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USING STREAMLIT AND BASIC4ANDROID (B4A) TO CREATE THE SAME APPLICATION – B4A VERSION

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Abstract: The paper describes "Unfold Sheets Parts" application designed to unfold the sheet metal parts (the unfolding of the following types of surfaces: cylinder intersected by two planes – 2 variants, intersection of two/ three cylinders of equal diameter and cylindrical elbow) designed with two programming languages: Streamlit and B4A. The Streamlit version of application use Python & Matplotlib to generate the unfolded geometry and to plot the numerical & graphical results; the application is publicly available on the Internet, does not contain any viruses and not store data to any external server. The B4A version of application is available to download for smartphones as "UnfoldSheetsParts.apk" in the "Programming" section of reference; this application does not share data over the internet, the code runs entirely on the user's smartphone, does not contain any viruses and not store data to any external server. Specific elements of the two languages are presented in comparison, as well as the conceptual differences resulting from their use in the creation of the application.
Keywords: sheet metal parts, B4A version of application, Streamlit version

INTRODUCTION

B4A includes all the features needed to develop an Android app and is 100% free. The app code is written in the Integrated Development Environment (IDE) self–editor and can be tested on PC using an emulator or directly on smartphone using B4A–Bridge software or USB connection. B4A–Bridge is a free software which run on mobile device (smartphone or tablet) and was created using B4A. B4A–Bridge includes an internal FTP server, and the connection is made over the local network. Running the app using B4A–Bridge or USB will activate a dialog on the device to confirm the app's installation on the device, because Android doesn't allow the installation from unknown sources. The B4A–Bridge installation and connection process are detailed in reference [5].

THE REQUIRED SOFTWARE PACKAGES

To develop a B4A app the following software packages are required to install on PC following steps specified in reference [6]:

- Oracle Java 8;
- Android SDK Command line tools + Required Resources;
- B4A;
- B4A–Bridge – allows the IDE to connect to the device over the wireless network as an alternative to USB debug mode, which is also supported.

B4A is a tool development for Android applications developed by Anywhere Software and the language is similar to Visual Basic with additional support for objects and driven by events. In B4A, a page displayed to a user is named Activity and a control placed on Activity is named View. The details of Views are saved in a file named Layout with the "bal" extension. The code which controls the Layout is called an Activity Module. After installation the following tools are available in the B4A environment:

- an Integrated Development Environment (IDE) – it is a code editor provided with menus and toolbars, module tabs, code area, windows area, logs and windows tabs;
- Visual Designer – organize Views into Layout and see how they look on either an emulator or a real device; the following type of controls can be placed on Activity: Button, Check Box, Edit Text, Horizontal Scroll View, Image View, Label, List View, Panel, Progress Bar, Radio Button, Scroll View, Seek Bar, Spinner, Tab Host, Toggle Button, WebView, Custom View (Animated Counter, Another Progress Bar, B4X Bread Crumb, B4X ComboBox, B4X Float Text Field, B4XImageView, B4XSeekBar, B4X Switch, B4XPlusMinus, Round Slider, B4X Loading Indicator, Swift Button, B4X Radio Button, Custom List View, Made With Love, Scrooling Label); the Layout created in Visual Designer

can be saved by typing Ctrl+S and is recommended to save with the same name like the Activity module; the Visual Designer environment is detailed in reference [7];

- Libraries Manager – contain SQL databases, GPS, serial ports, camera, Web services, JSON, animations, network, Text to Speech, Voice Recognition, WebView, Charts, Graphics and others;
- B4X suite – a library for B4A (Android), B4i (IOS), B4R (Arduino) and B4J (desktop, server and Raspberry Pi) allowing to develop cross–platform applications; using cross–platform libraries, B4A, B4J and B4i projects can share 90% of the code;
- the Android Virtual Device Manager (AVD) is a utility provided by Google as part of the Android SDK which allows to create emulated Android devices; through this tool many devices can be created, with different hardware specifications and different screen resolutions;
- Debugger – debugging is the process of removing errors in the code using breakpoints and logging events, which produces messages in the Logs tab placed at the right of the IDE;
- Compiling – to test and distribute the app, the B4A code must be compiled by converting into Java files and create a Manifest file and an APK file which are stored in the Objects folder of the project.

To develop a B4A project a folder in which will be saved the B4A code and other files must be created. Every project consists of one or more files with code called modules. Every project has an Activity Module called "Main" which is stored within a file with the extension "b4a" and cannot be changed. It may also contain other modules which are stored in folder:

- Activity modules – an app need several different screens; each one of these will require its own activity module; Activity modules are paused when they are not visible; if only Activity are used in the project is not possible to run any code while the application is not visible;
- Class modules – a class represents an object and encapsulates the data and functionality of that object; a class contains properties, which gives the state of a particular instance, and methods, which allow the properties of an instance to be manipulated or queried;
- Code modules – code modules contain only code; no Activity is allowed in Code modules; the purpose and advantage of code modules is that they allow the same code to be shared in different programs;
- Service modules – used to run the app when this is not visible; a service is unaffected by the currently visible activity; this allows to run tasks in the background; services usually use status bar notifications to interact with the user and do not have any other visible elements.

A complete documentation about Basic4Android is specified in reference [8]. Also, the B4A full documentation can be found at reference [9], where can be downloaded all booklets and tutorials source code.

THE APPLICATION STRUCTURE

A general view of the B4A Integrated Development Environment, Library Manager and Compiling window are presented in Figure 1. Figure 2 shows a general view of Visual Designer.

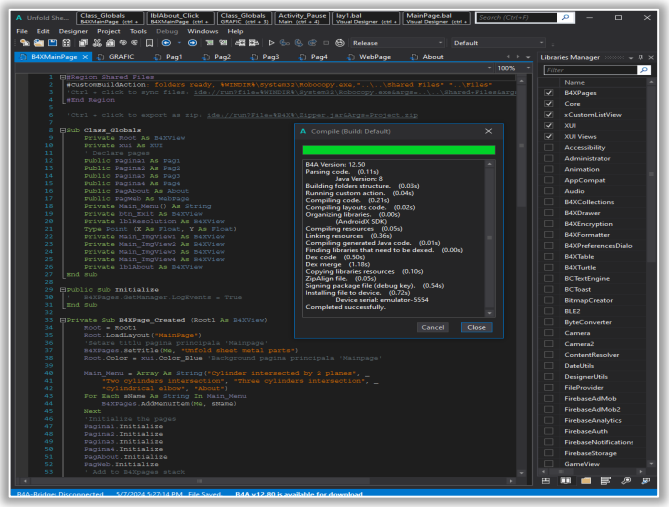


Figure 1. The B4A IDE & Library Manager

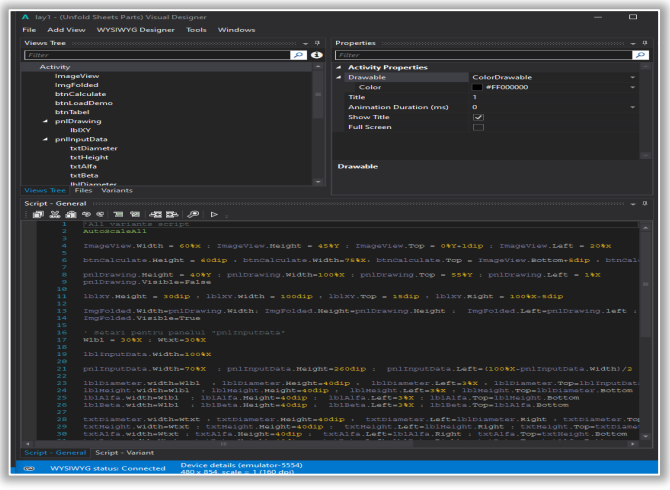


Figure 2. The Visual Designer

The folder content of the "Unfold Sheets Parts" application is presented in Figure 3, where:

- B4A – is the folder of Android app, which is described in the present paper; the content of B4A folder is shown in Figure 4; the folder Files

contain the 18 images and also the Layout (about.bal, lay1.bal, lay2.bal, lay3.bal, lay4.bal, layweb.bal, mainpage.bal) used by the application; the content of B4A app Objects folder is shown in Figure 5;

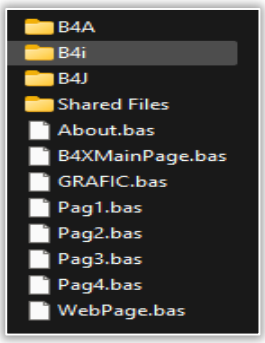


Figure 3. The structure of the "Unfold Sheets Parts" application

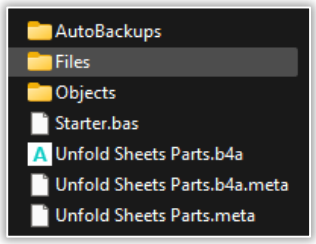


Figure 4. The content folder of B4A app

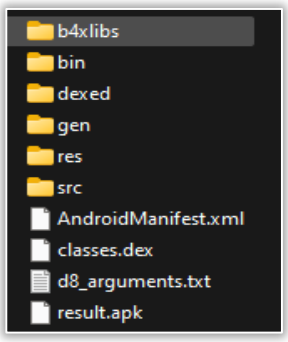


Figure 5. The content of B4A app Objects folder

- B4i – is the folder of IOS app, which is not covered in this paper.
- B4j – is the folder of desktop, server and Raspberry Pi app, which is not covered in this paper.
- Shared files – is the folder where are placed common files between B4A, B4i and B4j.
- B4XMainPage.bas – is the main module which create the interface presented in Figure 6; the vertical three dots placed at top–right open a menu used to launch modules Pag1.bas ÷ Pag4.bas or About.bas; the icon is used to exit the application; at right side of this icon the smartphone resolution is displayed; the icon launch the About.bas module; also, by left mouse click on any image, one of the modules Pag1.bas ÷ Pag4.bas can be launched;
- Grafic.bas – is the proprietary module responsible for plotting the geometry or an unfolded drawing;
- Pag1.bas – is the module 1 responsible for calculation and plotting the result for the "*One cylinder intersected with 2 planes*" option with the interface presented in Figure 7.
- Pag2.bas – is the module 2 responsible for calculation and plotting the result for the "*Two cylinders intersection*" option with the interface presented in Figure 8.
- Pag3.bas – is the module 3 responsible for calculation and plotting the result for the "*Three cylinder intersection*" option with the interface presented in Figure 9.
- Pag4.bas – is the module 4 responsible for calculation and plotting the result for the "*Cylindrical elbow*" option with the interface presented in Figure 10.
- About.bas – is the module responsible for general information about the app.
- WebPage.bas – is the module responsible for author info.

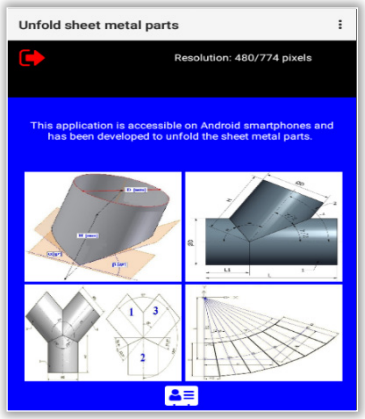


Figure 6. The main window of the B4A app

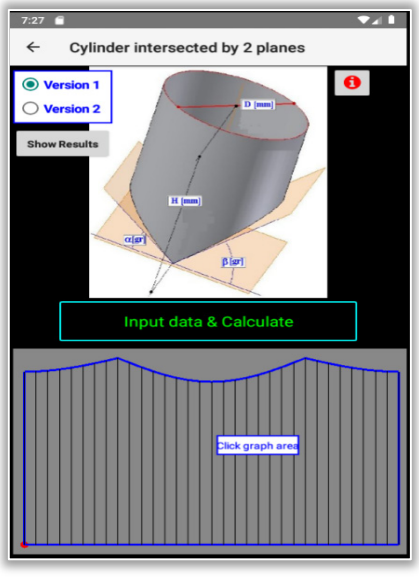


Figure 7. The main window of the module 1

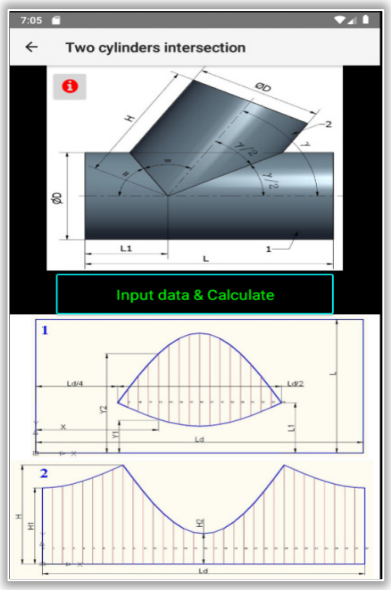


Figure 8. The main window of the module 2

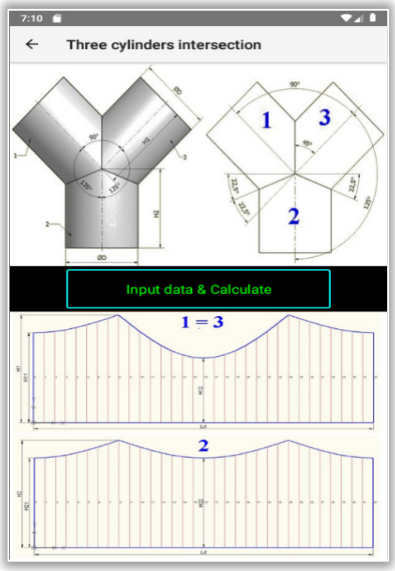


Figure 9. The main window of the module 3

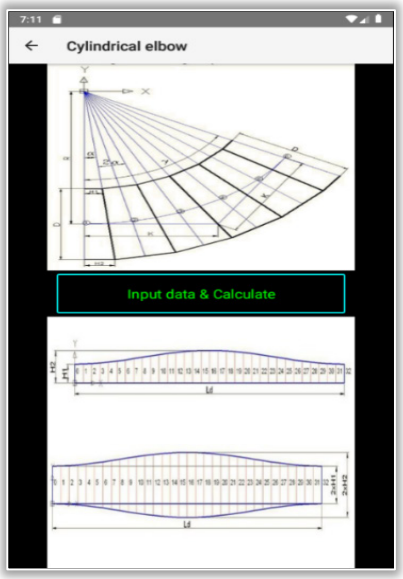


Figure 10. The main window of the module 4

Figure 11 show the fields required for module 1 "One cylinder intersected with 2 planes" while Figure 12 show the message with numerical results generated after click on Calculate button. Figure 13 show the fields required for module 2 "Two cylinders intersection" while Figure 14 show the message with numerical results generated after click on Calculate button.

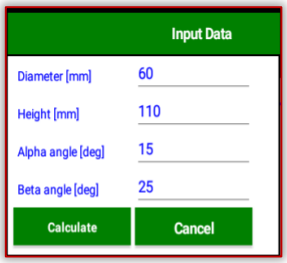


Figure 11. The fields required for module 1

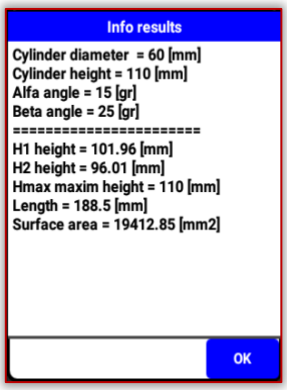


Figure 12. The Info results message for module 1

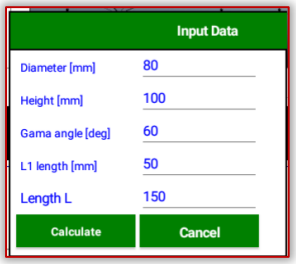


Figure 13. The fields required for module 2

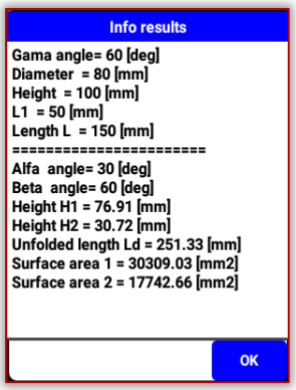


Figure 14. The Info results message for module 2

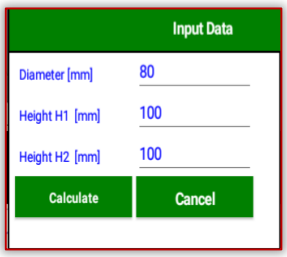


Figure 15. The fields required for module 3

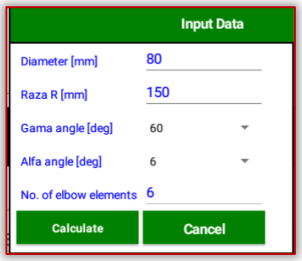


Figure 17. The fields required for module 4

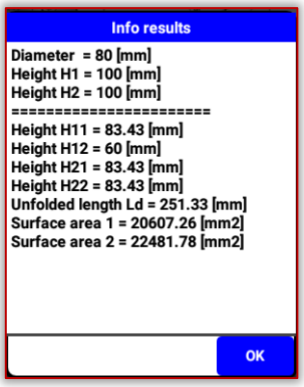


Figure 16. The Info results message for module 3

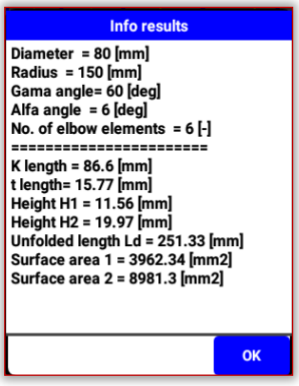


Figure 18. The Info results message for module 4

ID/Angle	X [mm]	Y [mm]
1 / 0	0.0	101.96
2 / 11.25	5.89	102.12
3 / 22.5	11.78	102.57
4 / 33.75	17.67	103.32
5 / 45	23.56	104.32
6 / 56.25	29.45	105.53
7 / 67.5	35.34	106.92
8 / 78.75	41.23	108.43

Figure 19. The Results table for module 1

Figure 15 show the fields required for module 3 "Three cylinders intersection" while Figure 16 show the message with numerical results generated after click on Calculate button. Figure 17 shows the fields required for module 4 "Cylindrical elbow" while Figure 18 show the message with numerical results generated after click on Calculate button. For module 1 the unfolded drawing is presented in Figure 7 and the numerical results are presented in tabular format in Figure 19, generated after click on Show Results button from the same Figure 7.

THE GRAFIC MODULE

The proprietary module Grafic.bas was used in all cases when must be drawn the geometry or an unfolded drawing and contain the following routines:

- Public Sub Initialize (iTarget As Panel, iCanvas As Canvas, iXGmin As Float, iYGmin As Float,iXGmax As Float, iYGmax As Float) – with the following parameters: Panel, Canvas, drawing limits which must be call before any drawing process;
- Sub RealToPix (Xreal As Float, Yreal As Float) As Point – to convert real coordinates into drawing coordinate;
- Sub PixToReal (Xpix As Float, Ypix As Float) As Point – to convert drawing coordinates into real coordinate;
- Public Sub DrawCurve (iListXY As List, iCuloare As Long, iGrosime As Int, iMarcare As Boolean, iEraseScreen As Boolean, iNX As Int, iNY As Int) – with the following parameters: coordinates array, the curve color and width, option to mark the curve or erase the drawing area and number of horizontal & vertical lines of rectangular grid.
- Public Sub DrawGrila () – to draw the horizontal & vertical rectangular grid.

The next line will initialize the chart:

chrt.Initialize (pnlDrawing, cvsDrawing, XGmin, YGmin, XGmax, YGmax)

where chrt must initially be declared in Sub Class_Globals with the following declaration:

Public chrt As GRAFIC

Then, a curve can be drawn on canvas with the following call:

chrt.DrawCurve (ListXY, Colors.Blue, 3dip, False, True,0, 0)

where the ListXY array must be converted into pixel coordinates by calling RealToPix routine.

For module 1 an example of unfolded drawing is presented in Figure 7. For module 4, Figure 20, 21, 22 shows example of elbow geometry drawn with Grafic module.

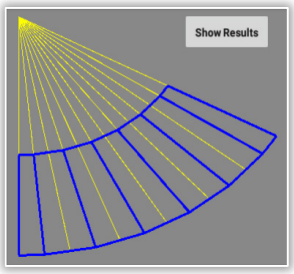


Figure 20. The elbow geometry for γ=60 α=5 no.=7

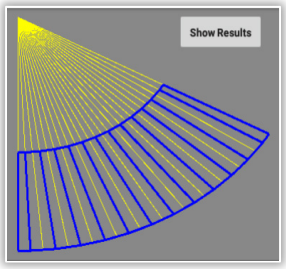


Figure 21. The elbow geometry for γ=60 α=2.5 no.=13

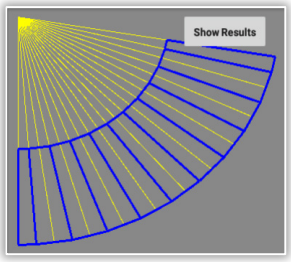


Figure 22. The elbow geometry for γ=80 α=4 no.=11

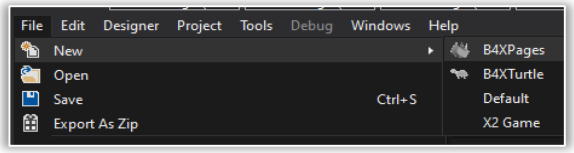
STEPS TO CREATE A B4A APPLICATION

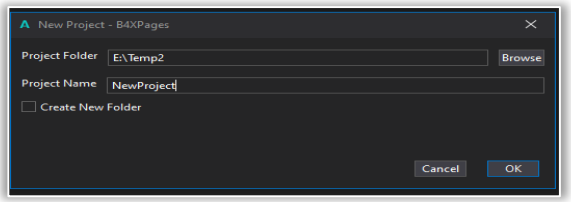
The process of creating a new B4A application must follow the next steps:

- load the B4A IDE environment with click on B4A icon;
- from B4A main menu select File → New → BXPages; in the New Project window specify the Project Folder and Project Name, Figure 23;
- the structure folder from Figure 23 is created; the three folders B4A, B4i and B4J include the codes required to create applications for Android, IOS, computers (Windows, Linux platforms) respectively; in the B4A folder there is the "Files" folder containing the files created with the Visual Designer and files used during the execution of the code, like images or videos; also the mainpage.bal file was created automatically, while the Shared Files

folder includes files that the three different type applications can share;

- also, the B4XMainPage is created with minimal code included, Figure 24, saved in B4XMainPage.bas file; the B4XMainPage is always the user's first contact form with the application;
- to insert new pages select from the menu Project → Add New Module → Class Module → B4XPage and give it the desired name; a number of pages can be created function the application requirements;
- from B4A main menu select Tools → Run AVD Manager; in this environment it is possible to create many emulated devices configuration with different hardware specifications and screen resolutions [10]; to connect to a emulated device select WYSIWYG → Connect option menu from Visual Designer;
- to open the Visual Designer select from the menu Designer – Open Designer; the mainpage.bal file is open with a minimal interface containing only Button1 control placed in the Activity, Figure 25; other controls can be placed on this view or others views used Add View option menu from Visual Designer interface;
- click on  icon from B4A main menu or press F5 keyboard taste to start the compiling process;
- after a successful code compilation, B4A will look for any selected emulated device or a real devices which have been connected to the computer and will provide a list of those devices; the real or emulated device can be selected from that list to run the compiled code.





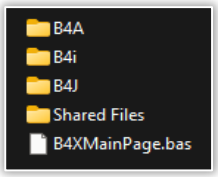


Figure 23. Create a new project

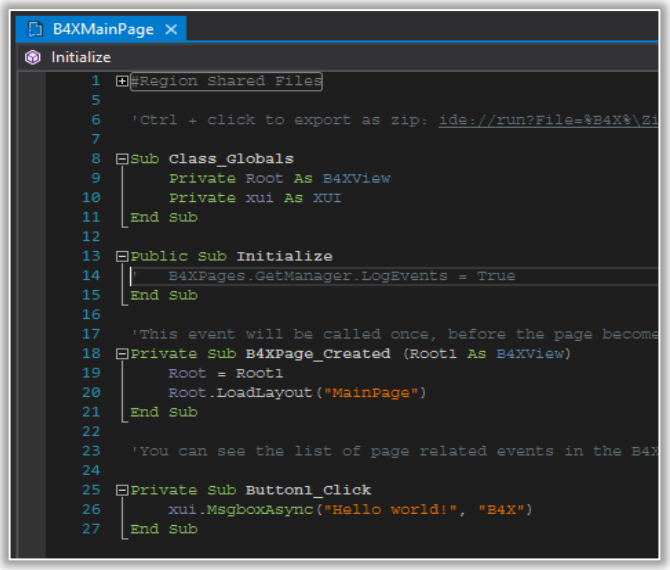


Figure 24. The B4XMainPage

The left side of Visual Designer from Figure 25 show a preview of the controls placed in the Activity window, while the right side contain the list of control placed in the view; click on any control will activate the properties of the selected control like: Name, Type, Event Name, Parent and others; these properties depend of the selected type control and can be modified by the programmer; also, the Script – General window can be used to define the controls position with code lines. The "Files" folder can be used to add images or icons used in the view. The "Variants" folder can be used to define different screen sizes and orientations of the emulator; so it is possible to create multiple layout variants, one to match every different device, and to adapt to changes in device orientation.[11]

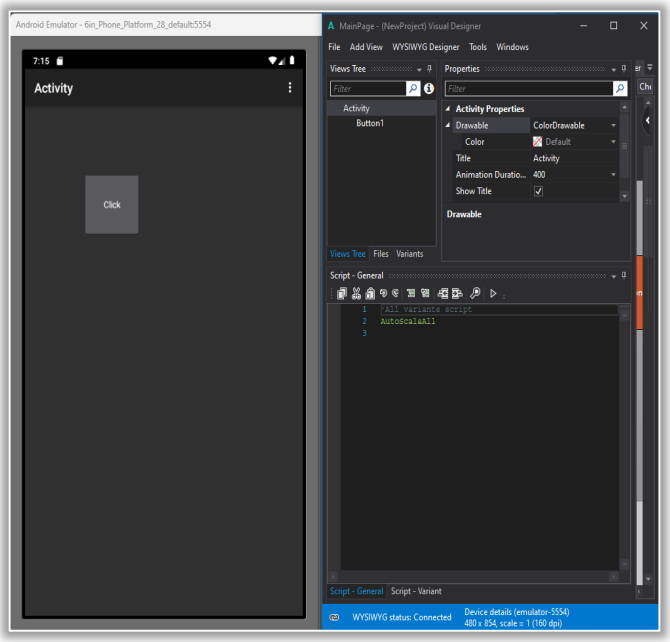


Figure 25. The mainpage interface in Visual Designer

CONCLUSIONS

The application was created in Basic4Android software and can be run on smartphones type only.

The limits of this paper length do not allow detailing all modules, but the application's complete code is available for download as zip file "'"UnfoldSheetsParts–Project.zip" from reference [4] at "Programming" section.

References

[1] *** Streamlit How is Streamlit works? https://streamlit.io/
[2] *** Guides for B4A, How to work with B4XVisualDesigner? https://www.b4x.com/guides/B4XVisualDesigner.html
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[4] *** Autors application built by Streamlit https://dorian–nedelcu.streamlit.app/
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Note: This paper was presented at **International Conference on Applied Sciences – ICAS2024**, organized by University Politehnica Timisoara, Faculty of Engineering Hunedoara (ROMANIA) and University Vitez, Travnik (BOSNIA & HERZEGOVINA), from May 30 to June 1, 2024, in Travnik (BOSNIA & HERZEGOVINA).

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