I. Climbing Mountain App Report

The GitHub Link: https://github.com/nminh2209/Mobileappp/tree/main/Assignment%201

A. Abstract

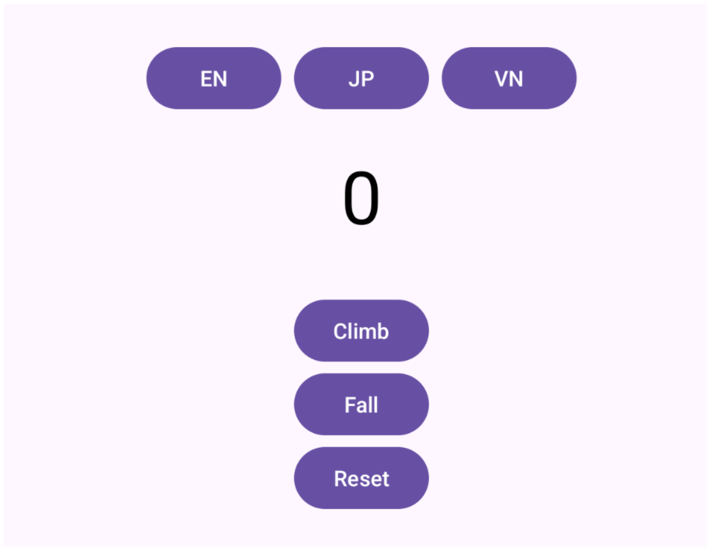
The "Climbing Mountain App" is an Android application that simulates a climbing experience by tracking user progress, managing falls, and supporting multilingual functionality. This report provides a detailed analysis of the application's features, technical implementation, UI/UX considerations, and potential improvements. Additionally, it aligns the project with key Unit Learning Outcomes (ULOs) to demonstrate its educational and technical relevance.

B. Introduction

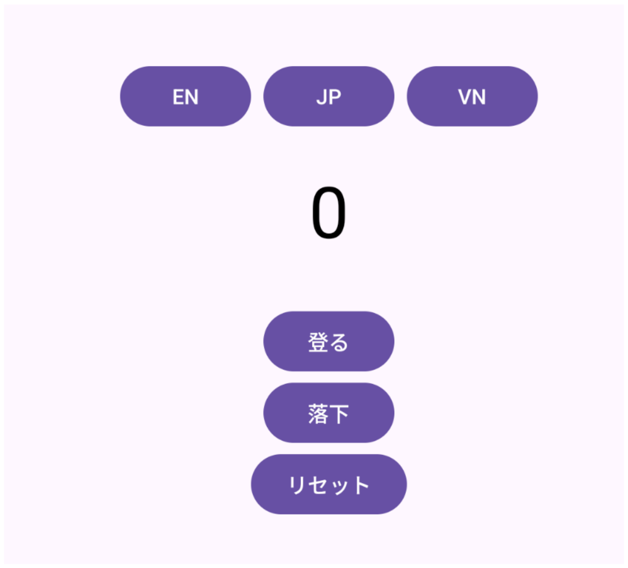
The development of mobile applications presents unique challenges compared to traditional personal computing or web-based environments. Factors such as screen size, memory constraints, and processor limitations significantly influence design choices. The "Climbing Mountain App" is designed to optimize user interaction while considering these hardware-imposed restrictions. This report examines the application's design, implementation, and alignment with relevant Unit Learning Outcomes.

C. Features

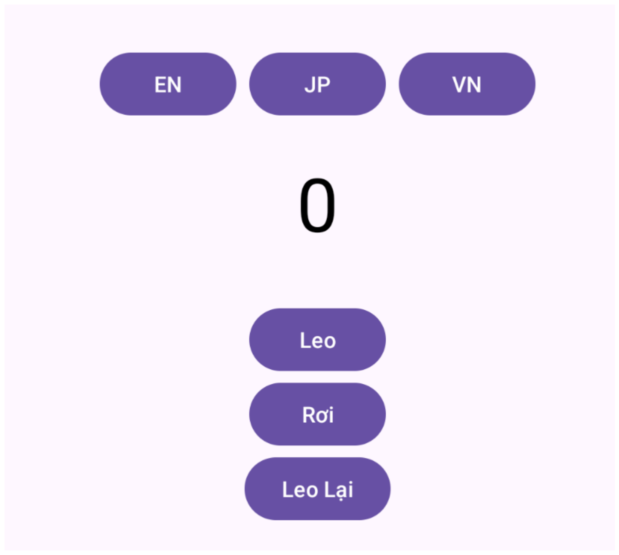
1) Screenshots of The Program:



English Version



Japanese Version



Vietnamese Version

2) Climbing Mechanism

- Users progress incrementally up to a maximum of nine holds.
- Score increments are based on hold levels:
    - Holds 1-3: +1 point per hold (Blue zone)
    - Holds 4-6: +2 points per hold (Green zone)
    - Holds 7-9: +3 points per hold (Red zone)
- Score display color changes dynamically to indicate the zone.

3) Falling Mechanism

- If a user falls before reaching hold 9:
    - 3 points are deducted.
    - The fall is recorded, preventing further climbing.
- Falling is not an option upon reaching hold 9.

4) Reset Functionality

- Resets climbing progress and score to zero.
- Allows users to restart the climb.

5) Localization Support

- Supports English, Japanese, and Vietnamese.
- Language selection updates the UI dynamically.

D. Technical Implementation

1) The Whole Program

```
package com.example.climbingmoutainapp

import android.content.res.Configuration

import android.graphics.Color
import android.os.Bundle
import android.util.Log
import android.view.View
import android.widget.Button
import android.widget.TextView
import androidx.appcompat.app.AppCompatActivity
import java.util.Locale


class MainActivity : AppCompatActivity() {
    private var currentScore = 0
    private var currentHold = 0
```

```kotlin
    private var hasFallen = false
    private lateinit var scoreText: TextView
    private lateinit var climbButton: Button
    private lateinit var fallButton: Button
    private lateinit var resetButton: Button

    companion object {
        private const val STATE_SCORE = "currentScore"
        private const val STATE_HOLD = "currentHold"
        private const val STATE_FALLEN = "hasFallen"
        private const val TAG = "ClimbingScoreApp"
    }

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);


        val langEnglish = findViewById<Button>(R.id.langEnglish)
        val langJapanese = findViewById<Button>(R.id.langJapanese)
        val langVietnamese = findViewById<Button>(R.id.langVietnamese)

        langEnglish.setOnClickListener { v: View? -> setLocale("en") }
        langJapanese.setOnClickListener { v: View? -> setLocale("ja") }
        langVietnamese.setOnClickListener { v: View? -> setLocale("vi") }

        initializeViews()
        restoreState(savedInstanceState)
        setupButtons()
        updateScoreDisplay()

        Log.d(TAG, "App initialized with score: $currentScore")
    }

    private fun setLocale(languageCode: String) {
        val locale = Locale(languageCode)
        Locale.setDefault(locale)
        val resources = resources
        val config: Configuration = resources.configuration
        config.setLocale(locale)
        resources.updateConfiguration(config, resources.displayMetrics)
        recreate()
    }


    private fun initializeViews() {
        scoreText = findViewById(R.id.scoreText)
        climbButton = findViewById(R.id.climbButton)
        fallButton = findViewById(R.id.fallButton)
        resetButton = findViewById(R.id.resetButton)
    }

    private fun setupButtons() {
        climbButton.setOnClickListener {
            if (!hasFallen && currentHold < 9) {
                currentHold++
                currentScore += when (currentHold) {
                    in 1..3 -> 1  // Blue zone
                    in 4..6 -> 2  // Green zone
                    in 7..9 -> 3  // Red zone
                    else -> 0
                }
                Log.d(TAG, "Climbed to hold $currentHold, score:
$currentScore")
                updateScoreDisplay()
            }
        }

        fallButton.setOnClickListener {
            if (currentHold > 0 && currentHold < 9 && !hasFallen) {
                currentScore = maxOf(0, currentScore - 3)
                hasFallen = true
                Log.d(TAG, "Fall recorded, new score: $currentScore")
                updateScoreDisplay()
            }
        }

        resetButton.setOnClickListener {
            currentScore = 0
            currentHold = 0
            hasFallen = false
            Log.d(TAG, "Score reset")
            updateScoreDisplay()
        }
    }

    private fun updateScoreDisplay() {
        scoreText.text = currentScore.toString()
        scoreText.setTextColor(when (currentHold) {
            in 1..3 -> Color.BLUE
            in 4..6 -> Color.GREEN
            in 7..9 -> Color.RED
            else -> Color.BLACK
        })
    }

    override fun onSaveInstanceState(outState: Bundle) {
        super.onSaveInstanceState(outState)
        outState.putInt(STATE_SCORE, currentScore)
        outState.putInt(STATE_HOLD, currentHold)
        outState.putBoolean(STATE_FALLEN, hasFallen)
        Log.d(TAG, "State saved")
    }

    private fun restoreState(savedInstanceState: Bundle?) {
        savedInstanceState?.let {
            currentScore = it.getInt(STATE_SCORE)
            currentHold = it.getInt(STATE_HOLD)
            hasFallen = it.getBoolean(STATE_FALLEN)
            Log.d(TAG, "State restored")
        }
    }
}
```

2) MainActivity Class

```
class MainActivity : AppCompatActivity() {
    private var currentScore = 0
    private var currentHold = 0
    private var hasFallen = false
    private lateinit var scoreText: TextView
    private lateinit var climbButton: Button
    private lateinit var fallButton: Button
    private lateinit var resetButton: Button
```

The `MainActivity` class extends `AppCompatActivity` and implements core functionalities, including UI interactions and state management.

3) Instance Variables

- `currentScore`: Tracks the user's score.
- `currentHold`: Tracks the hold level.
- `hasFallen`: Boolean flag to prevent additional actions after a fall.
- `scoreText`, `climbButton`, `fallButton`, `resetButton`: UI components.

4) Lifecycle Methods

- `onCreate(Bundle?)`

```
override fun onCreate(savedInstanceState: Bundle?) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);


    val langEnglish = findViewById<Button>(R.id.langEnglish)
    val langJapanese = findViewById<Button>(R.id.langJapanese)
    val langVietnamese = findViewById<Button>(R.id.langVietnamese)

    langEnglish.setOnClickListener { v: View? -> setLocale("en") }
    langJapanese.setOnClickListener { v: View? -> setLocale("ja") }
    langVietnamese.setOnClickListener { v: View? -> setLocale("vi") }

    initializeViews()
    restoreState(savedInstanceState)
    setupButtons()
    updateScoreDisplay()

    Log.d(TAG, "App initialized with score: $currentScore")
}
```

  - Initializes UI elements.
  - Restores previous state if available.
  - Configures button click listeners.
- `onSaveInstanceState(Bundle)`

```
override fun onSaveInstanceState(outState: Bundle) {
    super.onSaveInstanceState(outState)
    outState.putInt(STATE_SCORE, currentScore)
    outState.putInt(STATE_HOLD, currentHold)
    outState.putBoolean(STATE_FALLEN, hasFallen)
    Log.d(TAG, "State saved")
}
```

  - Saves the current score, hold level, and fall status to persist through configuration changes.

5) Event Handlers

- `setLocale(String)`: Dynamically updates the app language.
- `initializeViews()`: Initializes UI components.
- `setupButtons()`: Defines button actions for climbing, falling, and resetting.
- `updateScoreDisplay()`: Updates UI elements based on user progress.

6) Functionalities:

Language Settings

```kotlin
private fun setLocale(languageCode: String) {
    val locale = Locale(languageCode)
    Locale.setDefault(locale)
    val resources = resources
    val config: Configuration = resources.configuration
    config.setLocale(locale)
    resources.updateConfiguration(config, resources.displayMetrics)
    recreate()
}
```

The `setLocale` function dynamically updates the app's language by changing the locale settings and refreshing the UI.

Setup Buttons:

```kotlin
private fun setupButtons() {
    climbButton.setOnClickListener {
        if (!hasFallen && currentHold < 9) {
            currentHold++
            currentScore += when (currentHold) {
                in 1..3 -> 1  // Blue zone
                in 4..6 -> 2  // Green zone
                in 7..9 -> 3  // Red zone
                else -> 0
            }
            Log.d(TAG, "Climbed to hold $currentHold, score: $currentScore")
            updateScoreDisplay()
        }
    }

    fallButton.setOnClickListener {
        if (currentHold > 0 && currentHold < 9 && !hasFallen) {
            currentScore = maxOf(0, currentScore - 3)
            hasFallen = true
            Log.d(TAG, "Fall recorded, new score: $currentScore")
            updateScoreDisplay()
        }
    }

    resetButton.setOnClickListener {
        currentScore = 0
        currentHold = 0
        hasFallen = false
        Log.d(TAG, "Score reset")
        updateScoreDisplay()
    }
}
```

- Climb Button: Moves the player up, increases the score based on zones, and updates the UI.
- Fall Button: Deducts points, prevents further climbing, and updates the UI
- Reset Button: Resets the game, allowing a fresh start.

Handling:

```
• private fun updateScoreDisplay() {
      scoreText.text = currentScore.toString()
      scoreText.setTextColor(when (currentHold) {
          in 1..3 -> Color.BLUE
          in 4..6 -> Color.GREEN
          in 7..9 -> Color.RED
          else -> Color.BLACK
      })
  }

  override fun onSaveInstanceState(outState: Bundle) {
      super.onSaveInstanceState(outState)
      outState.putInt(STATE_SCORE, currentScore)
      outState.putInt(STATE_HOLD, currentHold)
      outState.putBoolean(STATE_FALLEN, hasFallen)
      Log.d(TAG, "State saved")
  }

  private fun restoreState(savedInstanceState: Bundle?) {
      savedInstanceState?.let {
          currentScore = it.getInt(STATE_SCORE)
          currentHold = it.getInt(STATE_HOLD)
          hasFallen = it.getBoolean(STATE_FALLEN)
          Log.d(TAG, "State restored")
      }
  }
```

- The `updateScoreDisplay`, `onSaveInstanceState`, and `restoreState` functions serve key roles in managing the app's UI and ensuring that game progress is not lost during activity lifecycle changes.
- `updateScoreDisplay()` updates the UI dynamically with the current score and zone-based color changes.
- `onSaveInstanceState()` stores the game state in a `Bundle` before the activity is paused or destroyed.
- `restoreState()` retrieves the stored data and reinstates the previous game state.

E. Unit Testing

```kotlin
package com.example.climbingmoutainapp

import android.widget.TextView
import android.widget.Button
import org.junit.Test
import org.junit.runner.RunWith
import org.robolectric.Robolectric
import org.robolectric.RobolectricTestRunner
import org.robolectric.annotation.Config
import org.junit.Assert.*

@RunWith(RobolectricTestRunner::class)
@Config(sdk = [33])
class MainActivityTest {
    @Test
    fun testScoring() {
        val activity = Robolectric.buildActivity(MainActivity::class.java)
            .create()
            .resume()
            .get()

        val scoreText = activity.findViewById<TextView>(R.id.scoreText)
        val climbButton = activity.findViewById<Button>(R.id.climbButton)
        val fallButton = activity.findViewById<Button>(R.id.fallButton)

        // Log initial state
        println("Initial score: ${scoreText.text}")
        assertNotNull("Score TextView should not be null", scoreText)
        assertNotNull("Climb Button should not be null", climbButton)
        assertNotNull("Fall Button should not be null", fallButton)

        // Test initial state
        assertEquals("Initial score should be 0", "0",
scoreText.text.toString())

        // Test climbing
        climbButton.performClick()
        println("Score after climb: ${scoreText.text}")
        assertEquals("Score should be 1 after climbing", "1",
scoreText.text.toString())

        // Test falling
        fallButton.performClick()
        println("Score after fall: ${scoreText.text}")
        assertEquals("Score should be 0 after falling", "0",
scoreText.text.toString())
    }
}
```

The application includes a unit test to ensure the proper functionality of the climbing and falling mechanisms.

F. Debugging and Logging

- Utilizes `Log.d(TAG, message)` to log key events such as climbing progress, falls, and resets.
- Enhances debugging efficiency by tracking user interactions.

G. Layout File:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:gravity="center"
    android:padding="16dp">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:gravity="center"
        android:layout_marginBottom="16dp">

        <Button
            android:id="@+id/langEnglish"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="EN"
            android:layout_margin="4dp"/>

        <Button
            android:id="@+id/langJapanese"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="JP"
            android:layout_margin="4dp"/>

        <Button
            android:id="@+id/langVietnamese"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="VN"
            android:layout_margin="4dp"/>
    </LinearLayout>

    <TextView
        android:id="@+id/scoreText"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:textSize="48sp"
        android:text="0"
        android:layout_marginBottom="32dp"/>

    <Button
        android:id="@+id/climbButton"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/climb"/>

    <Button
        android:id="@+id/fallButton"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/fall"/>

    <Button
        android:id="@+id/resetButton"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/reset"/>
</LinearLayout>
```

H. UI/UX Considerations

- Color-coded scoring zones for intuitive visual feedback.
- Interactive buttons enhance user engagement.
- Language selection improves accessibility.
- Score persistence across device rotations.

I. Potential Improvements

1. **Persistent Storage**: Use SharedPreferences or a database to save user progress across app restarts.
2. **Animation Effects**: Implement smooth UI animations for climbing and falling actions.
3. **Leaderboard System**: Introduce a scoring system with global or local leaderboards.
4. **Sound Effects**: Add auditory feedback for climbing, falling, and button clicks.
5. **Expanded Language Support**: Broaden localization to additional languages.

J. Conclusion

The Climbing Mountain App effectively demonstrates core principles of mobile application development by considering hardware limitations, user interaction, and multilingual accessibility. The project aligns with mobile computing best practices and supports Unit Learning Outcomes through its design and implementation. Future enhancements, such as persistent storage, animations, and leaderboards, can further improve user engagement and functionality.

K. References

Mobile SDK: *https://developer.salesforce.com/docs/platform/mobile-sdk/overview*

Calling activity's methods from a separate class: *https://teamtreehouse.com/community/calling-activitys-methods-from-a-separate-class*

For UI: https://xuanthulab.net/co-ban-ve-cach-tao-va-su-dung-activity-trong-android.html

From Android Developers: https://developer.android.com/?hl=vi