Nordic Folkecenter for Renewable Energies

Folkecenter Mobile Application Report

The Information and Communications Technology (ICT) Programme

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Abstract

The importance of mobile phones in our everyday life and activities is undeniably unending. This is so because there is ongoing tremendous transformation in that mobile phones are no longer the ordinary communication device it used to be. It has become the colossal point of attention for individuals and businesses alike, courtesy of the various incredible features and opportunities that mobile phones offer. The cumulative progress of mobile technology, the availability and access to high speed internet and the remarkable communicative interface in these devices results into a whole level of new and innovative experience mobile computing. This is made possible through the development of mobile applications (mobile apps).

Thus, the result of these project is the final product of the Folkecenter's need of a mobile application, which helps at promoting Folkecenter, its different events and renewable energy as a whole. This project report has the purpose of describing all the methods, stages and iterations that went into the development and implementation of this project. The app was developed by a single person, and one of the main requirements was that is it build in such a way that, in the future, if another person has to work on the application, it will be an easy task to do, such that this report has the purpose of simplifying this task.

The application has been fully designed with the end-user experience in mind, the app being developed to give the visitors of the Nordic Folkecenter a more enjoyable experience, including even a guided tour (in multiple languages). The user interface has been programmed using XML, and the back-end was implemented using Java. The app was envisioned to only run on Android mobile devices, but development for different platforms is possible in the future.

1 Introduction

The importance of mobile phones in our everyday life and activities is undeniably unending. This is so because there is ongoing tremendous transformation in that mobile phones are no longer the ordinary communication device it used to be. It has become the colossal point of attention for individuals and businesses alike, courtesy of the various incredible features and opportunities that mobile phones offer. The cumulative progress of mobile technology, the availability and access to high speed internet and the remarkable communicative interface in these devices results into a whole level of new and innovative experience mobile computing. This is made possible through the development of mobile applications (mobile apps).

Today, the availability of mobile apps is on the increase such that it is produce a noticeable change in the way humans feel and experience computing. Few years ago, in other to access the internet, check and read mails, one had to use the computer but today this has changed because computing is now carried everywhere in mobile phones. Imagine buying a train ticket on the go, this is something our ancestors never imagined or did. Imagine not going to the bank but still transfer money to family and friends. All thanks to app developers and top app development companies**.** No matter which, they have come to the rescue enabling easy life.

The developed product has the main purpose of giving the visitors of Nordic Folkecenter a more enjoyable experience, giving them an overall idea on what Folkecenter is all about, helping them keep up with the most recent news and events and even offering them the option to have a guided tour, in multiple languages, through the application.

2 Requirements

2.1 Functional Requirements

ID	User Story Description	Priority
1	As a user, I want to be able to run the application on my Android Device	High
2	As a user, I want the application to be light-weight and well optimized	High
3	As a user, I want to be able to use most of the app's features without a constant internet connection	High
4	As a user, I want the application to present me with relevant and well-organized information	Medium
5	As a user, I want it to be easy for me to access the Folkecenter website within the application	Medium
6	As a user, I want it to be easy for me to keep up with the latest news and events related to Folkecenter	Medium
7	As a user, I want to be able to have access to a guided tour, in my own language, within the application	Medium
8	As a user, I wish that, when using the application, as little data as possible is asked for me, and, if it is, this data is well-protected	Low
9	As a user, I wish for a crash-free experience	Low
10	As a user, I wish that the installation and deletion process is as easy as possible	Low

Table 1: Functional Requirements

3 Analysis

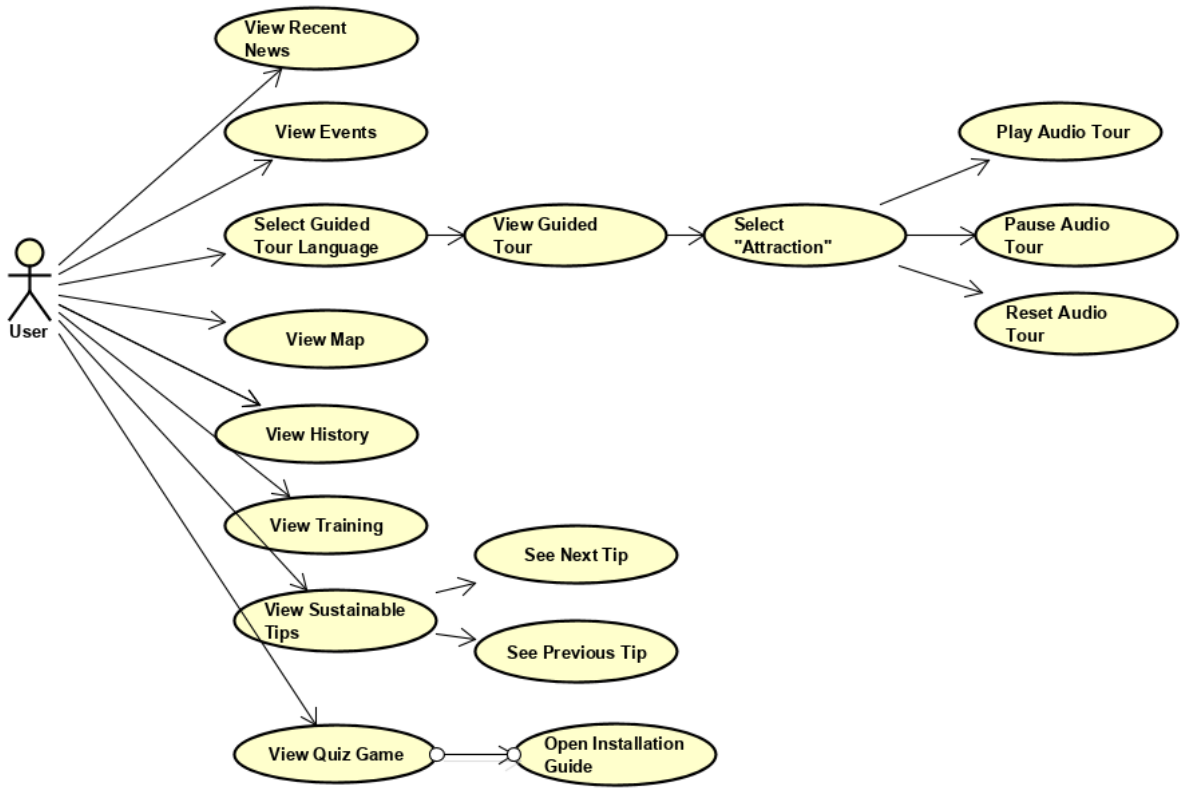


Figure 1: Use Case Diagram

3.1 Use Case Diagram

The above Use Case diagram represents the various operations that the user can perform in the application. Most of these operations are simple and straight-forward, since, to simplify the application, most of its functionality is viewing pre-defined data, rather than the user interacting with the app itself.

3.2 Use Case Descriptions

The following Use Case descriptions explain how the functionality of the system was envisioned to function described thoroughly.

Use Case	View Recent News
Actor	User
Pre-Condition	The application needs to be on the front page layout The device has an active internet connection
Post-Condition	The recent news are displayed
Base sequence	1.User taps on the “Recent News” icon 2.The application loads in the recent news and displays them on-screen
Exception Sequence	2A: The application cannot load in the news because the device is not connected to the internet

Table 2: View Recent News Use Case Description

Use Case	View Events
Actor	User
Pre-Condition	The application needs to be on the front page layout The device has an active internet connection
Post-Condition	The events are displayed
Base sequence	1.User taps on the “Events” icon 2.The application loads in the events page and displays them on-screen
Exception Sequence	2A: The application cannot load in the events page because the device is not connected to the internet

Table 3: View Events Use Case Description

Use Case	Select guided tour language
Actor	User
Pre-Condition	The application needs to be on the front page layout
Post-Condition	The application displays the “guided tour” main page in the selected language
Base sequence	1.User taps on the “Guided tour” icon from the front page

	2.User taps on one of the 3 icons with the language: Danish, German or English
Exception Sequence	

Table 4: Select Guided Tour Language Use Case Description

Use Case	Select Attraction
Actor	User
Pre-Condition	The application needs to be on the “guided tour” main page
Post-Condition	Application displays the selected attraction
Base sequence	1.The user taps one of the icons, depending on the Folkecenter attraction he wants to learn about 2.Application displays the page for the selected attraction
Exception Sequence	

Table 5: Select Attraction Use Case Description

Use Case	Play/Resume Audio Tour
Actor	User
Pre-Condition	The application needs to be set on one of the attraction pages
Post-Condition	The application plays the audio for the user
Base sequence	1.User taps on the “play audio” button 2.The system receives the requests and starts playing the audio file
Exception Sequence	

Table 6: Play/Resume Audio Tour Use Case Description

Use Case	Pause Audio Tour
Actor	User
Pre-Condition	The application needs to be set on one of the attraction pages

	The audio needs to be in the “playing” state
Post-Condition	The sound is paused
Base sequence	1.User taps on the “stop audio” button 2.The system pauses the audio file, which can be resumed using the play/resume audio function
Exception Sequence	

Table 7: Pause Audio Tour Use Case Description

Use Case	Reset Audio Tour
Actor	User
Pre-Condition	The application needs to be set on one of the attraction pages Audio needs to be in either the “paused” or “play/resume” state
Post-Condition	The audio file is reset, thus, if played again, it will start from the 00 time mark
Base sequence	1.User taps on the “Reset Audio” button 2.The audio file is reset to the 00 time mark
Exception Sequence	

Table 8: Reset Audio Tour Use Case Description

Use Case	View Map
Actor	User
Pre-Condition	The application needs to be on the front page layout The device needs to be connected to the internet
Post-Condition	The map is displayed on the screen
Base sequence	1.User taps the “Map” icon 2.System loads in the Map page
Exception Sequence	2A:The application cannot load in the map page because the device is not connected to the internet

Table 9: View Map Use Case Description

Use Case	View History Page
Actor	User
Pre-Condition	The application needs to be on the front page layout The device needs to be connected to the internet
Post-Condition	The history page is displayed on the screen
Base sequence	1.User taps the “History” icon 2.System loads in the History page
Exception Sequence	2A:The application cannot load in the history page because the device is not connected to the internet

Table 10: View History Page Use Case Description

Use Case	View Training Page
Actor	User
Pre-Condition	The application needs to be on the front page layout
Post-Condition	The training page is displayed on the screen
Base sequence	1.User taps the “Training” icon 2.System loads in the Training page
Exception Sequence	

Table 11: View Training Page Use Case Description

Use Case	View Sustainable Tips
Actor	User
Pre-Condition	The application needs to be on the front page layout
Post-Condition	The Sustainable Tips page is displayed on the screen by the application
Base sequence	1.User taps the “Tips” icon 2.System loads in the Sustainable tips page
Exception Sequence	

Table 12: View Sustainable Tips Use Case Description

Use Case	See Next Tip
Actor	User
Pre-Condition	The application needs to be set on one of the tips layouts
Post-Condition	The application displays the next tip
Base sequence	1.User taps on the “Next tip” arrow 2.The application displays a new tip layout
Exception Sequence	2A: An exception appears when the applications reaches the last tip, and here, when the “next tip” arrow is tapped by the user, he will be sent back to the main page

Table 13: See Next Tip Use Case Description

Use Case	See Previous Tip
Actor	User
Pre-Condition	The application needs to be set on one of the tips layouts
Post-Condition	The application displays the previous tip
Base sequence	1.User taps on the “Previous tip” arrow 2.The application displays the previous tip layout
Exception Sequence	2A. An exception appears when the application is set on the first tip, the back arrow sending the user back to the main tips page

Table 14: See Previous Tip Use Case Description

Use Case	View Quiz Game Page
Actor	User
Pre-Condition	The application needs to be on the front page layout
Post-Condition	Application displays the quiz game page
Base sequence	1.User taps on the “Quiz Game” layout 2.The application displays the Quiz Game page
Exception Sequence	

Table 15: View Quiz Game Page Use Case Description

Use Case	View Quiz Game Installation Guide
Actor	User
Pre-Condition	The application needs to be on the quiz game layout There is an active internet connection on the device
Post-Condition	The installation guide page is displayed
Base sequence	1.User taps on the “installation guide” button 2.Installation guide page is displayed
Exception Sequence	2A. The page cannot be displayed due to the lack of an internet connection

Table 16: View Quiz Game Installation Guide Use Case Description

4 Design & Implementation

The purpose of this part is to define the architecture, technologies, design patterns and UI choosing of the system.

4.1 Architecture

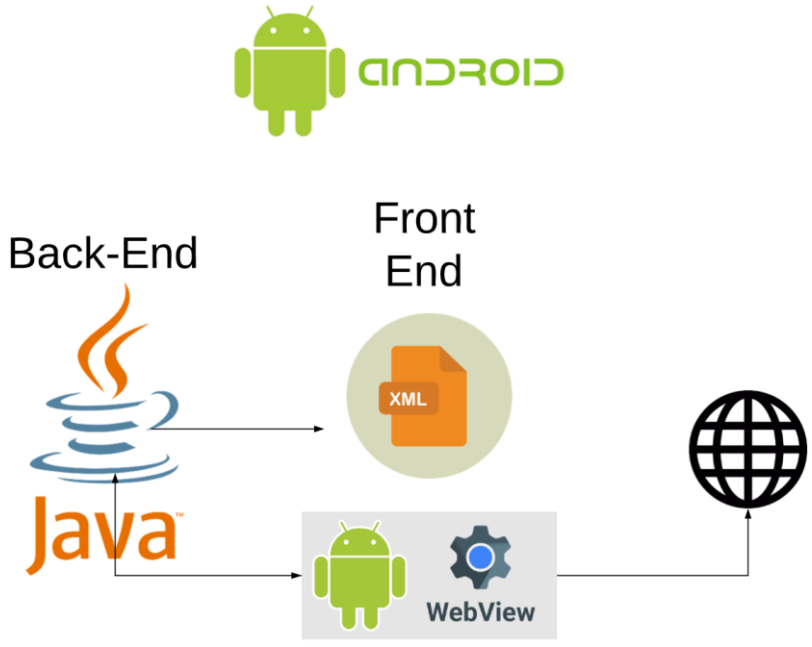


Figure 2: Android Architecture Diagram

The architecture diagram has the purpose of showing the logic behind the Android application. The application was designed for Android devices, thus, as the big majority of Android applications, the whole back-end of the application was coded using the object-oriented programming language Java.

```
@Override
public myViewHolder onCreateViewHolder(ViewGroup parent, int viewType)
{
    LayoutInflater inflater =LayoutInflater.from(mContext);
    View v=inflater.inflate(R.layout.recent_news,parent, attachToRoot: false);
    return new myViewHolder(v);
}
```

Figure 3: Java Code Example inside the Application

Java was needed to initialize all the layouts, but also to add different back-end logic for the application, such as adding functionality to different buttons and hyperlinks in the application.

As far as the front-end of the application goes, it has been coded using the XML language, which is a markup language (same as HTML).

```
<LinearLayout
    android:layout_gravity="center_horizontal|center_vertical"
    android:layout_margin="10dp"
    android:orientation="vertical"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content">

    <ImageView
        android:src="@drawable/plant_oil_lab_icon"
        android:layout_gravity="center_horizontal"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content" />
```

Figure 3: XML code example inside the Android Application

Apart from standard Android layouts, inside the app, WebViews are also used, which allow the Android Application to display a webpage inside the layout itself, which gives the

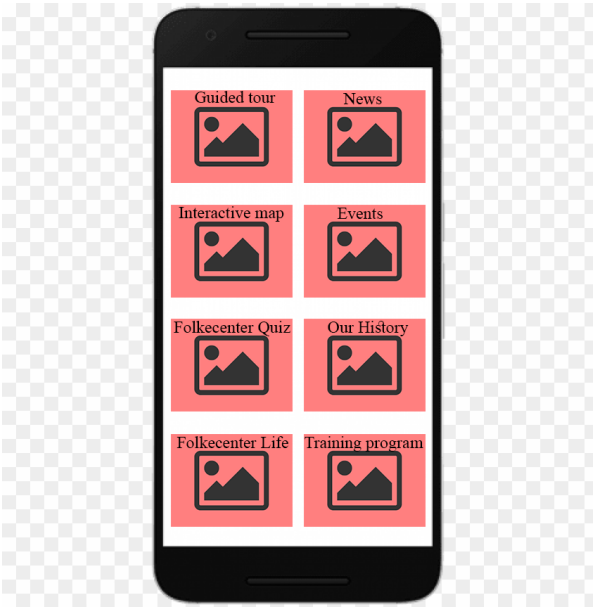
developer some freedom, given that the linked web-page is responsive, but, as a downside, to access such a layout, a constant internet connection is required (the application itself won't request for constant internet connection of the application contains a WebView).

```
<WebView
    android:id="@+id/training_activity_main_webview"
    android:layout_width="match_parent"
    android:layout_height="match_parent"/>
```

Figure 4: WebView XML code example

4.2 User Interface/Back-end Design and Implementation

From the early stages of the project, the main focuses regarding the User Interface were to make every layout of every single activity in the Android Application simple, intuitive and eye-catching. Before starting the actual implementation of the application, a few small sketches of the layouts have been created.



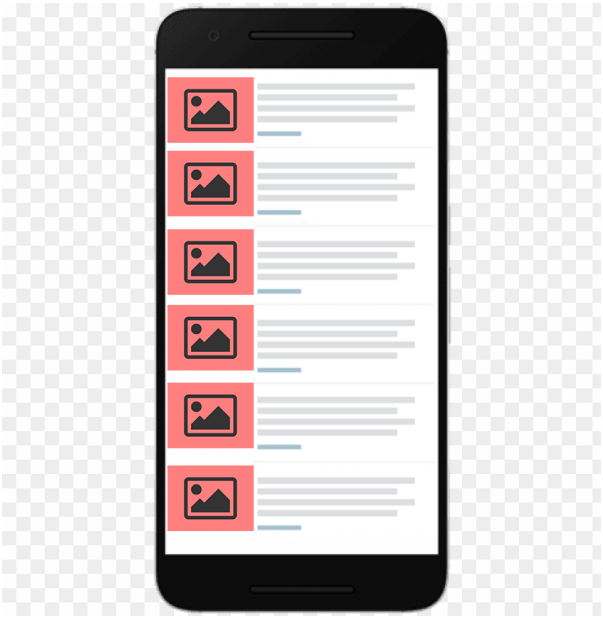


Figure 5/6/7: Small Sketches that were designed in preparation of layout implementation

To stick with simplicity and ease of use, a clean and eye-catching front-page has been created – all the features of the application can be accessed from a grid layout, with appealing icons. Thus, the icons in the grid layout send the user to the following features: Recent News, Upcoming Events, Guided Tour, Interactive Map, Our History, Training, Sustainable Tips and Quiz Game.

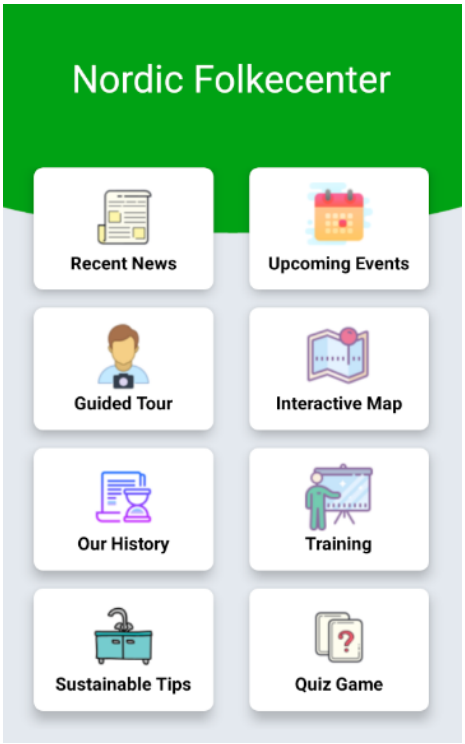


Figure 8: Front page of the Android Folkecenter Application

This Grid Layout makes use of Card Views, which, essentially can be thought as a FrameLayout with rounded corners and shadow based on the elevation of elements. CardView wraps a layout and is often the container used in a layout for each item within a ListView or a RecyclerView.

The main element of the front page is a grid layout, containing eight CardView elements/children. The GridLayout is a layout that places its children in a rectangular grid, which is composed of a set of infinitely thin lines that separate the viewing area into cells. Throughout the API, grid lines are referenced by grid indices. A grid with N columns has N + 1 grid indices that run from 0 through N inclusive. Regardless of how GridLayout is configured, grid index 0 is fixed to the leading edge of the container and grid index N is fixed to its trailing edge (after padding is taken into account).

Children occupy one or more contiguous cells, as defined by their GridLayout.LayoutParams#rowSpec and GridLayout.LayoutParams#columnSpec layout parameters. Each spec defines the set of rows or columns that are to be occupied; and how children should be aligned within the resulting group of cells. Although cells do not normally overlap in a GridLayout, GridLayout does not prevent children being defined to occupy the same cell or group of cells. In this case however, there is no guarantee that children will not themselves overlap after the layout operation completes.

```
<GridLayout
    android:columnCount="2"
    android:rowCount="4"
    android:alignmentMode="alignMargins"
    android:columnOrderPreserved="false"
    android:layout_weight="8"
    android:layout_width="match_parent"
    android:padding="14dp"
    android:layout_height="0dp">
```

Figure 9: Grid Layout XML code example

CardView provides a default elevation and corner radius so that the cards have a consistent appearance across the platforms. However, these values can be customized, a background color for the card can also be set.

```
<android.support.v7.widget.CardView
    android:id="@+id/main_news_cardview"
    android:layout_width="0dp"
    android:layout_height="0dp"
    android:layout_columnWeight="1"
    android:layout_rowWeight="1"
    android:layout_marginBottom="16dp"
    android:layout_marginLeft="16dp"
    android:layout_marginRight="16dp"
    app:cardElevation="8dp"
    app:cardCornerRadius="8dp"
    >

    <LinearLayout
        android:layout_gravity="center_horizontal|center_vertical"
        android:layout_margin="10dp"
        android:orientation="vertical"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content">

    <ImageView
        android:src="@drawable/news_icon"
        android:layout_gravity="center_horizontal"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content" />

    <TextView
        android:text="Recent News"
        android:textAlignment="center"
        android:textColor="@android:color/black"
        android:textSize="16sp"
        android:textStyle="bold"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content" />

    </LinearLayout>

</android.support.v7.widget.CardView>
```

Figure 10: Card View XML code example

The above code is an example of the implementation of a CardView inside the Folkecenter Mobile Application – proprieties such as Elevation, Corner Radius, margins etc. for the CardView are defined in the element itself, and then, the CardView contains an ImageView, which sets the icon and defines it's proprieties, and a TextView – a small caption for the icon, these two views being wrapped in a Linear Layout. This implementation repeats 8 times, since the GridLayout is composed of eight CardView elements/children.

The main design of the front-page has been recycled for other layouts in the application. The green arch on the top side of the layout is not generated by any XML code – a background image is set, which is a grey wallpaper containing the green arch on the top side.

```
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:background="@drawable/bg"
    android:weightSum="10"
    tools:context=".MainActivity">
```

Figure 11: Setting the background of an XML page

Recent news

The recent news section makes use of a RecyclerView. A RecyclerView is a more advanced version of ListView with improved performance and other benefits. The way a RecyclerView works is, by creating a template (framework) element, and, whenever a new element needs to be created, data is provided to the RecyclerView, and, based on the template, the new element is created.

There are three major components for any RecyclerView:

Recycler.LayoutManager- In the RecyclerView model, several different components work together to display your data. The overall container for your user interface is a RecyclerView object that you add to your layout. The RecyclerView fills itself with views provided by a layout manager that you provide. You can use one of our standard layout managers (such as LinearLayoutManager or GridLayoutManager), or implement your own.

RecyclerView.ViewHolder -The views in the list are represented by view holder objects. These objects are instances of a class you define by extending RecyclerView.ViewHolder. Each view holder is in charge of displaying a single item with a view. For example, if your list shows music collection, each view holder might represent a single album. The RecyclerView creates only as many view holders as are needed to display the on-screen portion of the dynamic content, plus a few extra. As the user scrolls through the list, the RecyclerView takes the off-screen views and rebinds them to the data which is scrolling onto the screen.

```
        //setting up the recyclerView with the adapter

        RecyclerView recyclerView = findViewById(R.id.rv_list_news);
        List<news_item> mlist = new ArrayList<>();
        mlist.add(new news_item(R.drawable.img1,  newsTitle: "Patoc",  newsDate: "23.12.2019"));
        mlist.add(new news_item(R.drawable.img2,  newsTitle: "Sobolan",  newsDate: "23.12.2019"));
        mlist.add(new news_item(R.drawable.img3,  newsTitle: "Cartita",  newsDate: "23.12.2019"));
        mlist.add(new news_item(R.drawable.img4,  newsTitle: "Arici pogonici",  newsDate: "23.12.2019"));
        Adapter adapter=new Adapter( mContext: this,mlist);
        recyclerView.setAdapter(adapter);
        recyclerView.setLayoutManager(new LinearLayoutManager( context: this));
    }
}
```

Figure 12: RecyclerView Java Implementation

RecyclerView.Adapter - The view holder objects are managed by an adapter, which you create by extending RecyclerView.Adapter. The adapter creates view holders as needed. The adapter also binds the view holders to their data. It does this by assigning the view holder to a position, and calling the adapter's onBindViewHolder() method. That method uses the view holder's position to determine what the contents should be, based on its list position.

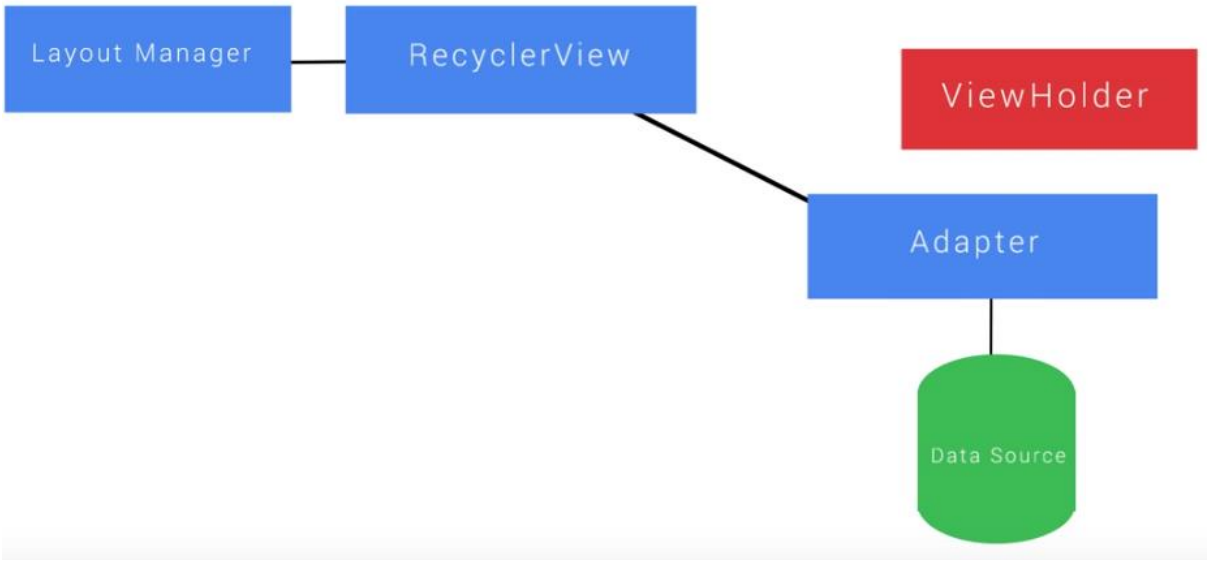


Figure 13: RecyclerView functional diagram

Upcoming Events, Interactive Map & Our History

Inside the application, so simplify some implementation, and take advantage of already existing implementations, some of the layouts are implemented using WebViews. In Android, a WebView is a way to link an external website inside the application. The only disadvantage when using this technique is that, to access such a layout, the device needs a constant internet connection, otherwise the app is going to crash or display an error message.

The WebView in Android enables you to show the web browser in your Activity. It is very useful if our application needs to embed some web content, like maps from some other providers and so on.

Here, the web page can be loaded inside the application with the help of URL. Mainly it is used to show the internet content inside the activity.

WebView in Android turns the application into a web application. It comes from android.webkit.WebView. Here, the WebView class is an extension of Android's View class which is used to show the web pages.

WebView doesn't include all the features of Web-browser-like navigation controls or an address bar etc. But we can navigate back or forward inside WebView. Because it automatically accumulates the history of web pages. So we can navigate backward and forward through the history with the help of goBack() and goForward() methods by using device back button in our activity.

```xml
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    xmlns:tools="http://schemas.android.com/tools"
    tools:context=".InteractiveMapActivity">

    <WebView
        android:id="@+id/activity_main_webview"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>


</RelativeLayout>
```

Figure 14: WebView XML implementation for Interactive Map

```java
        mWebView=findViewById(R.id.activity_main_webview);

        //Force links and redirects to open in the WebView instead of in a browser

        mWebView.setWebViewClient(new WebViewClient());

        //Enable Javascript

        WebSettings webSettings = mWebView.getSettings();
        webSettings.setJavaScriptEnabled(true);

        //Remote Resource
        mWebView.loadUrl("http://www.folkecenter.eu/pages/Virtual-tour-Folkecenter.html");
        mWebView.setWebViewClient(new WebViewClient());
    }

    //prevent the back-button from closing the application
    @Override
    public void onBackPressed()
    {
        if(mWebView.canGoBack())
        {
            mWebView.goBack();
        }
        else
        {
            super.onBackPressed();
        }
    }

}
```

Figure 15: WebView Java implementation for Interactive Map

Guided Tour

The guided tour feature is the most complex feature of the Folkecenter Mobile Application, as, during its development, the requirements for this feature expanded – the supervisor decided that he wants this feature to also be available in Danish and German, not

only English, so a few changes had to be done. The guided tour page features a “front-page”, which uses the same template as the main layout of the application, a grid layout with card views and image icons – from here, the user is able to choose a location from Folkecenter that he is interested to learn about.

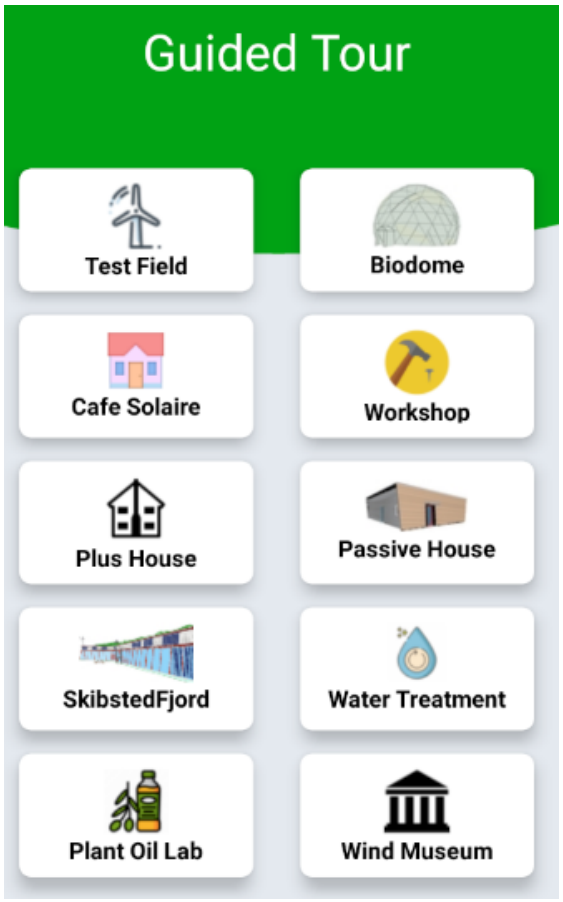


Figure 16: Guided Tour Layout

Once the user picks one of the locations, a new layout will open, which features a CollapsingToolbarLayout, a NestedScrollView, a written version of the tour, and also an audio version of the guided tour, where, with the help of three buttons, the user can play an audio file containing information about the chosen attraction, he can pause the audio, or reset it, so that it plays again from the beginning.

During the development of the feature, the application supervisor decided he wants this feature to be available in multiple languages – to implement this, a new layout has been created, where, by pressing one of the three language buttons, the user is able to select his preferred language, which will redirect him to the proper guided tour page with the updated text and audio files. The AudioPlayer makes use of the MediaPlayer library, using implementations of the play, pause, stop and onStop methods.

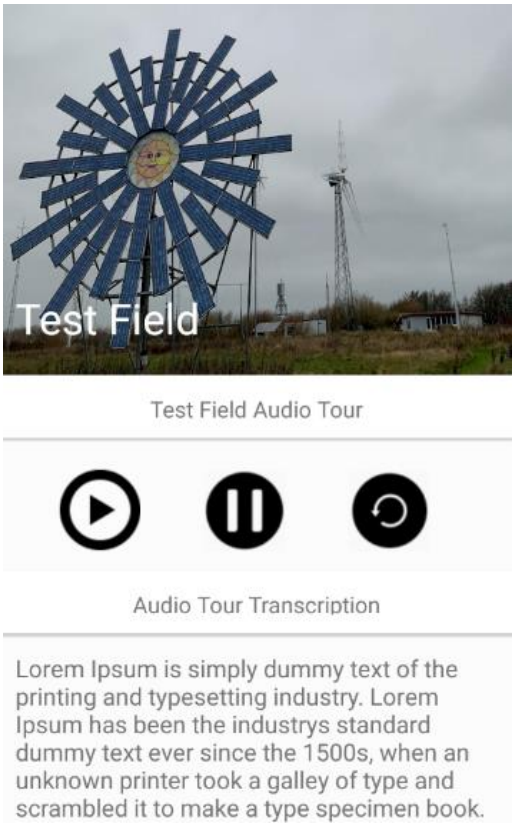


Figure 17/18: Select Language Layout/Test Field Guided Tour Layout

```
public void play(View v)
{
    if(passive_house_player==null)
    {
        passive_house_player=MediaPlayer.create( context: this, R.raw.song);
        passive_house_player.setOnCompletionListener(new MediaPlayer.OnCompletionListener() {
            @Override
            public void onCompletion(MediaPlayer mp) {

            }
        });
    }
    passive_house_player.start();
}

public void pause(View v)
{
    if(passive_house_player!=null)
    {
        passive_house_player.pause();
    }
}

public void stop(View v) { stopPlayer(); }

public void stopPlayer()
{
    if(passive_house_player!=null)
    {
        passive_house_player.release();
        passive_house_player=null;
    }
}

@Override
protected void onStop()
{
    super.onStop();
    stopPlayer();
}
}
```

Figure 19: Audio Player Java Implementation

Training & Quiz Game

The Training page is very similar to the Quiz Game page – they both feature simple Android views – a title, an image, some descriptive text along with a button which opens an external page. The button on the Training page is going to open a section on the Folkecenter website, which offers people information about the trainee program at Nordisk Folkecenter, along with a guide on how to sign up for to be a trainee.

The Quiz Game page sends the user to a GitHub page, with a guide on how to install the Folkecenter Quiz Game on a desktop device (Windows, Mac or Linux), as, during the development of the Folkecenter Mobile Application, the Quiz Game didn't make its way yet on Mobile Platforms.

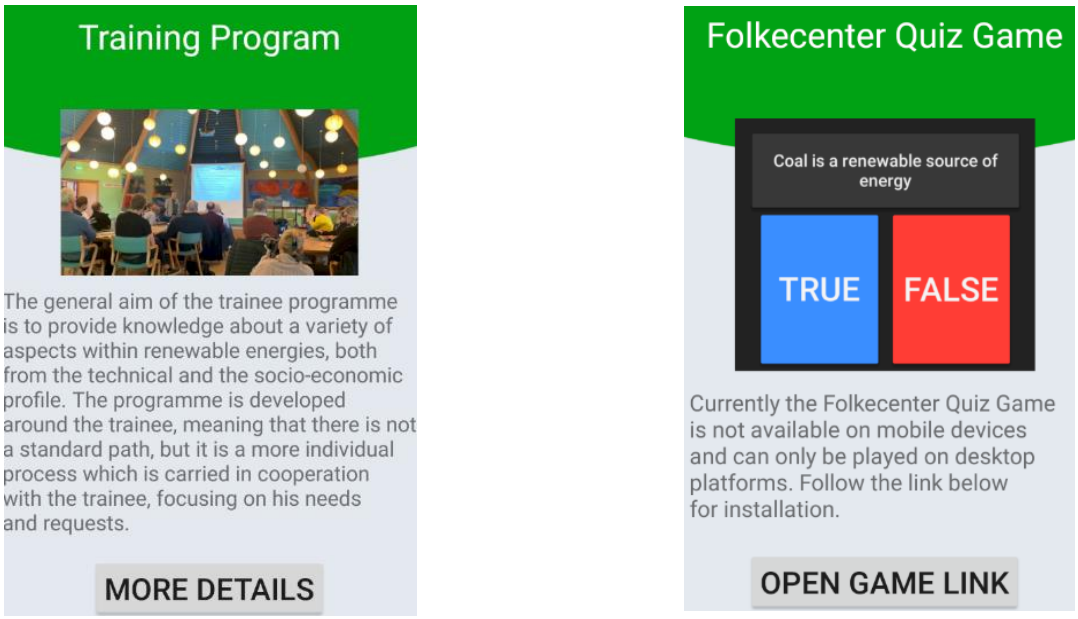


Figure 20/21: Training Page/Quiz Game Page

Sustainable Tips

The Sustainable Tips feature contains multiple pages with tips regarding on how to save energy in money in the everyday life. After tapping the icon, the user is sent to a page similar to the ones described above – the quiz game and training pages. The only difference is that the button won't send the user to an external website, they will send him to a layout containing the first tip. The navigation between the tips is made using arrow, for each of them an intent being created, which allows the user to skip to the next tip, or go the the previous one. The "next" arrow on the last tip is sending the user to the front page of the Android Application. The user can also use the "back" button of the Android device in order to navigate to a previous tip.

Figure 22: Tip Layout Example

```
public void backToMainTips(View v)
{
    Intent intent= new Intent( packageContext: this, TipsActivity.class);
    startActivity(intent);
}

public void OpenTip3(View v)
{
    Intent intent= new Intent( packageContext: this, Tip3Activity.class);
    startActivity(intent);
}
```

Figure 23: Redirect Next/Previous Tip Java Implementation

Intents

Android application components can connect to other Android applications. This connection is based on a task description represented by an Intent object.

Intents are asynchronous messages which allow application components to request functionality from other Android components. Intents allow you to interact with components from the same applications as well as with components contributed by other applications. For example, an activity can start an external activity for taking a picture.

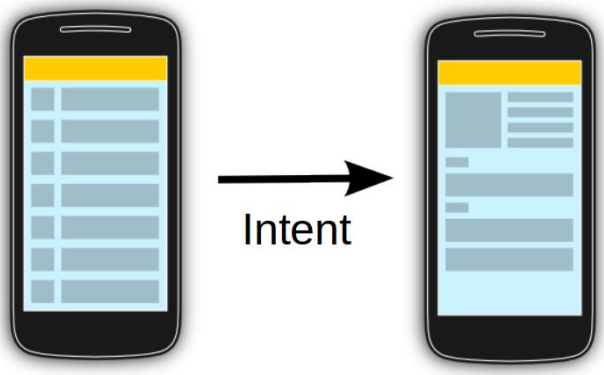


Figure 24: Android Intent Diagram

There are two types of intents:

Explicit intents specify which application will satisfy the intent, by supplying either the target app's package name or a fully-qualified component class name. You'll typically use an explicit intent to start a component in your own app, because you know the class name of the activity or service you want to start. For example, you might start a new activity within your app in response to a user action, or start a service to download a file in the background.

Implicit intents do not name a specific component, but instead declare a general action to perform, which allows a component from another app to handle it. For example, if you want to show the user a location on a map, you can use an implicit intent to request that another capable app show a specified location on a map.

An intent can be triggered by multiple types of views – in the Folkecenter Mobile Application, to trigger intens, buttons, card views and images are being used.

```
<ImageView

    android:id="@+id/previous_tip_arrow"
    android:layout_width="120dp"
    android:padding="5dp"
    android:layout_height="60dp"
    android:onClick="BackToTip5"
    android:src="@drawable/previous_tip_arrow"
    android:layout_toLeftOf="@id/next_tip_arrow
    android:layout_marginRight="110dp"/>


<ImageView
    android:layout_marginLeft="45dp"
    android:id="@+id/next_tip_arrow"
    android:layout_width="120dp"
    android:layout_height="60dp"
    android:padding="5dp"
    android:onClick="OpenTip7"
    android:layout_marginRight="10dp"
    android:src="@drawable/next_tip_arrow"
    android:layout_alignParentRight="true"/>
```

Figure 25: Redirect Next/Previous Tip XML Implementation

```
public void BackToTip5(View v)
{
    Intent intent= new Intent( packageContext: this, Tip5Activity.class);
    startActivity(intent);
}

public void OpenTip7(View v)
{
    Intent intent= new Intent( packageContext: this, Tip7Activity.class);
    startActivity(intent);
}
```

Figure 26: Redirect Next/Previous Tip Java Implementation

External Resources

In order to optimize the application, resources such as images, strings and audio files are externalized.

Resources are the additional files and static content that your code uses, such as bitmaps, layout definitions, user interface strings, animation instructions, and more.

You should always externalize app resources such as images and strings from your code, so that you can maintain them independently. You should also provide alternative resources for specific device configurations, by grouping them in specially-named resource directories. At runtime, Android uses the appropriate resource based on the current configuration. For example, you might want to provide a different UI layout depending on the screen size or different strings depending on the language setting.

Once you externalize your app resources, you can access them using resource IDs that are generated in your project's R class. This document shows you how to group your resources in your Android project and provide alternative resources for specific device configurations, and then access them from your app code or other XML files.

```
<!--RECENT NEWS PAGE STRINGS-->
<string name="news_read_more">Read More</string>
<string name="news_subtitle_date">Date</string>
<string name="news_title">Title</string>

<!--GUIDED TOUR PAGE STRINGS-->
<string name="guided_tour_title">Guided Tour</string>
<string name="grid_test_field">Test Field</string>
<string name="grid_biodome">Biodome</string>
<string name="grid_cafe_solaire">Cafe Solaire</string>
<string name="grid_workshop">Workshop</string>
<string name="grid_plus_house">Plus House</string>
<string name="grid_passive_house">Passive House</string>
<string name="grid_skibstedfjord">SkibstedFjord</string>
<string name="grid_water_treatment">Water Treatment</string>
<string name="grid_oil_lab">Plant Oil Lab</string>
<string name="grid_wind_museum">Wind Museum</string>
```

Figure 27: External Strings Example

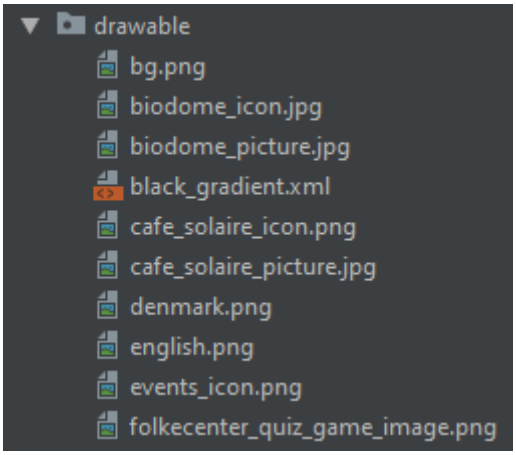


Figure 28: Drawable Resources Example

5 Testing

Black Box Testing

Black Box Testing, also known as Behavioral Testing, is a software testing method in which the internal structure/design/implementation of the item being tested is not known to the tester. These tests can be functional or non-functional, though usually functional.

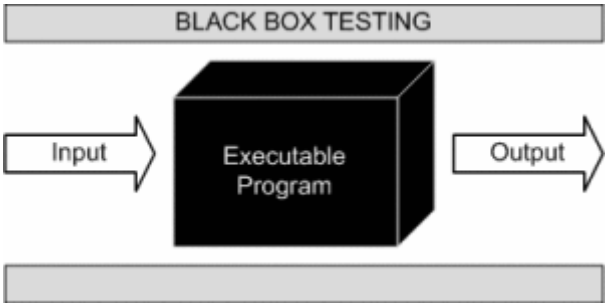


Figure 29: Black Box Testing Diagram

The tests check if the android application works correctly from the user perspective. Does each function and feature do what it should do/what it promises and is the User Interface easy to understand?

The main purpose of the testing is also to validate if the main use cases that were defined have been implemented and work as intended.

Description	Expected Result	Result
The user wants to run the application on his Android device without any crashes on start-up	The application is started and the user can see the front-page, without any crashes or errors in the process	Success, works as expected
The user runs the Events page without being connected to the internet	The application displays an error message and sends the user back to the front-page	Success, works as expected
The user runs the Events page while being connected to the internet	The application displays the proper section from the Folkecenter Website	Success, works as expected
The user can access the Guided Tour feature and select the preferred language	The proper guided tour front-page is displayed, depending on the selected language	Success, works as expected

The user taps on the “play audio” button in one of the guided tour pages	The assigned audio file starts playing	Success, works as expected
The user taps on the “pause audio” button in one of the guided tour pages	The audio file is paused	Success, works as expected
The user taps on the “reset audio” button in one of the guided tour pages and then plays the file again	The audio file is restarted and, if played again, starts from the 0:00 time mark	Success, works as expected
The user wants to scroll through the sustainable tips using the assigned arrows	The arrows send the user to the previous tip or to the next tip, depending on which one was tapped	Success, works as expected

Table 17: Test Cases Results

6 Results, Discussion, Conclusion and Project Future

The Folkecenter Android Application was developed in order to give the visitors at the center a better experience, and also a better understanding of the history of Folkecenter and the activities that are happening here. The step-by-step progress of the entire project, including documentation can be followed on the following GitHub link (the development process followed the version control protocols) - https://github.com/IonutPutinica/FolkecenterMobileApp .

Some features have been left umimplemented, thus paving the way for future development and possible new features – some of the layouts of the android application are not fully-responsive yet, a PDF reader needs to be implemented inside the application so that PDF files can be opened inside WebViews, a notification system should be implemented.

The development of the Android application is a big step forward for Folkecenter, allowing the center to promote itself easier, especially to young audiences.

Sources of Information

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