Handheld Application Development

Lec 7: Saving data (Database)

Ekarat Rattagan, PhD

Outline

- Saving Key-Value Sets
- Saving Files
- Saving Data in SQL Databases

SQL Databases

- Ideal for repeating or structured data, such as contact information.

- SQLite
  - A relational DBMS contained in a C programming library.
  - Embedded into the end program.
  - Android.database.sqlite

DBMS

- Schema: a formal declaration of how the DB is organized, such as table, relation, etc.

Table name: Contacts

Field	Type	Key
id	INT	PRIMARY
name	TEXT	
phone_number	TEXT	

Example 1 (Contact DB).

- Writing Contact.java Class

```
public class Contact
{
    public int _id;
    public String _name;
    public String _phone_number;

    public Contact(){}

    public Contact(String name, String _phone_number)
    {
        this._name = name;
        this._phone_number = _phone_number;
    }

    public Contact(int id, String name, String _phone_number)
    {
        this._id = id;
        this._name = name;
        this._phone_number = _phone_number;
    }
}
```

Example 1.

- Use SQLiteOpenHelper class to handle the DB operations

```
import android.content.Context;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteOpenHelper;
import android.provider.ContactsContract;
public class DatabaseHandler extends SQLiteOpenHelper {

    private static final String DATABASE_NAME = "contactsManager";
    private static final int DATABASE_VERSION = 1;
    private static final String TABLE_CONTACTS = "contacts";
    // Contacts Table Columns names
    private static final String KEY_ID = "id";
    private static final String KEY_NAME = "name";
    private static final String KEY_PH_NO = "phone_number";
     private static final String KEY_LINE_ID = "line_id";
    SQLiteDatabase db;

    public DatabaseHandler(Context context){
        super(context,DATABASE_NAME, null, DATABASE_VERSION);
         db = getWritableDatabase();
    }
```

Example 1.

- Use SQLiteOpenHelper class to handle the DB operations

```
    // Creating Tables
    @Override
    public void onCreate(SQLiteDatabase db) {
        String CREATE_CONTACTS_TABLE = "CREATE TABLE " + TABLE_CONTACTS + "("
                + KEY_ID + " INTEGER PRIMARY KEY,"
                + KEY_NAME + " TEXT NOT NULL UNIQUE,"
                + KEY_PH_NO + " TEXT NOT NULL UNIQUE" + ")";
        db.execSQL(CREATE_CONTACTS_TABLE);
    }

    private static final String DATABASE_ALTER_CONTACT_1 = "ALTER TABLE "
        + TABLE_CONTACTS + " ADD COLUMN " + KEY_LINE_ID + " string;";

    // Upgrading database
    @Override
    public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
        if (oldVersion < 2) {
            db.execSQL(DATABASE_ALTER_CONTACT_1);
        }
    }
}
```

The implementation should use this method to drop tables, add tables, or do anything else it needs to upgrade to the new schema version.

```
//drop tables
public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
    // Drop older and create a new table
    db.execSQL("DROP TABLE IF EXISTS " + TABLE_CONTACTS);
    onCreate(db);
}
```

CRUD operations

- Use SQLiteOpenHelper class to handle the DB operations

```
// Adding new contact
public void addContact(Contact contact) {}

// Getting single contact
public Contact getContact(int id) {}

// Getting All Contacts
public List<Contact> getAllContacts() {}

// Updating single contact
public int updateContact(Contact contact) {}

// Deleting single contact
public void deleteContact(Contact contact) {}
```

CRUD (Insert)

- Long insert (String table, String nullColumnHack, ContentValues values)

```
// Adding new contact
public void addContact(Contact contact)
{

    SQLiteDatabase db = this.getWritableDatabase();

    ContentValues values = new ContentValues();
    values.put(KEY_NAME, contact._name);
    values.put(KEY_PH_NO,contact._phone_number);

    //return: the row ID of the newly inserted row, or -1 if an error occurred
    long insert = db.insert(TABLE_CONTACTS, null, values);

    db.close();

}
```

Sometimes you want to insert an empty row, in that case ContentValues have no content value, and you should use nullColumnHack.

For example, you want to insert an empty row into a table student(id, name), which id is auto generated and name is null. You could invoke like this:

ContentValues cv = new ContentValues();
db.insert("student", "name", cv);

****

SQL doesn't allow inserting a completely empty row without naming at least one column name. If your provided values is empty, no column names are known and an empty row can't be inserted.

CRUD (Select)

- Select (query)

```
// Getting single contact
public Contact getContact(int id) {

    SQLiteDatabase db = this.getReadableDatabase();

    Cursor cursor = db.query(
         TABLE_CONTACTS
            , new String[]{KEY_ID, KEY_NAME, KEY_PH_NO}
            , KEY_ID + "=?"
            , new String[]{String.valueOf(id)}
            , null
            , null
            , null
            , null);

    if (cursor != null)
        cursor.moveToFirst();

    Contact contact = new Contact(Integer.parseInt(cursor.getString(0)),
            cursor.getString(1), cursor.getString(2));
    // return contact
    return contact;
}
```

```
Cursor query (

    String table,
    String [] columns,
    String selection,
    String [] selectionArgs,
    String groupBy,
    String having,
    String orderBy,
    String limit

)
```

Can we use the column names instead of index number?

Answer:
we can use
“cursor.getString(cursor.getColumnIndex(“COLUMN_NAME”));

CRUD (Select)

Parameters	
`table`	`String`: The table name to compile the query against.
`columns`	`String`: A list of which columns to return. Passing null will return all columns, which is discouraged to prevent reading data from storage that isn't going to be used.
`selection`	`String`: A filter declaring which rows to return, formatted as an SQL WHERE clause (excluding the WHERE itself). Passing null will return all rows for the given table.
`selectionArgs`	`String`: You may include ?s in selection, which will be replaced by the values from selectionArgs, in order that they appear in the selection. The values will be bound as Strings.
`groupBy`	`String`: A filter declaring how to group rows, formatted as an SQL GROUP BY clause (excluding the GROUP BY itself). Passing null will cause the rows to not be grouped.
`having`	`String`: A filter declare which row groups to include in the cursor, if row grouping is being used, formatted as an SQL HAVING clause (excluding the HAVING itself). Passing null will cause all row groups to be included, and is required when row grouping is not being used.
`orderBy`	`String`: How to order the rows, formatted as an SQL ORDER BY clause (excluding the ORDER BY itself). Passing null will use the default sort order, which may be unordered.
`limit`	`String`: Limits the number of rows returned by the query, formatted as LIMIT clause. Passing null denotes no LIMIT clause.

Returns	
`Cursor`	A `Cursor` object, which is positioned before the first entry. Note that `Cursor`s are not synchronized, see the documentation for more details.

CRUD (Select)

```
public List<Contact> getAllContacts()
{
    List<Contact> contactList = new ArrayList<Contact>();
    String selectQuery = "SELECT  * FROM " + TABLE_CONTACTS;

    SQLiteDatabase db = this.getWritableDatabase();
    Cursor cursor = db.rawQuery(selectQuery, null);

    // looping through all rows and adding to list
    if (cursor.moveToFirst()) {
        do {
            Contact contact = new Contact();
            contact._id = Integer.parseInt(cursor.getString(0));
            contact._name = cursor.getString(1);
            contact._phone_number = cursor.getString(2);
             contactList.add(contact);
        } while (cursor.moveToNext());
    }

    // return contact list
    return contactList;
}
```

CRUD (Update)

```
// Updating single contact
public int updateContact(Contact contact)
{
    SQLiteDatabase db = this.getWritableDatabase();
    ContentValues values = new ContentValues();
    values.put(KEY_NAME, contact._name);
    values.put(KEY_PH_NO, contact._phone_number);

    // updating row
    return db.update(                    //return the number of rows affected
       TABLE_CONTACTS,
       values,
       KEY_ID + " = ?",
          new String[] { String.valueOf(contact._id) }
       );
}
```

CRUD (Delete)

```
// Deleting single contact
public void deleteContact(Contact contact)
{
    SQLiteDatabase db = this.getWritableDatabase();

    db.delete(
       TABLE_CONTACTS,
       KEY_ID + " = ?",
              new String[] { String.valueOf(contact._id) }
              );

    db.close();
}
```

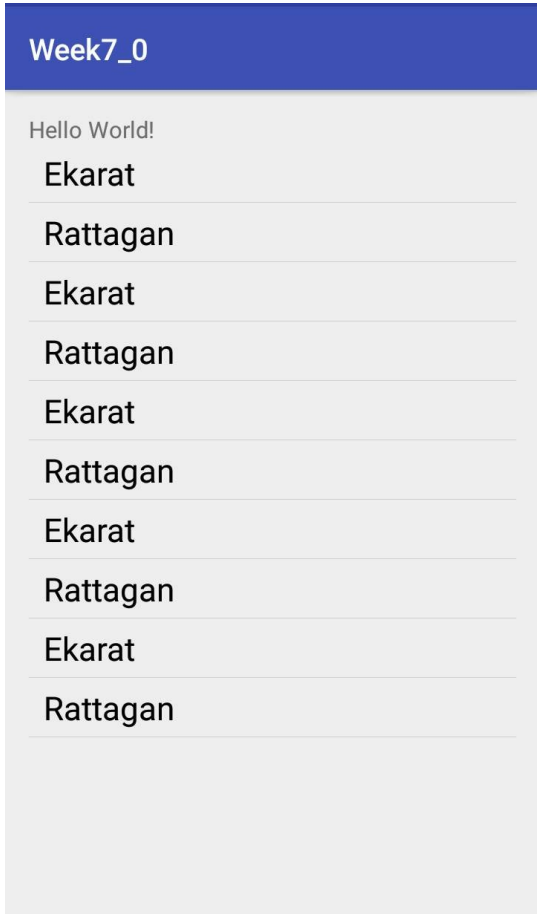
```
// Passing null will delete all rows.
// the number of rows affected if a whereClause is passed in, 0 otherwise.
// To remove all rows and get a count, pass "1" as the whereClause
```

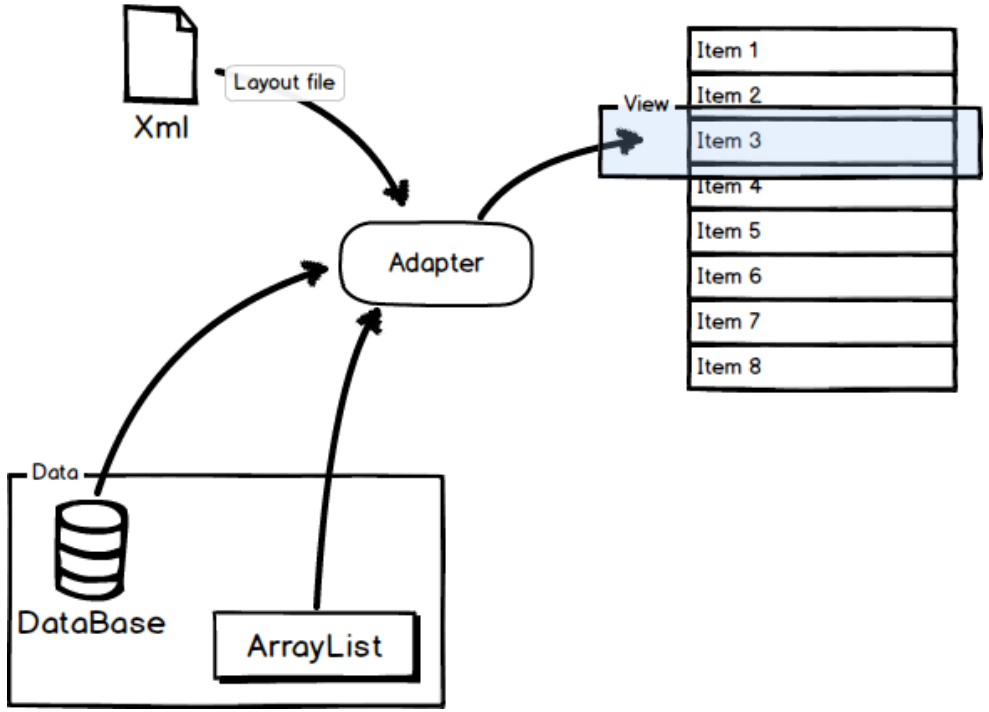
Example: MainActivity.java

```
@Override
protected void onCreate(Bundle savedInstanceState) {

    super.onCreate(savedInstanceState);

    setContentView(R.layout.activity_main);

    DatabaseHandler db = new DatabaseHandler(this);

    db.addContact(new Contact("Ekarat","0899999999"));

    List<Contact> contacts = db.getAllContacts();
    Toast.makeText(getActivity( ), contacts.get(0)._name, Toast.LENGTH_LONG).show( );
}
```

ListView (Obsolete) Replaced by RecyclerView (Tutorial link)

Show the results of DB in ListView





http://neohsu.github.io/images/SVG/0-talk-about-listview-and-adapter-on-android.png

ListView

1. Create a ListView in activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
< LinearLayout    xmlns:android=http://schemas.android.com/apk/res/android
    …… >

    <ListView
        android:layout_marginTop="20dp"
        android:id="@+id/listView1"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:layout_alignParentBottom="true"
        android:layout_alignParentStart="true" />

</ LinearLayout   >
```

2. Create a new layout file named it as “listview_row.xml”

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="horizontal"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <TextView
        android:id="@+id/textView1"
        android:layout_width="182dp"
        android:layout_height="wrap_content"
        android:text="Name"
        android:textColor="#000000"
        android:textSize="20sp" />

</LinearLayout>
```

ListView

2. Create a CustomAdapter class (BaseAdapter)

```
import android.content.Context;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.BaseAdapter;
import android.widget.TextView;

public class CustomAdapter extends BaseAdapter {

    Context mContext;
    String[] strName;

    public CustomAdapter(Context context, String[] strName){
        mContext = context;
        this.strName = strName;

    }
```

Is it good to design a constructor by using only String[ ] strName?

Would it be another better choice?

ListView

2. Create a CustomAdapter class

```
@Override
public int getCount() {
    return strName.length;
}

@Override
public Object getItem(int i) {
    return null;
}

@Override
public long getItemId(int i) {
    return 0;
}
```

ListView

2. Create a CustomAdapter class

```
@Override
public View getView(int position, View view, ViewGroup parent)
{
    LayoutInflater mInflater = (LayoutInflater)mContext.getSystemService
    (Context.LAYOUT_INFLATER_SERVICE);

    if(view == null)
        view = mInflater.inflate(R.layout.listview_row, parent, false);

    TextView textView = (TextView)view.findViewById(R.id.textView1);
    textView.setText(strName[position]);

    return view;
}
}
```

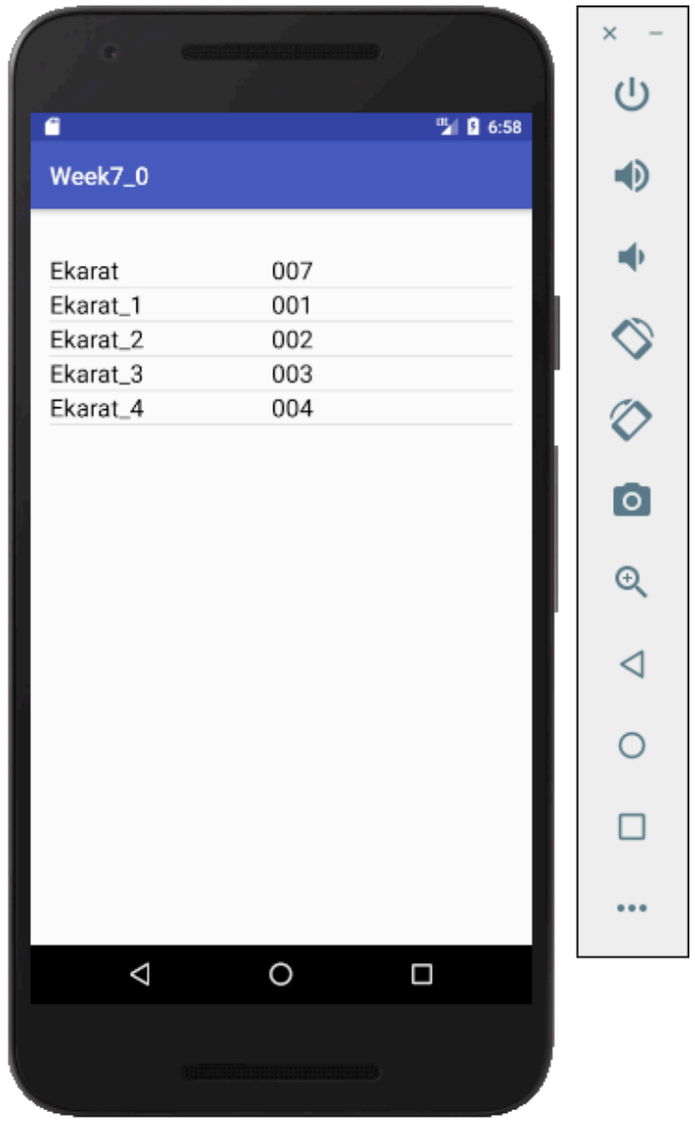
ListView

3. Inside MainActivity.java

```
db.addContact(new Contact("Ekarat","0899999999"));
db.addContact(new Contact("Rattagan","011111111"));

List<Contact> contacts = db.getAllContacts();

String[] datas = new String[contacts.size()];
for(int i=0; i<datas.length; i++)
{
    datas[i]= contacts.get(i)._name;
}

CustomAdapter adapter = new CustomAdapter(getApplicationContext(),datas);
ListView listView = (ListView)findViewById(R.id.listView1);
listView.setAdapter(adapter);
```

Exercise

- Insert Name and phone number as shown on the right-hand-side figure.



Resources

http://www.sqlitetutorial.net/
https://developer.android.com/training/data-storage/room/index.html