Android Development Guide for ThinkGear

Features

- Develop Android applications that utilize ThinkGear technology
- Downloadable ThinkGear-enabled sample Android project with full sample code

Introduction

Thanks to the availability of the MindWave Mobile, developers can now create Android applications that can sense users’ brainwaves. This development guide will walk you through the process of creating a MindWave-capable Android application.

This guide is written for programmers who are familiar with Android development on Eclipse. More information on how to develop on Android can be found at http://developer.android.com.

SDK Bugs and Issues

The current iteration of the SDK has the following limitations:

- Only one ThinkGear compatible device may be paired with Android device.

If you encounter any bugs or issues, please visit http://support.neurosky.com, or contact support@neurosky.com.

Supported Hardware

The ThinkGear Android API supports the following hardware:

- MindSet
- MindWave Mobile
- ThinkCap 1.0
- TGAP DS SDK
- BMD100
- MindBand
- BrainAthlete
Section 5 – Using the ThinkGear API

MindWave Mobile

The MindWave Mobile utilizes Bluetooth to connect to an Android device.

Usage

1. Open the Settings app on the Android device
2. Navigate to **Wireless and network** and enable Bluetooth if not already enabled
3. Go to **Bluetooth settings**
4. Power on the MindWave Mobile
5. **MindWave Mobile** will show up in the list of devices
6. Touch **MindWave Mobile** and pairing will complete automatically
   (a) If prompted for a passkey, enter ‘0000’

**Notes**: Consult the MindWave Mobile User guide for pairing details.

Broadcast data

Data is sent from the MindWave Mobile with the following information:

- Poor signal value (1Hz)
- eSense Attention (1Hz)
- eSense Meditation (1Hz)
- EEG power bands (1Hz)
- Raw EEG data (512Hz)
- Blink (When a blink is detected)

Using the ThinkGear API

For most applications, using the ThinkGear Android API is recommended. It reduces the complexity of managing ThinkGear accessory connections and handles parsing of the data stream from these ThinkGear accessories. To make a brainwave-sensing application, all you need to do is to import a library, add the requisite setup and teardown functions, and create a handler object to which accessory event notifications will be dispatched.

Some limitations of the ThinkGear Android API include:

- Can only communicate with one attached ThinkGear-enabled accessory

The Android API Reference contains descriptions of the classes and protocols available in the ThinkGear Android API.

The ThinkGear Android SDK also includes the HelloEEG sample project (contained in src/), which is a simple Android application that displays the data coming from a MindWave Mobile headset.
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Configuring Your Environment

1. Add the ThinkGear.jar file to your project in the lib folder. If the lib folder does not exist, create it. Then right-click on ThinkGear.jar in the package explorer inspector and select Build Path > Add to build path.

2. Then import the following classes into your application activity:

```java
import com.neurosky.thinkgear.TGData;
import com.neurosky.thinkgear.TGDevice;
import com.android.bluetooth.BluetoothAdapter;
import com.android.bluetooth.BluetoothDevice;
import com.android.util.Log;
```

In order for your application to access the Bluetooth API’s, your application must declare the Bluetooth permission. Declare the Bluetooth permission in your application manifest file.

```xml
<manifest ...
   <uses-permission android:name="android.permission.BLUETOOTH" />
   ...
</manifest>
```

Setting Up the TGDevice

Declare a TGDevice and a BluetoothAdapter instance in your activity class

```java
public class HelloEGGActivity extends Activity {
   //...
   TGDevice tgDevice;
   BluetoothAdapter btAdapter;
   //...

   Initialize tgDevice and btAdapter in the onCreate() method

   public void onCreate(Bundle savedInstanceState) {
      //...
      btAdapter = BluetoothAdapter.getDefaultAdapter();
      if(btAdapter != null) {
         tgDevice = new TGDevice(btAdapter, handler);
      }
      //...
   }
```

Handling Data Receipt

The TGDevice will communicate with the application through messages send to a handler function. Add the following code to your application class:

```java
private final Handler handler = new Handler() {
   @Override
   public void handleMessage(Message msg) {
      switch (msg.what) {
      case TGDevice.MSG_STATE_CHANGE:
         switch (msg.arg1) {
            case TGDevice.STATE_IDLE:
               break;
         }
      }
   }
```

Configuring Your Environment

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```java
    case TGDevice.STATE_CONNECTING:
        break;
    case TGDevice.STATE_CONNECTED:
        device.start();
        break;
    case TGDevice.STATE_DISCONNECTED:
        break;
    case TGDevice.STATE_NOT_FOUND:
        break;
    case TGDevice.STATE_NOT_PAIRS:
        default:
            break;
    }
    break;
    case TGDevice.POOR_SIGNAL:
        Log.v("HelloEGG", "PoorSignal: " + msg.arg1);
    case TGDevice.MSG_ATTENTION
        Log.v("HelloEGG", "Attention: " + msg.arg1);
        break;
    case TGDevice.MSG_RAW_DATA:
        int rawValue = msg.arg1;
        break;
    case TGDevice.MSG_EEG_POWER:
        TSEGPower ep = (TSEGPower)msg.arg1;
        Log.v("HelloEGG", "Delta: " + ep.delta);
        default:
            break;
    }
    }
```

The following table details each message type:
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<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSG_STATE_CHANGE</td>
<td>The state of the TGDevice has changed</td>
<td>STATE messages stored in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_POOR_SIGNAL</td>
<td>Signal quality status data</td>
<td>The poor signal status from the headset is stored in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_ATTENTION</td>
<td>Attention level data</td>
<td>The attention level is stored in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_MEDITATION</td>
<td>Meditation level data</td>
<td>The meditation level is stored in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_BLINK</td>
<td>Strength of detected blink</td>
<td>The blink strength is stored in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_RAW_DATA</td>
<td>Raw EEG data</td>
<td>The raw EEG value is stored as an int in the arg1 field of the message object</td>
</tr>
<tr>
<td>MSG_EEG_POWER</td>
<td>EEG powers data</td>
<td>The EEG powers are passed in as TGEegPower object in the obj field of the message object</td>
</tr>
<tr>
<td>MSG_RAW_MULTI</td>
<td>Multi-channel raw data</td>
<td>The multi-channel raw data is passed in as a TGRawMulti object in the obj field of the message object</td>
</tr>
<tr>
<td>MSG_HEART_RATE</td>
<td>Heart rate data</td>
<td>The heart rate data is passed in as an int in the arg1 field of the message object</td>
</tr>
</tbody>
</table>

**TGDevice States**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE_IDLE</td>
<td>Initial state of the TGDevice. Not connected to a headset</td>
</tr>
<tr>
<td>STATE_CONNECTING</td>
<td>Attempting a connection to the headset</td>
</tr>
<tr>
<td>STATE_CONNECTED</td>
<td>A valid device hand been found and data is being received</td>
</tr>
<tr>
<td>STATE_DISCONNECTED</td>
<td>The connection to the device is lost</td>
</tr>
<tr>
<td>STATE_NOT_FOUND</td>
<td>Could not connect to headset</td>
</tr>
<tr>
<td>STATE_NOT_PAIRED</td>
<td>A valid headset could not be found</td>
</tr>
</tbody>
</table>

**Starting the Data Stream**

Connect to a headset by calling the tgDevice's connect method as follows

```javascript
tgDevice.connect(true);
```

The tgDevice will search through the paired Bluetooth devices and connect to the first known ThinkGear compatible device. Setting the parameter to true or false will enable or disable raw EEG output.
Section 6 — References

After successfully connecting to a ThinkGear device, the tgDevice will send a "BT_STATE_CONNECTED" message. To start receiving data, call the tgDevice's start method.

tgDevice.start();

Close the connection by calling the close method

tgDevice.close();

Further Considerations

- The application should not expect there to be a ThinkGear accessory attached to the Android-based device on startup. As such, it should handle that case accordingly (e.g. by displaying a static splash screen prompting the user to connect a ThinkGear accessory).

References

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Community Forum: http://developer.neurosyrn.com/forum

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