

Building an app that can provide solutions to large equations

Manash Das¹, Sulekha Das²

¹Student Dept. of ECE, Techno Engineering College, Banipur, Kolkata-124, India

²Assistant Prof. Dept. of CSE, Techno Engineering College, Banipur, Kolkata-124, India

Abstract: The android application calculator “EquSol” is an android app that is useful for students, teachers as well as research-related work. Our engineers have to perform lots of calculations but there is no such calculator that is developed keeping in mind about engineers or for researchers as they have to perform large calculations and also wants all the important operations at their fingertips. We have developed a calculator application named “EquSol” that can solve both linear equations up to 25 unknown variables and polynomial equations up to the highest degree of 25. All the necessary operations that are usually used by engineers will be at their fingertips. We have used a library “mXparser” for carrying out all the basic operations.

Keywords: Android, Linear Equation, Polynomial Equation, Researchers, mXparser.

1. INTRODUCTION

The use of this application provides service to all students, teachers, and researchers all around the world. This application provides a complete solution for solving large equations.

When we go for research-related work, we need a calculator that can solve large equations, but unfortunately, there is no such scientific calculator available to us that supports it. When we go for a search of such a calculator, we found calculator applications like “ CalcEs”^[1] and Microsoft “Math”^[2], there is some website like “handyman”^[3]. But every application or websites have their limitations, which is described in section 2.

This application contains many features which we usually didn’t find in the normal calculator. We provide all types of operations in one place making it suitable for the user to perform all kinds of operations. Many more points are discussed in deep in the 3 section.

All the hardware and software requirements required by this application is discussed in the 4 section.

We have implemented a mathematical library “mXparser” for carrying out all the basic operations which will mainly help to check syntax error or any kind of error that a user has done in the equation. This library also helps in finding arithmetic trigonometric operations. We have discussed more it in the 5 section in great detail.

It is a one-stop for calculating all types of calculations. It includes four modes. These modes are a) Simple mode b) Complex mode c) Equation mode d) Converter mode.

Simple mode carries out all the basic calculations on real numbers that are needed by the user on daily basis. Complex mode performs all types of calculations for complex numbers or imaginary numbers like finding argument, rectangular form polar form etc. Equation mode performs all solve polynomial as well as linear equations up to 25 degrees and 25 variable respectively. All this are explained in detail in the 6 section.

2 LIMITATION OF EXISTING SYSTEM

[1] The existing systems aren’t user-friendly lots of functions and operations are jumbled up which makes it inconvenient for the user to work on the application, that it provides solutions up to 5 unknown variables and up to the highest degree of 5. [2][3] Some of the application uses the internet to provide the solution to a given equation. That means no internet no solution.

3 FEATURE OF THIS ANDROID APPLICATION

Our application provides the following features to the user:

- Provides all basic operations and some advance functions in one place.
- No limitation on how long the equation be.
- Provide a solution to linear equation up to 25 unknown variables.
- Provides a solution to degree equation up to the highest degree of 25.
- Provides solutions without using the internet.

4. HARDWARE AND SOFTWARE REQUIREMENTS

Software that is essential for this application:

- Runs on any android platform.
- Android version should be greater than 5.0 (Lollipop).

Hardware that is essential for this application:

- Need space of 40 Mb.

5. MXPARSER LIBRARY

“mXparser” is an open-source mathematical expression parser/evaluator providing abilities to calculate various expression at run time. Expression are given as plain text, then verified in terms of grammar/syntax, finally calculated. Library source code is maintained separately for Java and c#, providing the same API for java/JVM, Android, .NET and Mono. Software is free and distributed under Simplified BSD License.

6. WORKFLOW OF THIS APPLICATION

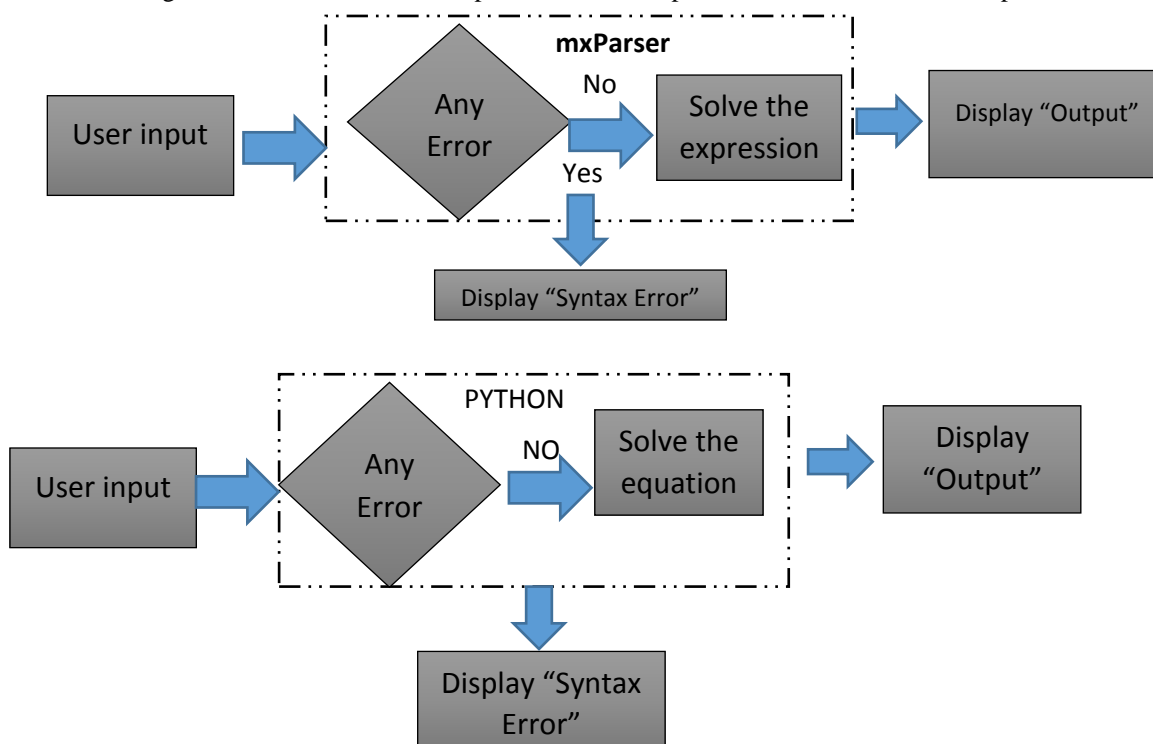
This application is divided into 4 categories. All the categories are described as follow:

A. Simple mode

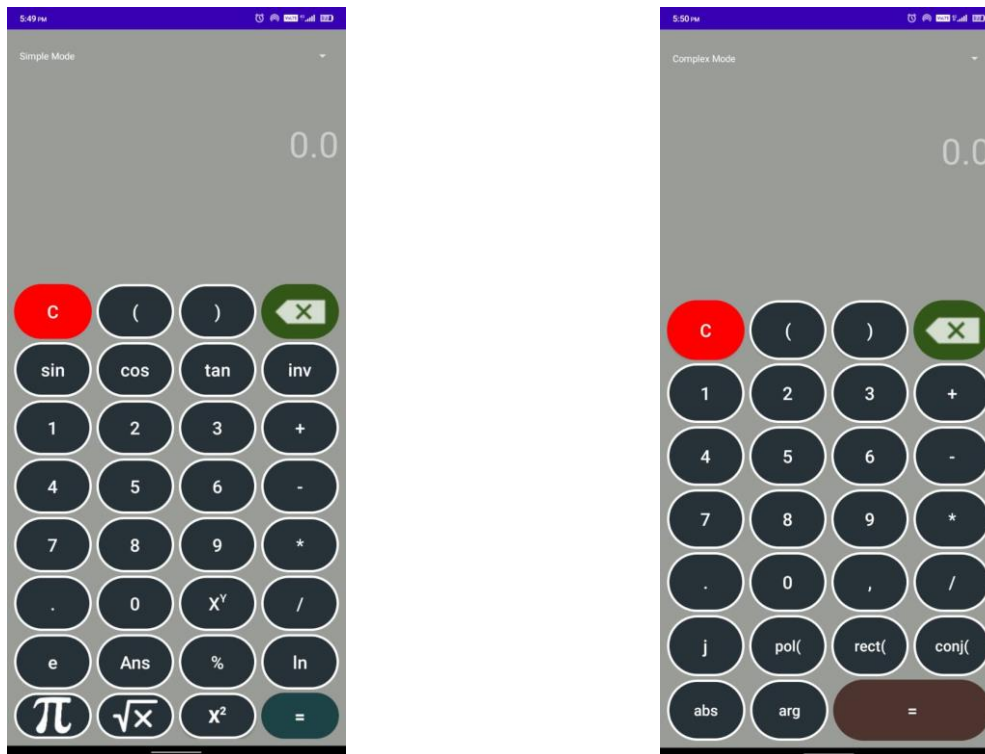
This mode carries out all the basic calculations on real numbers that are needed by the user. This mode includes arithmetic operations, trigonometric operation, logarithm operation, etc. The user provides mathematical expression which is in plain text as the user clicks equal this text is passed to mXparser library. This provides a solution to that expression.

B. Complex mode:

This mode carries out all the operations on the complex or imaginary number. This mode includes conversion of polar form to rectangular form or vice versa, an operation like sum, product, division, etc. of a complex number. We have used



python inbuilt library “math” in the backend to provide a solution to the given expression.



C. Equation mode:

This mode carries out all the equation-related problems like polynomial and degree equations. This can provide solutions to linear algebra up to 25 unknown variables and degree equations up to the highest degree of 25. We just have to input the coefficients of the equation and this will provide the solution to that. This is not only limited to real number solutions but it can also solve if the solution is complex. We have used here python module “NumPy” to find the solution to the given equation.

Let’s see how it works, at first, we have to choose degree equation or linear algebra. If we choose a linear equation it will ask how many unknown variables are in the equation or else it will ask what the highest degree of the equation is. Then we have to provide coefficients of the equation accordingly. This data or coefficients will be provided to the python module “NumPy”. We have used three functions of this module “roots()”, “matmul()” and “linalg.inv()”.

The function “roots()” is used to find the solution to linear algebra. Matmul() to find the multiplication of two matrices.

Linalg.inv() is used to find the inverse of a matrix.

Say we have to find solution of a polynomial equation of three unknown x_1 , x_2 and x_3

$$ax_1 + bx_2 + cx_3 = d$$

$$ex_1 + fx_2 + gx_3 = h$$

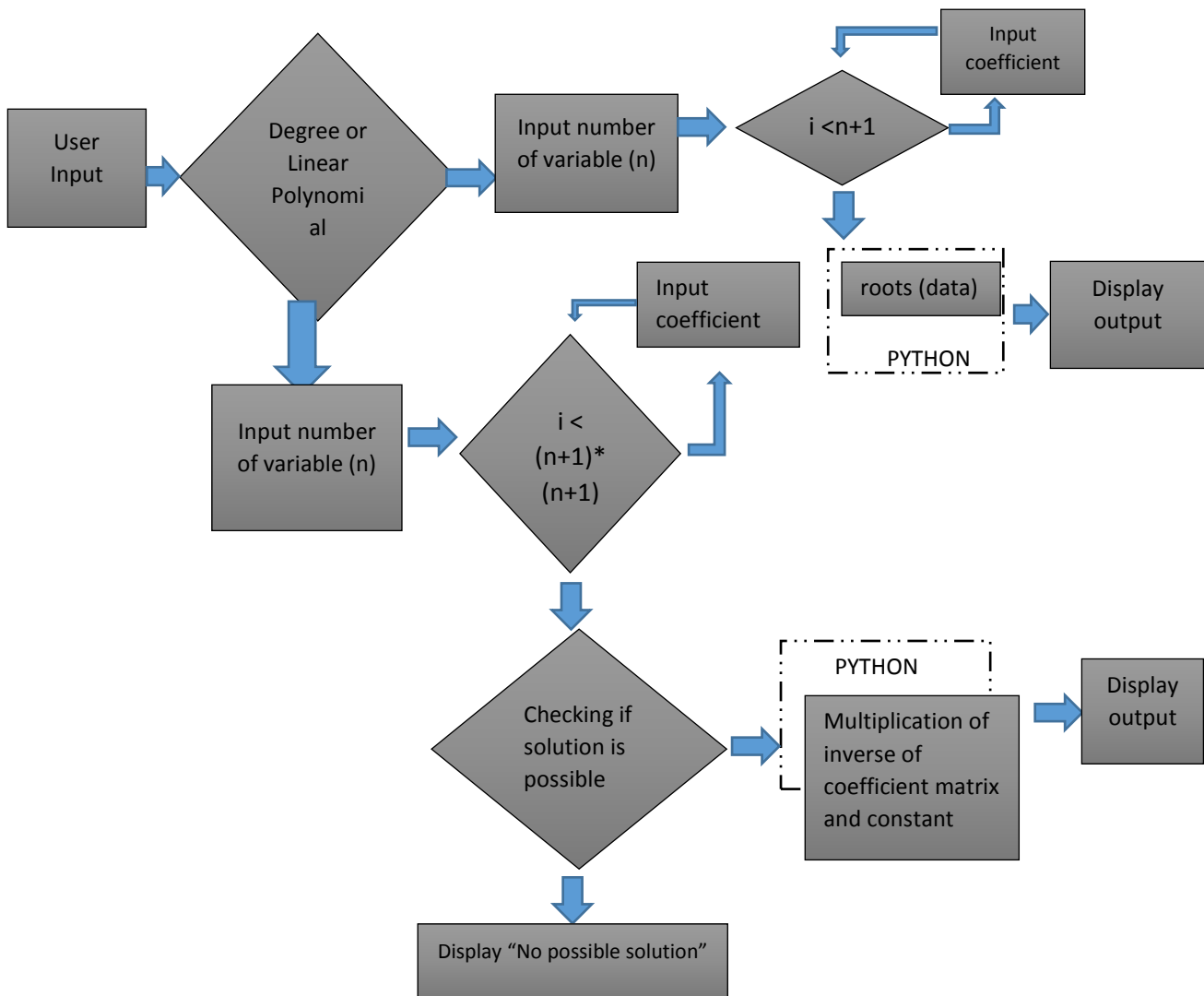
$$ix_1 + jx_2 + kx_3 = l$$

Converting in a matrix form we get

$$\begin{bmatrix} d \\ h \\ l \end{bmatrix} = \begin{bmatrix} a & b & c \\ e & f & g \\ i & j & k \end{bmatrix} * \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

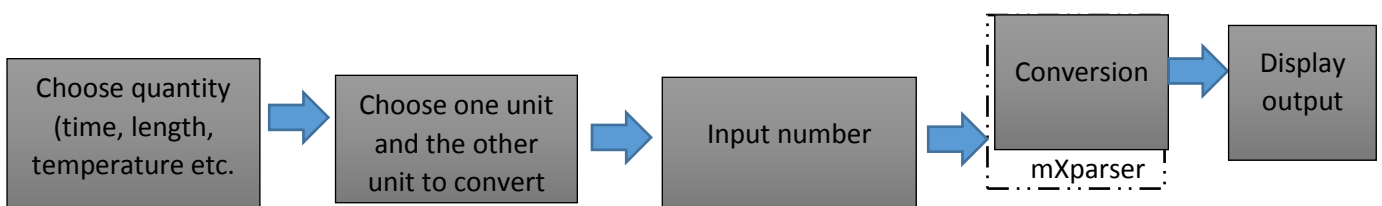
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} a & b & c \\ e & f & g \\ i & j & k \end{bmatrix}^{-1} * \begin{bmatrix} d \\ h \\ l \end{bmatrix}$$

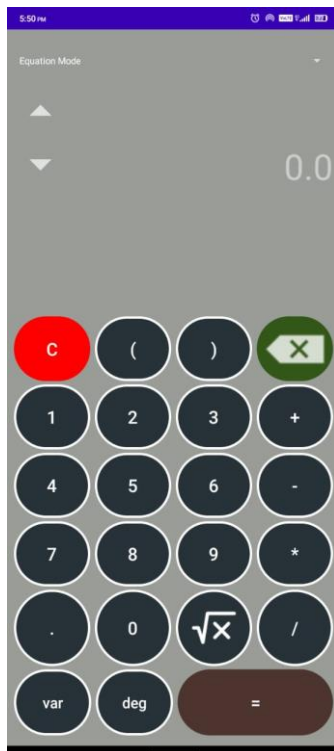
Solving this we get the values of x_1 , x_2 and x_3 . All operations are performed by python using `linalg.inv()` to find the inverse of the matrix and `matmul()` to multiply the resultant matrix with another matrix. In this way, we get the solution of the equation.



D. Unit Converter

This mode helps in the conversion of one unit to other. This supports a wide range of quantities like length, number system, temperature, time, weight, etc. This mode uses `mXparser` library to convert one unit to other.





VI. CONCLUSION

Our calculator “EquSol” is an easy-to-use and user-friendly application. It is a one-stop for many kinds of equations. It can solve basic expressions, complex numbers, linear equations, degree equations and also provides a converter. We don’t have to use multiple calculators to do a different operations. It provides a solution without using any internet.