Exercise 5 - Android Application using Multithreading

Objective

Develop an android application to perform multithreading. Define 3 threads to run concurrently when “start” button is clicked.
The first thread should change the color of the text indefinitely The second thread should implement a moving banner
The third thread should display a counter starting from 0 to 1000 When the “Stop” button is pressed all the threads should be stopped

Algorithm

1. Initialize the Project:
   - Open Android Studio and create a new Android project.
   - Set up the project with a suitable name and package.

2. Design Layout:
   - Design the main layout with buttons to start and stop threads.
   - Include a TextView for displaying the color change, moving banner, and counter.

3. Implement Multithreading:
   - Thread 1 (Color Change):
     - Create a thread to change the color of the TextView indefinitely.
     - Utilize `Handler` to update the UI from the background thread.

   - Thread 2 (Moving Banner):
     - Create a thread to implement a moving banner.
     - Use `TranslateAnimation` to move the banner horizontally.

- Again, use `Handler` to update the UI.

- Thread 3 (Counter):
  - Create a thread to display a counter from 0 to 1000.
  - Update the TextView with the current counter value.

4. Start and Stop Threads:
   - Use buttons to start and stop the threads.
   - When the "Start" button is clicked, start all three threads concurrently.
   - When the "Stop" button is clicked, stop all the threads.

Features used

Main Features:
- Multithreading: Implementation of three concurrent threads for color change, moving banner, and counter.
- UI Update: Use of `Handler` to update the UI from background threads.
- Animation: Incorporation of animation (moving banner) using `TranslateAnimation`.
- Start and Stop Controls: Buttons to start and stop the concurrent threads.

Source Code

MainActivity.java:

```
package com.example.ex5;
import androidx.appcompat.app.AppCompatActivity;
import android.graphics.Color;
import android.os.Bundle;
import android.util.Log;
import android.view.View;
import
android.widget.Button;
import android.widget.TextView;
public class MainActivity extends AppCompatActivity {
@Override
protected void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
setContentView(R.layout.activity_main);
TextView t1 = findViewById(R.id.t1);
```

```
Thread1 th1 = new Thread1(t1);
TextView t2 = findViewById(R.id.t2);
Thread2 th2 = new Thread2(t2);
TextView t3 = findViewById(R.id.t3);
Thread3 th3 = new Thread3(t3);
final boolean[] init = {false};
Button start = findViewById(R.id.start);
start.setOnClickListener(new View.OnClickListener() { @Override
public void onClick(View v) {
if(!init[0]){
th1.start();
th2.start();
th3.start();
init[0] = true;
}
else{
Log.d("debug","hello");
th1.pause(false);
th2.pause(false);
th3.pause(false);
}
}
});
Button stop = findViewById(R.id.stop);
stop.setOnClickListener(new View.OnClickListener() { @Override
public void onClick(View v) {
th1.pause(true);
th2.pause(true);
th3.pause(true);
}
});
}
}
```

Thread1.java:

```
package com.example.ex5;
import android.graphics.Color;
import android.util.Log;
import android.widget.TextView;
public class Thread1 extends Thread{ TextView t;
int red = 120;
```

```
int green = 120;
int blue = 120;
boolean paused = false;
Object lock = new Object();
Thread1(TextView t){
this.t=t;
}
public void pause(boolean paused){ synchronized (lock){
if(paused)
this.paused = true;
else{
this.paused = false;
lock.notifyAll();
}
}
Log.d("Debug",""+paused);
}
public void run(){
while(true) {
try {
int color = Color.rgb(red, green, blue); t.setTextColor(color);
red = (red + 20) % 255;
green = (green + 10) % 255;
blue = (blue + 5) % 255;
Thread.sleep(500);
synchronized (lock){
while(paused){
try{
lock.wait();
}catch(InterruptedException e){
}
}
}
} catch (InterruptedException e) {
e.printStackTrace();
}
}
}
}
```

Thread2.java:

```
package com.example.ex5;
import android.util.Log;
import android.view.animation.TranslateAnimation; import
android.widget.TextView;
public class Thread2 extends Thread{
TextView t;
int dir = 1;
int translationDistance = 300; boolean paused=false;
Object lock = new Object(); Thread2(TextView t){
this.t=t;
}
public void pause(boolean paused){ synchronized (lock){
if(paused)
this.paused =
true;
else{
this.paused = false;
lock.notifyAll();
}
}
Log.d("Debug",""+paused); }
public void run(){
while (!paused) {
try {
TranslateAnimation animation;
if (dir == 1) {
animation = new TranslateAnimation(-translationDistance, translationDistance,
0, 0);
} else {
animation = new TranslateAnimation(translationDistance, -translationDistance,
0, 0);
}
animation.setDuration(3000); // Keep the total duration the same
animation.setFillAfter(true);
t.startAnimation(animation);
Thread.sleep(3000)
; dir = 1 - dir;
synchronized (lock){
while(paused){
```

```
try{
lock.wait();
}catch(InterruptedException e){
}
}
}
} catch (InterruptedException e) {
e.printStackTrace();
}
}
}
}
```

Thread3.java:

```
package com.example.ex5;
import android.util.Log;
import android.widget.TextView;
public class Thread3 extends Thread{ TextView t;
int ctr=0;
boolean paused = false;
Object lock = new Object();
Thread3(TextView t){
this.t=t;
}
public void pause(boolean paused){ synchronized (lock){
if(paused)
this.paused =
true;
else{
this.paused = false;
lock.notifyAll();
}
}
Log.d("Debug",""+paused);
}
public void run(){
while (ctr < 3000 && !paused) {
try {
Thread.sleep(1000)
; ctr += 1;
// Update the TextView on the UI thread t.post(new Runnable() {
```

```
@Override public
void run() {
t.setText(Integer.toString(ctr));
}
});
synchronized (lock){
while(paused){
try{
lock.wait();
}catch(InterruptedException e){
}
}
}
} catch (InterruptedException e) {
paused = true;
e.printStackTrace();
}
}
}
}
```

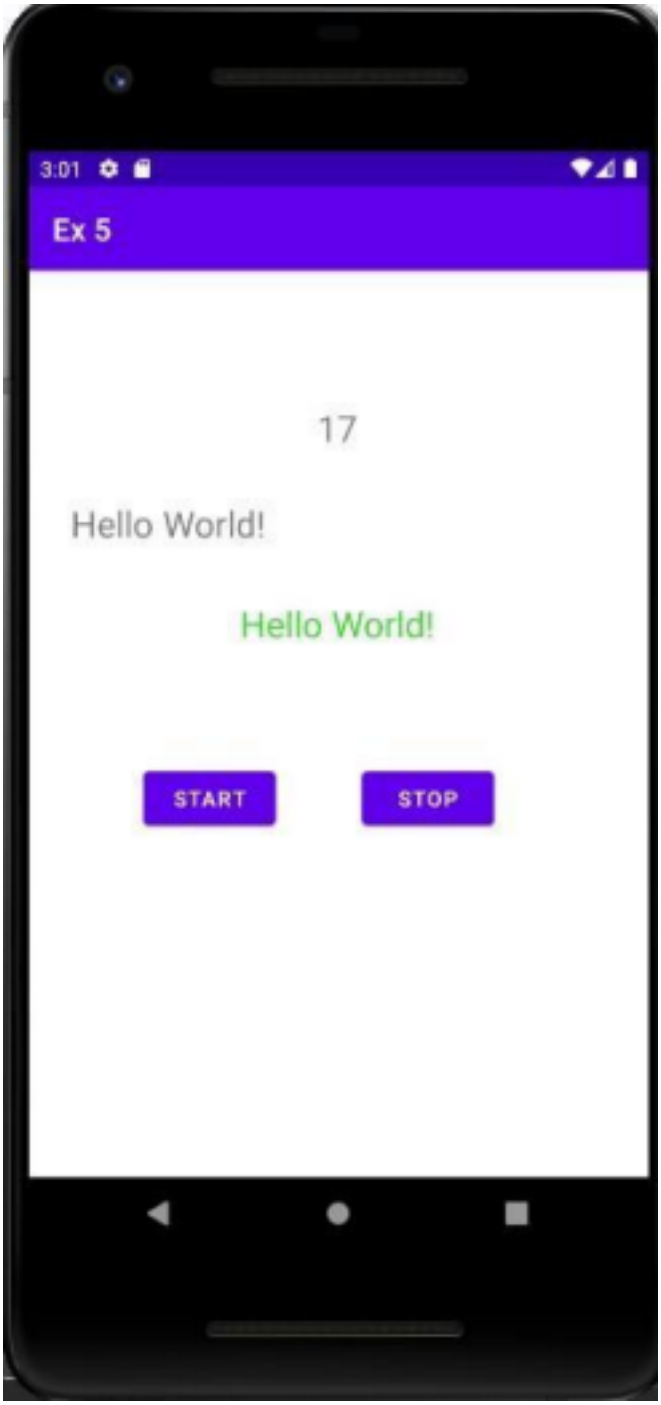
Activity_main.xml:

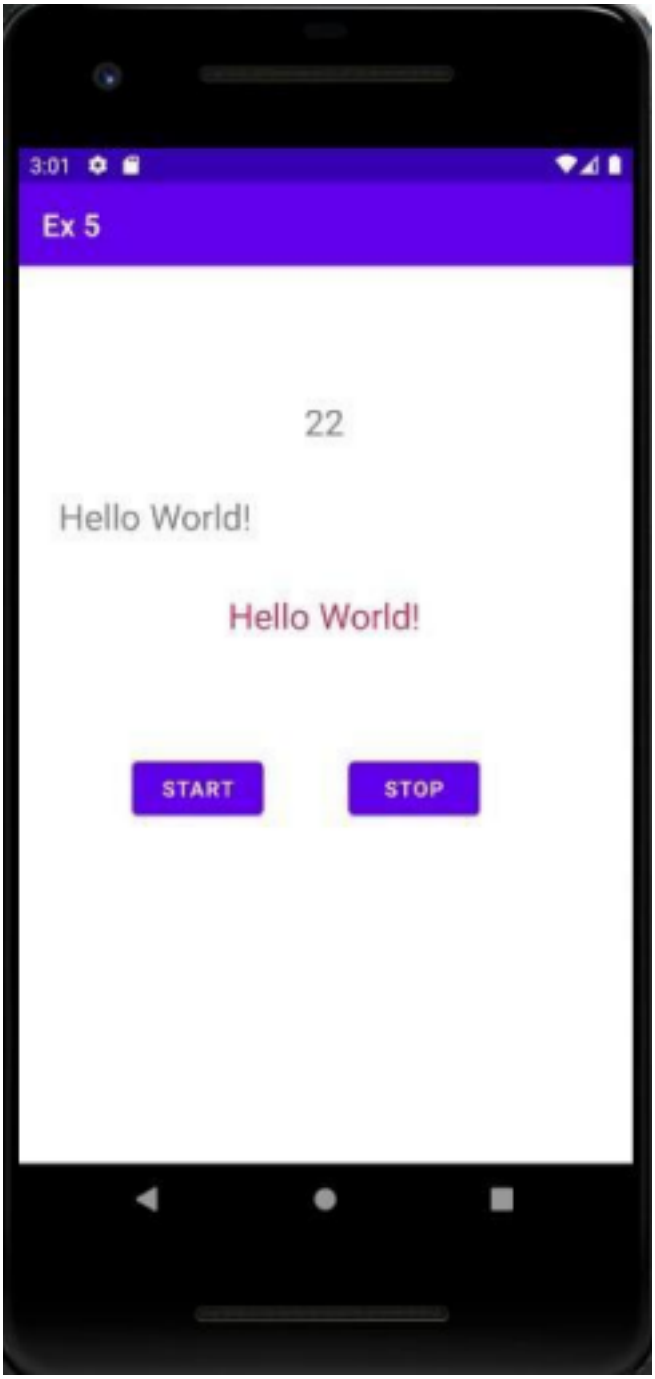
```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:app="http://schemas.android.com/apk/res-auto"
xmlns:tools="http://schemas.android.com/tools"
android:layout_width="match_parent"
android:layout_height="match_parent"
tools:context=".MainActivity"
tools:layout_editor_absoluteX="-1dp"
tools:layout_editor_absoluteY="-83dp">
<TextView
android:id="@+id/t1"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="Hello World!"
android:textSize="24sp"
app:layout_constraintBottom_toBottomOf="parent"
app:layout_constraintHorizontal_bias="0.498"
app:layout_constraintLeft_toLeftOf="parent"
```

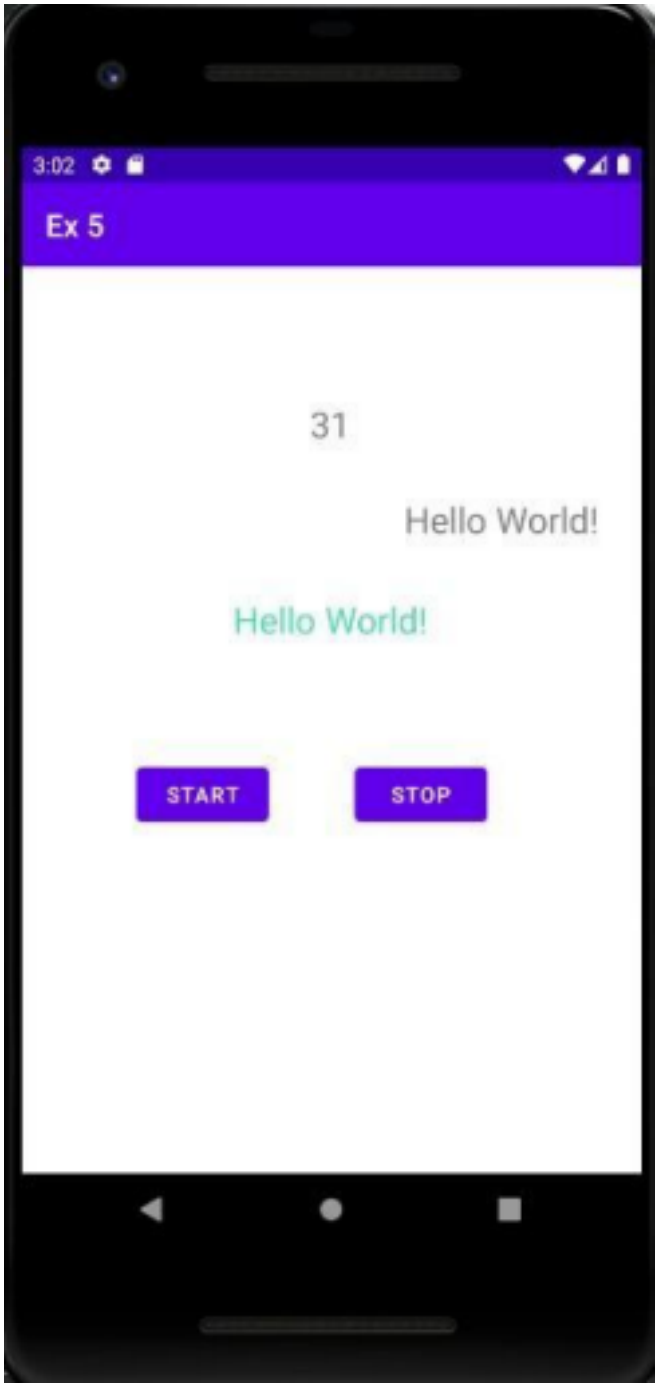
```
app:layout_constraintRight_toRightOf="parent"
app:layout_constraintTop_toTopOf="parent"
app:layout_constraintVertical_bias="0.383" />
<TextView
android:id="@+id/t2"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="Hello World!"
android:textSize="24sp"
app:layout_constraintBottom_toBottomOf="parent"
app:layout_constraintHorizontal_bias="0.501"
app:layout_constraintLeft_toLeftOf="parent"
app:layout_constraintRight_toRightOf="parent"
app:layout_constraintTop_toTopOf="parent"
app:layout_constraintVertical_bias="0.266" />
<TextView
android:id="@+id/t3"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="0"
android:textSize="24sp"
app:layout_constraintBottom_toBottomOf="parent"
app:layout_constraintHorizontal_bias="0.498"
app:layout_constraintLeft_toLeftOf="parent"
app:layout_constraintRight_toRightOf="parent"
app:layout_constraintTop_toTopOf="parent"
app:layout_constraintVertical_bias="0.155" />
<Button
android:id="@+id/stop"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_marginTop="76dp"
android:text="Stop"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintHorizontal_bias="0.684"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toBottomOf="@+id/t1" />
<Button
android:id="@+id/start"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_marginTop="76dp"
```

```
android:text="Start"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintHorizontal_bias="0.236"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toBottomOf="@+id/t1" />
</androidx.constraintlayout.widget.ConstraintLayout>
```

Output Screenshots


3:01
Ex 5
17
Hello World!
Hello World!
START
STOP


3:01
Ex 5
22
Hello World!
Hello World!
START
STOP



Result

Thus multithreading was implemented

Best Practices

1. User friendly design
2. Readable layouts
3. Modularity
4. Used apt names for xml and java files.
5. Set padding and margins for dynamically added elements
6. Exception handling
7. Pause and resume in a single function

Learning outcomes

- Basic GUI components and layouts that are available
- Passing data between activities
- Learnt to implement multithreading
- Learnt to start, stop and resume threads