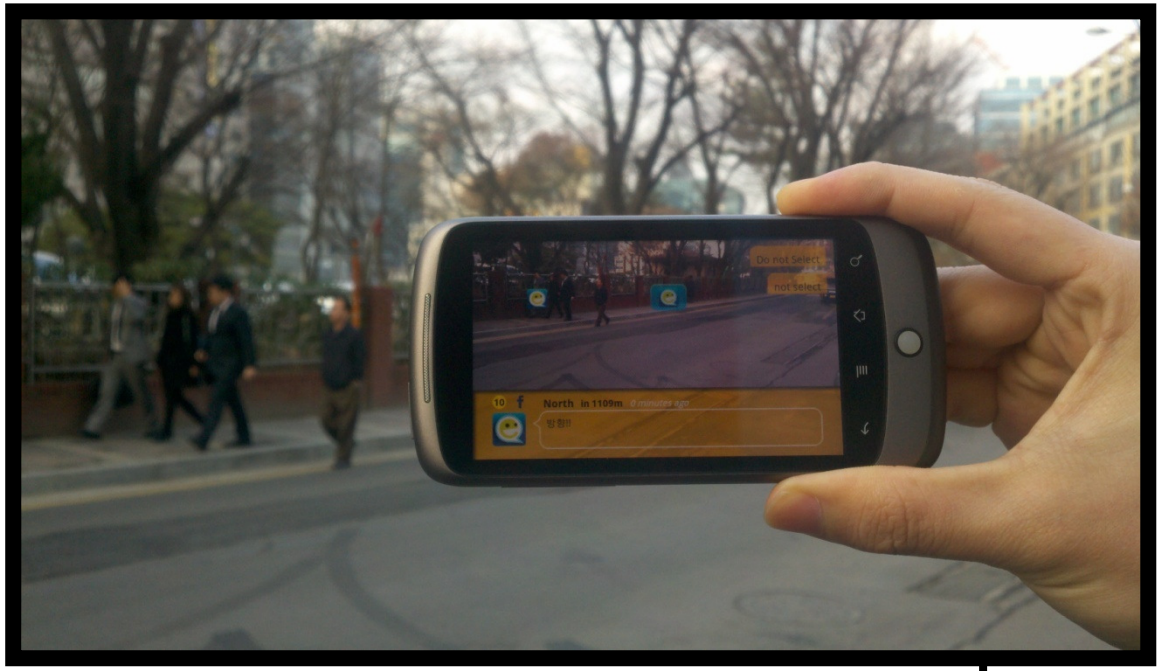
Android Location

(GPS, NETWORK)

Android COMPASS



Android Camera

Android Location
(GPS, NETWORK)

Android COMPASS

AR

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Subject Index

1. Augmented Reality
2. Camera
3. Location
4. Compass
5. OpenSource

What is AR?

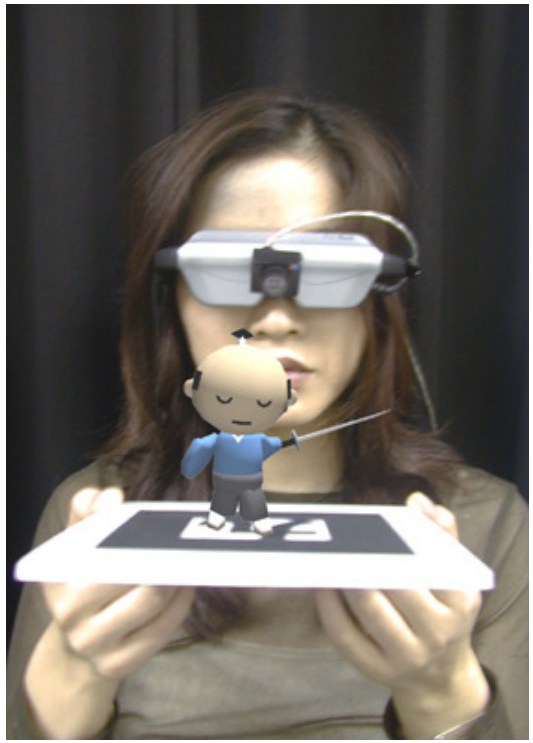
- 실제와 가상의 혼합
- Ronald Azuma의 정의
  - 현실(Real- world elements)의 이미지와 가상의 이미지를 결합한 것.
  - 실시간으로 인터랙션(interaction)이 가능한 것.
  - 3차원의 공간 안에 놓인 것.

VR (Virtual Reality)

- 실제와 가상의 혼합
  - Virtual Reality

AR (Augmented Reality)

- 실제와 가상의 혼합
  - Augmented Reality



< ARToolkit >

Location- based AR

- AR 구현의 필수 고려 사항

특징!! + 현실

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Location- based AR

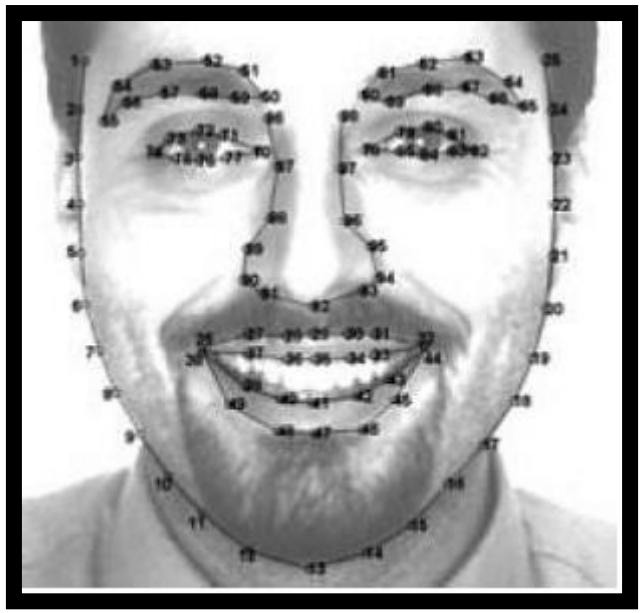
- 특징 추출
  - Marker, Markerless
  - Location

- But.

NO!!

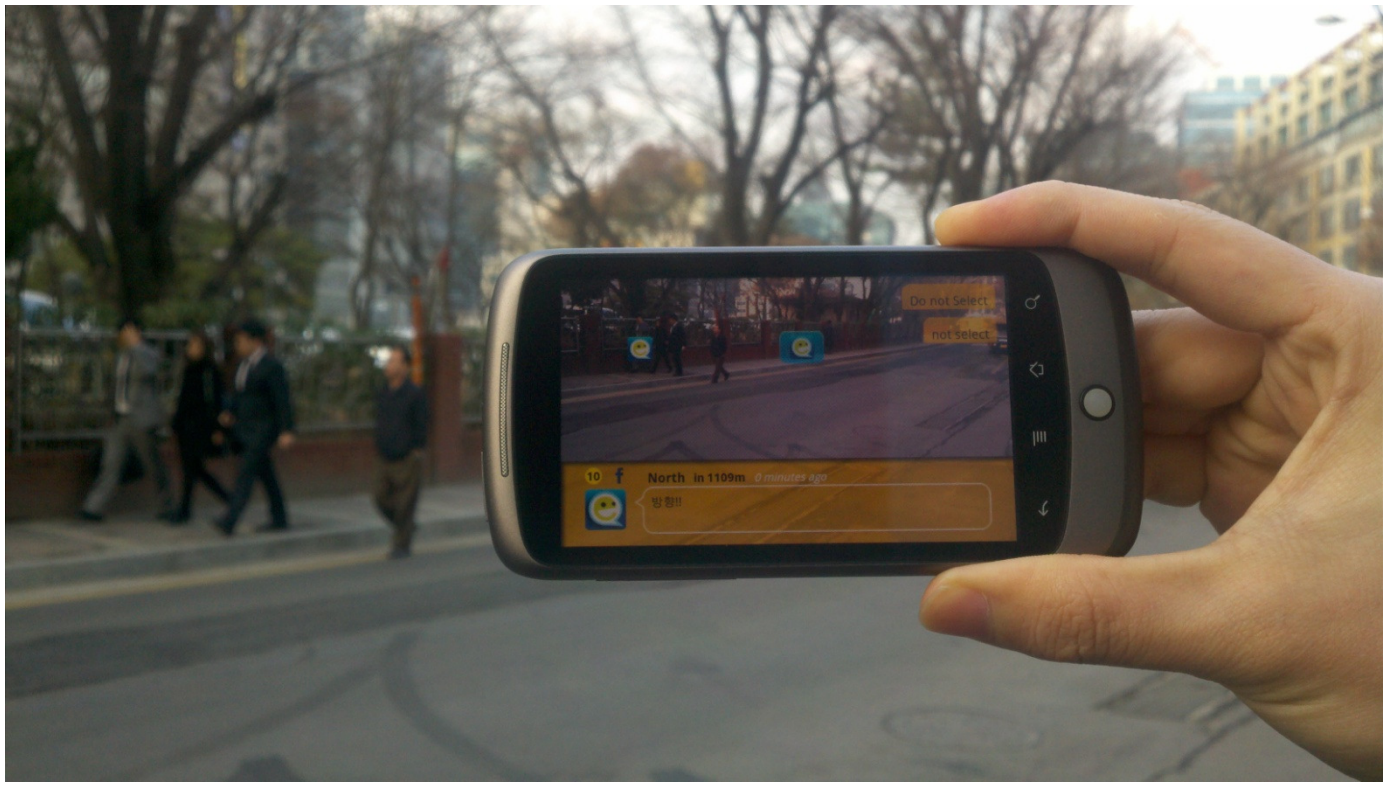
Pseudo- AR

- 가짜 AR ??
  - Location도 하나의 특징
  - Real AR ? Pseudo- AR? 은 소모적인 논쟁
  - 헤게모니.
  - 특징에 대한 인식



Location- based AR

- 실제와 가상의 혼합
  - Augmented Reality



Location- based AR in Android

- 필요 조건

Android Camera

SurfaceView

Camera

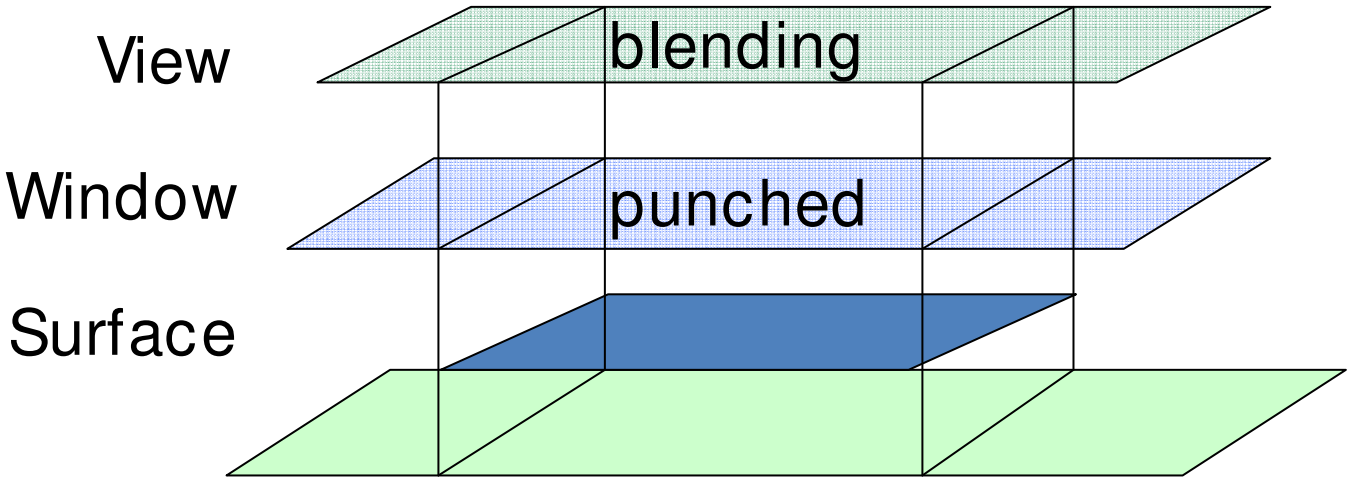
- 권한 설정
  - <uses-permission android:name="android.permission.CAMERA" />

- SurfaceView for Camera Capture Frame

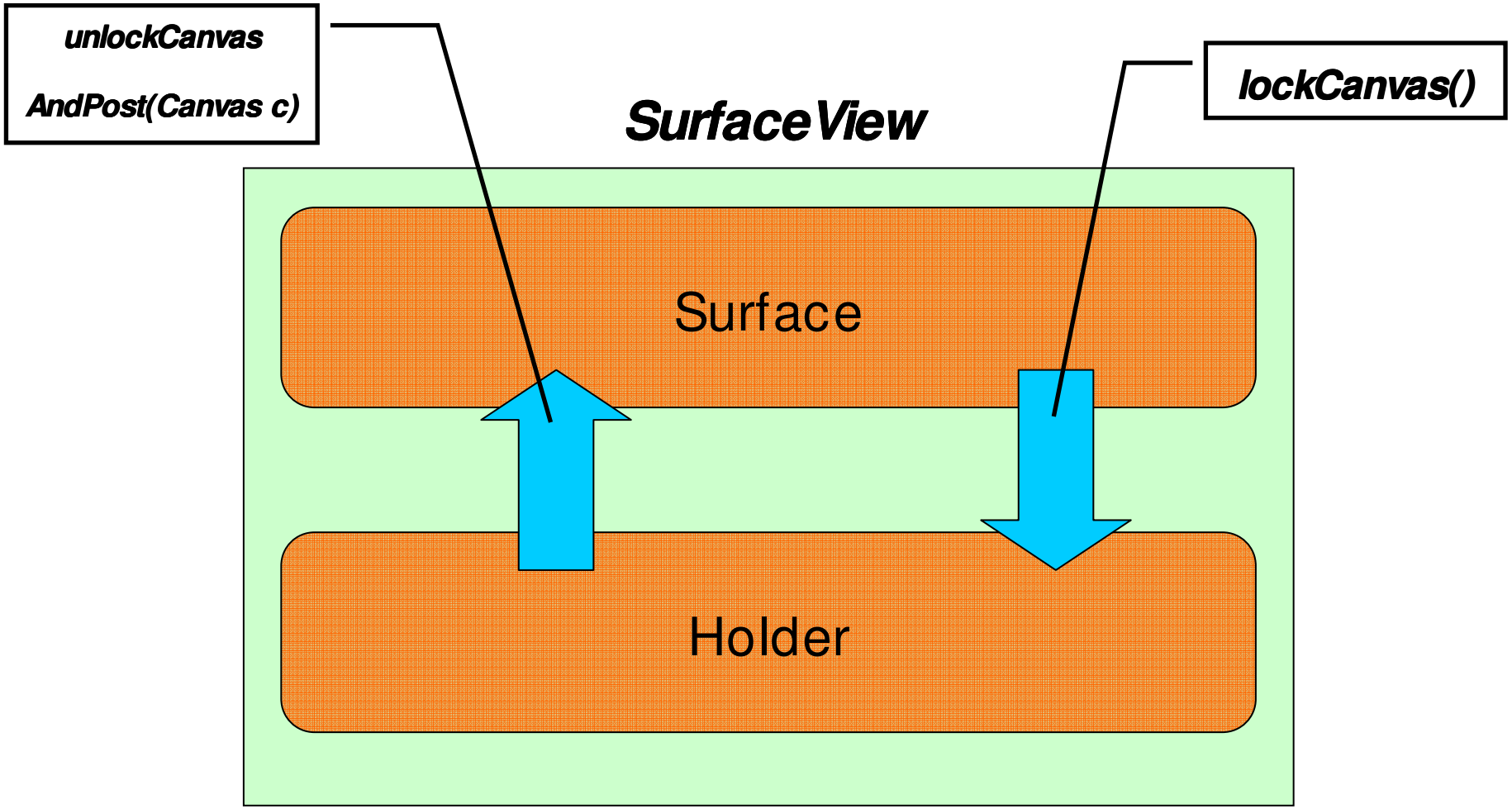
```
public void onCreate(Bundle savedInstanceState) {
        try{
                super.onCreate(savedInstanceState);
                cv = new CustomCameraView( this.getApplicationContext());
                FrameLayout fl = new FrameLayout( this.getApplicationContext());
                setContentView(fl);
                rl.addView(cv);
        }
        catch(Exception e){}
}
```

Camera

- What is SurfaceView?
  - UI Thread가 아닌 다른 Thread에서 UI 작업 : 성능!
  - The surface is Z ordered so that it is behind the window holding its SurfaceView
  - the SurfaceView punches a hole in its window to allow its surface to be displayed.



SurfaceView



SurfaceView

- CallBack 메커니즘
  - surfaceCreated
    - Surface 생성시 호출.
  - surfaceChanged
    - Surface 변경시 호출(화면 크기...)
  - surfaceDestroyed
    - Surface 제거시 호출, 할당된 자원 반납.
- Holder를 통한 관리
  - getHolder();

SurfaceView

```
Camera camera;
SurfaceHolder previewHolder;

public CustomCameraView(Context ctx)
{
  super(ctx);
  previewHolder = this.getHolder();
  previewHolder.setType(SurfaceHolder.SURFACE_TYPE_PUSH_BUFFERS);
  previewHolder.addCallback(surfaceHolderListener);
}
```

Surface Create

```
SurfaceHolder.Callback surfaceHolderListener = new
SurfaceHolder.Callback() {
        public void surfaceCreated(SurfaceHolder holder) {
            camera=Camera.open();
            try
            {
              camera.setPreviewDisplay(previewHolder);
            }
            catch (Throwable t) {

            }
        }
```

Surface Change

```
public void surfaceChanged(SurfaceHolder
surfaceHolder, int format, int w, int h)
{
   Parameters params = camera.getParameters();
   params.setPreviewSize(320, 480);
   params.setPictureFormat(PixelFormat.JPEG);
   camera.setParameters(params);
   camera.startPreview();
}
```

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Surface Destroy

```
public void surfaceDestroyed(SurfaceHolder arg0)
{
    // TODO Auto-generated method stub
    camera.stopPreview();
    camera.release();
}
```

Android Location

GPS Provider
Network Provider

Location

- 현재 위치의 자세한 정보가 필요해!!

- 권한 설정
  - <uses- permission android:name="android.permission.LOCATION"/>
  - <uses- permission android:name="android.permission.ACCESS_FINE_LOCATION" />
  - <uses- permission android:name="android.permission.ACCESS_COARSE_LOCATION" />

Location

- Location Manager

```
locMan =
(LocationManager)ctx.getSystemService(Context.
LOCATION_SERVICE);
```

```
locMan.requestLocationUpdates(LocationManager.
GPS_PROVIDER, 100, 1, this);
```

public void ***requestLocationUpdates*** (String provider, long minTime, float minDistance, LocationListener listener)

Providers

- GPS Provider
  - ACCESS_FINE_LOCATION Permission.
  - Cold Start : 2분~ 15분 소요.
  - 환경적 요인에 민감.

- Network Provider
  - ACCESS_COARSE_LOCATION Permission.
  - 위치확인 가능한 Network 연결 시 바로 작동
  - 오차범위가 크다.

Location

```
public void onLocationChanged(Location location)
{
      if(curLocation == null) {
         curLocation = location;
         ARView.Location = location;
         locationChanged = true;
      }
      else if(curLocation.getLatitude() == location.getLatitude() &&
              curLocation.getLongitude() == location.getLongitude()){
          locationChanged = false;
      }
      else{
          locationChanged = true;
      }
      curLocation = location;
      postInvalidate();
}
```

Android Compass

Sensor

SensorEvent, SensorManager

Compass

넌 대체 누굴 보고 있는 거야?

- 시스템 서비스 획득

```
sensorMan =
(SensorManager)ctx.getSystemService(Context.SENSOR_SERVICE);

sensorMan.registerListener
(this, sensorMan.getDefaultSensor(Sensor.TYPE_ORIENTATION),
SensorManager.SENSOR_DELAY_FASTEST);

sensorMan.registerListener
(this, sensorMan.getDefaultSensor(Sensor.TYPE_ACCELEROMETER),
 SensorManager.SENSOR_DELAY_FASTEST);
```

Sensor List

- Sensor Class
  - TYPE_ACCELEROMETER
    - A constant describing an accelerometer sensor type.
  - TYPE_GYROSCOPE
    - A constant describing a gyroscope sensor type
  - TYPE_LIGHT
    - A constant describing an light sensor type.
  - TYPE_MAGNETIC_FIELD
    - A constant describing a magnetic field sensor type.
  - TYPE_ORIENTATION
    - deprecated. use SensorManager.getOrientation() instead.
  - TYPE_PRESSURE
    - A constant describing a pressure sensor type
  - TYPE_PROXIMITY
    - A constant describing an proximity sensor type.
  - TYPE_TEMPERATURE
    - A constant describing a temperature sensor type

public final float[] **values** Since: API Level 3

The length and contents of the values array vary depending on which sensor type is being monitored (see also SensorEvent for a definition of the coordinate system used):

Sensor.TYPE_ORIENTATION:

All values are angles in degrees.

values[0]: Azimuth, angle between the magnetic north direction and the Y axis, around the Z axis (0 to 359). 0=North, 90=East, 180=South, 270=West

values[1]: Pitch, rotation around X axis (-180 to 180), with positive values when the z-axis moves **toward** the y-axis.

values[2]: Roll, rotation around Y axis (-90 to 90), with positive values when the x-axis moves **away** from the z-axis.

Note: This definition is different from **yaw, pitch and roll** used in aviation where the X axis is along the long side of the plane (tail to nose).

Note: It is preferable to use getRotationMatrix() in conjunction with remapCoordinateSystem() and getOrientation() to compute these values; while it may be more expensive, it is usually more accurate.

Sensor.TYPE_ACCELEROMETER:

All values are in SI units (m/s^2) and measure the acceleration applied to the phone minus the force of gravity.

values[0]: Acceleration minus Gx on the x-axis

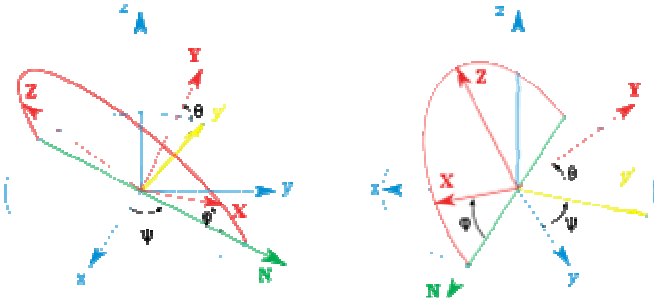
values[1]: Acceleration minus Gy on the y-axis

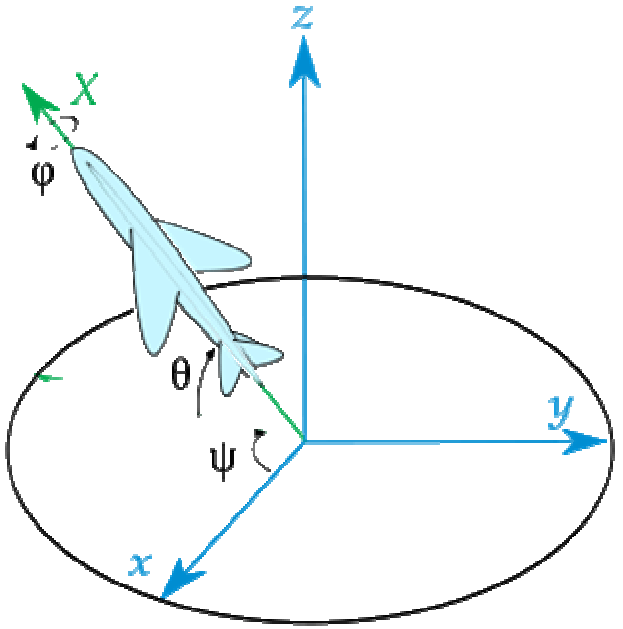
values[2]: Acceleration minus Gz on the z-axis

Examples:

- When the device lies flat on a table and is pushed on its left side toward the right, the x acceleration value is positive.
- When the device lies flat on a table, the acceleration value is +9.81, which correspond to the acceleration of the device (0 m/s^2) minus the force of gravity (-9.81 m/s^2).
- When the device lies flat on a table and is pushed toward the sky with an acceleration of A m/s^2, the acceleration value is equal to A+9.81 which correspond to the acceleration of the device (+A m/s^2) minus the force of gravity (-9.81 m/s^2).

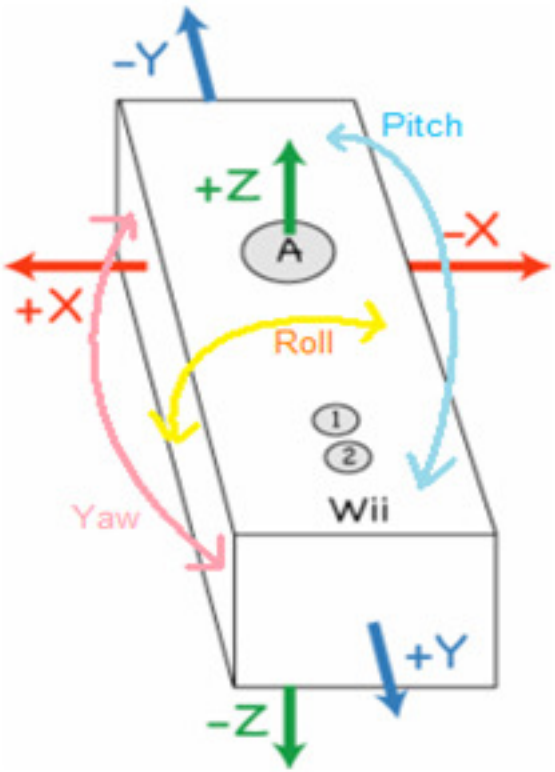
- Yaw,Pitch and Roll

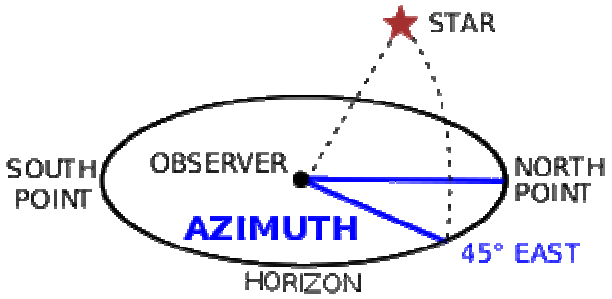




Sensor

- Azimuth,Pitch and Roll





Sensor

- Device Orientation
  - Orientation Sensor directly – Legacy
  - Accelerometers + Magnetic field
- According to Android Doc
  - SLOW…
  - But increased accuracy, ability to modify

Note: It is preferable to use `getRotationMatrix()` in conjunction with `remapCoordinateSystem()` and `getOrientation()` to compute these values; while it may be more expensive, it is usually more accurate.

Sensor - Legacy

```
   public static volatile float direction = (float) 0;
   public static volatile float inclination;
   public static volatile float rollingZ = (float)0;


   public static volatile float kFilteringFactor =
(float)0.05;
   public static float aboveOrBelow = (float)0;


   public void onAccuracyChanged(Sensor arg0, int
arg1){}


   public void onSensorChanged(SensorEvent evt)
   {
      float vals[] = evt.values;


      if(evt.sensor.getType() ==
Sensor.TYPE_ORIENTATION)
      {
         float rawDirection = vals[0];


         direction =(float) ((rawDirection *
kFilteringFactor) +
            (direction * (1.0 - kFilteringFactor)));
```

```
inclination =
         (float) ((vals[2] * kFilteringFactor) +
         (inclination * (1.0 - kFilteringFactor)));

if(aboveOrBelow > 0)
          inclination = inclination * - 1;


       if(evt.sensor.getType() ==
Sensor.TYPE_ACCELEROMETER)
       {
          aboveOrBelow =
            (float) ((vals[2] * kFilteringFactor) +
            (aboveOrBelow * (1.0 -
kFilteringFactor)));
       }
    }
  }
```

Sensor - conjunction

```
float[] values = new float[3];
float[] R = new float[9];

SensorManager.getRotationMatrix(R,
null,accelerometerValues,magneticFieldValues);

SensorManager.getOrientation(R, values);

// Convert from radians to degrees.
values[0] = (float) Math.toDegrees(values[0]);
values[1] = (float) Math.toDegrees(values[1]);
values[2] = (float) Math.toDegrees(values[2]);
```

Sensor

- `SensorManager.getRotationMatrix(R, null, aValues, mValues);`
- `float[] outR = new float[9];`
- `SensorManager.remapCoordinateSystem(R,SensorManager.AXIS_X,SensorManager.AXIS_Z, outR);`
- `SensorManager.getOrientation(outR, values);`
- `// Convert from radians to degrees.`
- `values[0] = (float) Math.toDegrees(values[0]);`
- `values[1] = (float) Math.toDegrees(values[1]);`
- `values[2] = (float) Math.toDegrees(values[2]);`

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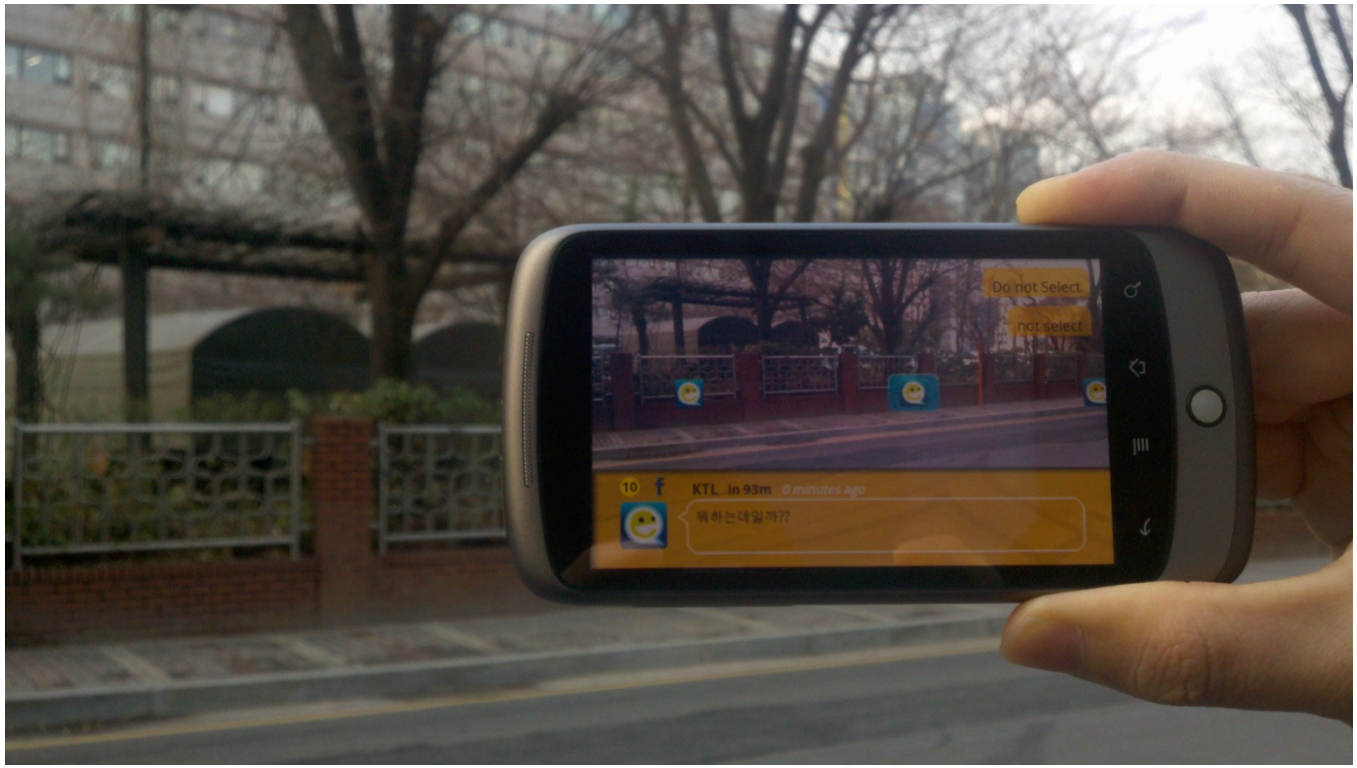
Location- based AR in Android



AR OpenSource

- ***NyARToolkit***
  - http://nyatla.jp/nyartoolkit/wiki/index.php?FrontPage.en
- ***AndAR***
  - http://code.google.com/p/andar/
- ***mixare***
  - http://www.mixare.org/

참고자료

- 안드로이드 펍 – www.androidpub.com
- Professional Android2 – Reto meier, Wrox
- Wikipedia
  - Android
  - AR
  - Wii Remote
  - Azimuth,Pitch,Roll

Thanks!!

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