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Techniques To Create Customised Documents And Android Apps From latex Files And Impact Of Developed Android Applications

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Abstract

There are several ICT tools to teach Mathematics. A vast amount of e-content is available for higher mathematics. One of the handiest ICT tools is smartphones for students and teachers of mathematics. A significant proportion of smartphone users are android based. LaTeX is one of the most widely used typesetting systems for scientific publications. There are no easy ways to create Android Apps from LaTeX files. The research aims to present techniques we developed for creating android apps from LaTeX files. We have developed unique techniques to create Android Apps from LaTeX files. The outline of developed techniques and their impact are discussed in this research paper.

Keywords: LaTeX, Mathematical Software, Web Applications, Android Applications, Teaching Tools, Higher Mathematics

1. EXISTING OPTIONS OF PUBLISHING MATHEMATICAL CONTENT ON THE WORLD WIDE WEB (WWW) AND CREATING WEB APPS:

This section reviews and compares different Mathematics publishing options on World Wide Web. Various features of different publishing options are discussed. System requirements, outputs, and ease of use are compared. Beginning with the classical option of converting mathematics content into images, it also includes recently developed options such as KaTeX. The different methods of publishing mathematics content are discussed in subsections of this section.

1.1 Converting Mathematics Content into Images: This method converts mathematics content (formulae, expressions, and equations) into images. The output may be in jpeg, png, gif, or svg format. There are different ways to do these. Roger's Online Equation Editor [13] also offers the same. The followings are some utilities/tools for generating images of mathematical content.

- Online equation editors: Server-side scripts convert mathematics content into images. Some websites such as latex4technics [5] and codecogs [4] offer these.
- Offline equation editors are available for different platforms. For example, the freeware program "Latex Equation Editor" [8] is available for the Windows platform to convert mathematical content into images.

- Different packages in LaTeX. For example, the package latex2html [9] converts all mathematics content into images when the parameter No SIMPLE MATH is set.
- PhpMathPublisher: With PhpMathPublisher [12], every mathematical expression is transformed into an image by a PHP script which returns the corresponding HTML code. It creates cross-browser pages. It is simple to install and use. The visitor has nothing to install on his system: neither fonts nor plugins.

1.2 MathML: MathML [11] is a low-level specification for mathematical and scientific content on the World Wide Web. MathML can be categorized as an application of XML. So browsers can render mathematical expressions natively. Many browsers smoothly support MathML. Several applets and plugins are available to render mathematics content into browsers and online applications. Many online utilities and software are MathML enabled. They support input and output in MathML mode. To write MathML, one does not need more than a text editor. However, there are many tools available that make it easier with the graphical user interface.

1.3 ASCIIMathML: ASCIIMathML [2] includes all common symbols, sets, functions, and operators. It includes matrices, determinants, vectors, limits, derivatives, and integration. ASCIIMathML has no dependencies. It is one of the most accessible options for publishing mathematics content on the World Wide Web.

1.4 jsMath: The jsMath [6] tool makes it possible to include mathematical content on World Wide Web.jsMath uses native TeX fonts. It helps to display mathematical content natively and dynamically in browsers. There is no need to pre-process mathematical content that is typed in LaTeX. It is thus independent of the arrangement of web pages. The web pages may be modified independently. On the server side, it needs the installation of TeX fonts. If they are unavailable on a server, it falls back on image-based or Unicode fonts. A small set of controls is displayed floatingly to users for selecting processing methods and display settings. The jsMath package is based on the TeX mathematics layout engine. As it is based on TeX fonts, the output is very close to the TeX output after the compilation of TeX Files to DVI or PDF format.

1.5 MathJax: MathJax[10] is an open-source JavaScript display engine for LaTeX, MathML, and AsciiMath. It is compatible with all standard browsers. It is designed with the recent advances in web technologies. It is a single, definitive web platform supporting mathematics content across major browsers and operating systems. It also supports mathematics content on mobile devices. It requires no setup on the user's part (no plugins to download or software to install). One includes MathJax as a resource in a webpage or application. It is the most widely used option for publishing mathematics on World Wide Web.

1.6 KaTeX: Ben Alpert and Emily Eisenberg at Khan Academy have released a promising new way to deliver math on the Web called KaTeX[7]. It is a competitor to MathJax though lagging in many respects. KaTeX produces mathematical content much faster than MathJax mainly because it does not need to re-flow the page. It has cross-browser support like MathJax. Not all features are available as it is under development.

2. CUSTOMISED DOCUMENTS USING MAKE4HT, LUA AND MATHJAX

It is possible to produce Customised documents using Make4ht, Lua, and Mathjax. The pre-compilation of mathematical content into plain HTML with Mathjax fonts is possible. Authors have successfully developed and implemented techniques for creating Customised documents from LaTeX files. Figure 1 describes techniques for creating Customised documents from LaTeX files. The technique is based on the make4ht package, which comes bundled with popular TeX distributions such as TeXLive or MikTeX.

Figure 1: Creating Customised Documents from LaTeX files

Table 1 provides examples of Customised documents produced from LaTeX files using developed techniques.

Title of Customised Document	Link on World Wide Web
Foundations of Mathematics	http://www.kthmcollege.ac.in/Data/Fom%20Web%20App/webfom.html
Sequences of Real Numbers	http://www.kthmcollege.ac.in/Data/Sequences%20Topics%20and%20Problems%20Web%20App/seqtopics.html
Examples on Sequences of Real Numbers	http://www.kthmcollege.ac.in/Data/Sequences%20Topics%20and%20Problems%20Web%20App/seqprmore.html

Table 1: Customised Documents from LaTeX files

After implementing existing techniques, it can be concluded that the implemented technique is the best option for creating Customised documents from LaTeX files. This is for the following reasons.

- The rendering of the pre-compiled mathematical font in browsers is speedy.
- There are almost no flaws in compiled mathematical content.
- The customisations in a produced HTML document are easily possible with custom configuration files.
- The customised documents can readily be extended to web applications with other resources such as CSS, javascript, and jquery.
- The entire technique can be used in offline mode without need of online resources.

3. TECHNIQUES FOR CREATING WEB AND ANDROIDAPPLICATIONS:

Figure 2 describes the outline of developing Android Apps from LaTeX files. This technique is introduced by authors and has been successfully implemented for producing android apps from LaTeX files.

Figure 2: Creating Web and Android Apps from LaTeX file

Many techniques can be used to produce android applications from Customised documents or web applications [3]. One of the techniques to create android apps from latex files is to use the webview class. The WebView class [1] is an extension of android's web view class. The hierarchy of the android webview class in the java platform of android is given in Figure 3.

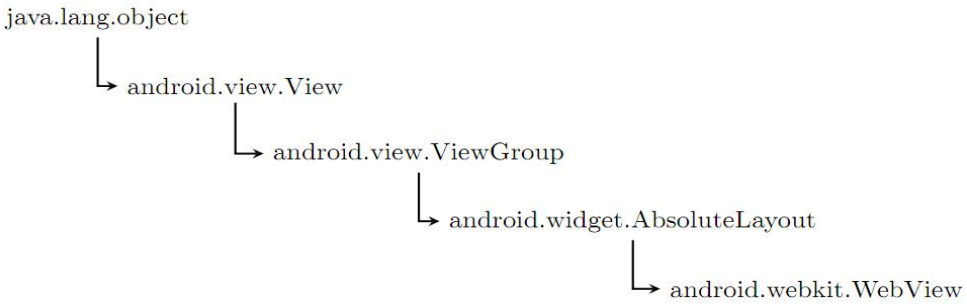

Figure 3: Android WebView Class

4. EXAMPLES OF ANDROID APPLICATIONSCREATED USING TECHNIQUE:

Table 2 provides links to android apps developed by us on Google Play Store and their brief description.

App	Link on Google Play Store
LaTeX in Easy Tutorials	https://play.google.com/store/apps/details?id=com.unimaths.latex
Business Mathematics and Statistics	https://play.google.com/store/apps/details?id=com.unimaths.bmathsstats
Sequences of Real Numbers	https://play.google.com/store/apps/details?id=com.unimaths.realseq
Euclidean Algorithm	https://play.google.com/store/apps/details?id=com.unimaths.euclid
Foundations of Mathematics	https://play.google.com/store/apps/details?id=com.unimaths.fomaths

sageMath Course	https://play.google.com/store/apps/details?id=com.unimaths.sagemath
Calculus : Graphical Approach	https://play.google.com/store/apps/details?id=com.unimaths.calculus
Primes between Two Numbers	https://play.google.com/store/apps/details?id=com.unimaths.primes

Table 2: Android Apps Created Using Developed Technique

5. IMPACTS OF DEVELOPED ANDROID APPLICATIONS:

Table 3 summarizes number of installs by users and average rating given by users. The average rating is 4.3 and overall there have been thousands of downloads and installs of android apps by android users across the globe (source: Google Play Store and Google Console for Play Store).

App	Installs	Average Rating out of 5
LaTeX in Easy Tutorials	50,000+	4.6
Business Mathematics and Statistics	50,000+	2.9
Sequences of Real Numbers	5,000+	4.2
Euclidean Algorithm : GCD and Linear Combination	1,000+	4.8
Foundations of Mathematics	1,000+	-
sageMath Course	1,000+	4.3
Calculus : Graphical Approach	500+	5.0
Primes between Two Numbers	100+	-

Table 3: No. of Downloads and Average Rating of Android Apps

6. ADVANTAGES OF TECHNIQUES DEVELOPED AND METHODS USED

The techniques and methods used in research work do not need special resources. All the techniques are platform-independent and work on most standard operating systems, including Microsoft Windows, Linux and its derived versions, and Macintosh. The technique mainly uses Lua and LaTeX, which are platform-independent and do not need strong hardware resources. No proprietary software and tools are used in the research work. All tools are freeware and open source. The entire research work is made available as freeware and open source. This is important as the carried research work can further be extended without restrictions. This is within the philosophy of open source and freeware tools available for the mathematics community.

7. CONCLUSIONS

Techniques developed make use of only freeware tools. Some Android apps have been developed from developed techniques. These apps created some good impact, and some have received thousands of downloads with hundreds of positive reviews. The developed Android apps are handy tools that can be used effectively during classroom teaching and student interaction.

REFERENCES

1. Android WebView Class, URL: https://developer.android.com/reference/android/webkit/WebView (visited on 20/05/2021).
2. ASCIIMathML webpage, URL: http://asciimath.org (visited on 06/01/2022).
3. [3] Create your own applied mathematics software for Android mobile device, B.V. Cioruta, M. Coman: Nov. 2018, ISBN: 978-620-2-31631-6, URL: https://www.researchgate.net/publication/328967784 (visited on 18/01/2022).
4. Equation editor on codecogs website,URL: https://www.codecogs.com/latex/eqneditor.php (visited on 20/04/2022).
5. Equation editor on latex4technics website, URL: https://www.latex4technics.com (visited on 04/20/2022).
6. jsMath: Including Mathematics in Web Pages, 2004, URL: https://www.math.union.edu/~dpvc/jsMath (visited on 03/06/2022).
7. KaTeX tool, URL: https://khan.github.io/KaTeX (visited on 03/01/2022).
8. LaTeX equation editor, URL: https://sourceforge.net/projects/latexeqedit (visited on 04/20/2022).
9. latex2html package, 2015, URL: https://ctan.org/pkg/latex2html?lang=en (visited on 22/02/2022).

10. MathJax resources, URL: http://www.mathjax.org (visited on 03/01/2022).
11. MathML on W3org, URL: https://www.w3.org/Math (visited on 01/04/2022).
12. PhpMathPublisher tool, URL: https://docs.openeclass.org/mathpublisherdoc/help.html(visited on 20/ 04/2022).
13. Roger's Online Equation Editor, URL: http://rogercortesi.com/eqn (visited on 20/04/2022).