ITW202: Mobile Application

Unit IV: Developing for Android

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SQLite Database

Features of SQLite

Open source database and supports standard relational database features

Very small in size

Android has built-in SQLite implementation

- No additional dependencies
- android.database.sqlite

Use SQLiteOpenHelper and SQLite database classes

Available storage classes

Storage Classes:

- integer
- text
- real
- null
- blob

When SQLite?

Shared Preference

- Key-value form of storage in XML files
- For small and simple data like username, password
- Stores only primitive type data
- Key required to retrieve the data

File System

- Storing files is easy and efficient
- No ACID

SQLite

- For complex and structured data like contact information
- Easy to retrieve data using queries
- ACID properties

ACID

Mobile Application

A — **Atomicity**
Execute all or nothing

C — **Consistency**
Maintain the consistency of the database before and after transaction

I — **Isolation**
Modification in midway of transaction is not visible to anyone

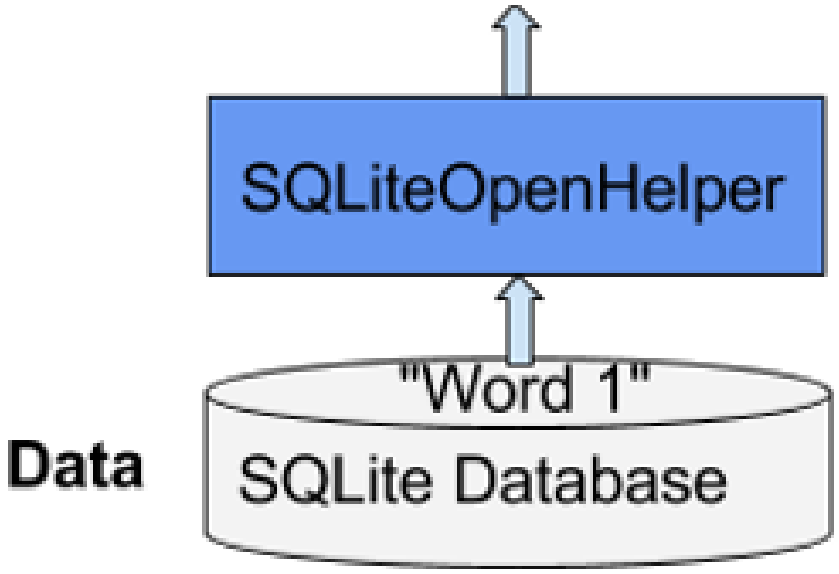
D — **Durability**
Once done, it is persistent

SQL and SQLite

SQL is a query language

SQLite is a relational database management system, which uses SQL

Components of SQLite database



SQLiteOpenHelper

- SQLite database represented as an SQLiteDatabase object and all interactions with database are done through SQLiteOpenHelper
- Executes your requests
- Manages your database
- Separates data and interaction from app

Cursor

- Provides read-write access to result set
- Provides row-by-row access
- Initial cursor position is -1
- To read the data, use cursor functions to move it to desired row
- SQLiteDatabase always presents results as Cursor

Cursor Functions

- moveToFirst() - Move the cursor to the first row
- moveToLast() - Move the cursor to the last row
- moveToNext() - Move the cursor to the next row
- moveToPosition(int position) - Move the cursor to an absolute position
- moveToPrevious() - Move the cursor to the previous row

Accessing Cursor Results

- Fetch column positions - getColumnIndex()
- Fetch column data - getString() or getLong()
- Close cursor after use to release resources - close()

Processing Cursors

```
// Store results of query in a cursor
Cursor cursor = db.rawQuery(...);
try {
    while (cursor.moveToNext()) {
        // Do something with data
    }
} finally {
    cursor.close();
}
```

Content Values

- Represents one table row
- Stores data as key-value pairs
- Key is the name of the column
- Value is the value for the field
- Used to pass row data between methods

Content Values

```
ContentValues values = new ContentValues();

// Inserts one row.
// Use a loop to insert multiple rows.
values.put(KEY_WORD, "Android");
values.put(KEY_DEFINITION, "Mobile operating system.");

db.insert(WORD_LIST_TABLE, null, values);
```

Implementing SQLite

You always need to ...

1. Create data model
2. Subclass SQLiteOpenHelper
   - Create constants for tables
   - onCreate()—create SQLiteDatabase with tables
   - onUpgrade(), and optional methods
   - Implement query(), insert(), delete(), update(), count()
3. In MainActivity, create instance of SQLiteOpenHelper
4. Call methods of SQLiteOpenHelper to work with database

Data model

- Class with getters and setters
- One "item" of data (for database, one record or one row)

```
public class WordItem {
    private int mId;
    private String mWord;
    private String mDefinition;
   ...
}
```

Subclass SQLiteOpenHelper

```
public class WordListOpenHelper extends SQLiteOpenHelper {

    public WordListOpenHelper(Context context) {
        super(context, DATABASE_NAME, null, DATABASE_VERSION);
        Log.d(TAG, "Construct WordListOpenHelper");
    }
}
```

Declare constants for tables

```
private static final int DATABASE_VERSION = 1;
// Has to be 1 first time or app will crash.
private static final String DATABASE_NAME = "wordlist";
private static final String WORD_LIST_TABLE = "word_entries";

// Column names...
public static final String KEY_ID = "_id";
public static final String KEY_WORD = "word";

// ... and a string array of columns.
private static final String[] COLUMNS = {KEY_ID, KEY_WORD};
```

Define query for creating database

- *You need a query to create the database*
- *Customarily defined as a string constant*

```
private static final String WORD_LIST_TABLE_CREATE =
            "CREATE TABLE " + WORD_LIST_TABLE + " (" +
                    KEY_ID + " INTEGER PRIMARY KEY, " +
                    // will auto-increment if no value passed
                    KEY_WORD + " TEXT );";
```

onCreate()

```
@Override
public void onCreate(SQLiteDatabase db) { // Creates new database
  // Create the tables
  db.execSQL(WORD_LIST_TABLE_CREATE);
  // Add initial data
  ...
}
```

onUpgrade()

```java
@Override
public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
    db.execSQL("DROP TABLE IF EXISTS "+TABLE_NAME);
    onCreate(db);
}
```

Database Operations

Database operations

- query()
- insert()
- update()
- delete()

Executing queries

- implement query() method in open helper class
- query() can take and return any data type that UI needs
- Only support queries that your app needs
- Use database convenience methods for insert, delete, and update

Database methods for executing queries

- SQLiteDatabase.rawQuery(): Use when data is under your control and supplied only by your app
- SQLiteDatabase.query(): Use for all other queries

SQLiteDatabase.rawQuery() format

```
rawQuery(String sql, String[] selectionArgs)
```

- ***First parameter is SQLite query string***
- ***Second parameter contains the arguments***

SQLiteDatabase.Query() format

```
query(
    TABLE_NAME,         // Table to query
    projection,         // Array of columns to return
    selection,          // Columns for the WHERE clause
    selectionArgs,      // Values for the WHERE clause
    null,               // Don't group the rows
    null,               // Don't filter by row groups
    sortOrder           // Sort order
)
```

Insert, Delete, Update, Count

insert() format

```
long insert(String table, String nullColumnHack,
            ContentValues values)
```

- ***First argument is the table name.***
- ***Second argument is a*** `String nullColumnHack`.
  - ***Workaround that allows you to insert empty rows***
  - ***Use*** `null`
- ***Third argument must be a ContentValues with values for the row***

delete() format

```
int delete (String table,
            String whereClause, String[] whereArgs)
```

- First argument is table name
- Second argument is WHERE clause
- Third argument are arguments to WHERE clause

update() format

```
int update(String table, ContentValues values,
        String whereClause, String[] whereArgs)
```

- ***First argument is table name***
- ***Second argument must be ContentValues with new values for the row***
- ***Third argument is WHERE clause***
- ***Fourth argument are the arguments to the WHERE clause***

Always!

- Always put database operations in try-catch blocks
- Always validate user input and SQL queries

Instantiate OpenHelper

Create an instance of your OpenHelper

- In MainActivity onCreate()
  mDB = new WordListOpenHelper(this);

THANK YOU