VOID WALKERS

PHOTOGRAPH

A Camera-based OCR app that solves and graphs mathematical expressions as well as performs operations on matrices.

OVERVIEW

We've created an Android application that scans a hand-written mathematical expression (eg- quadratic equations, matrices, simultaneous equations etc.) and processes them to produce suitable results, including graphs. You can also perform various operations on input matrices.

LIST OF FEATURES

Support for:
1) Quadratic/Polynomial equations
2) System of linear equations in two variables
3) Integration
4) Differentiation
5) Summation
6) Inequalities

Matrix-based operations, including:
1) Matrix Multiplication
3) Determinant calculation
4) Adjoint Calculation
5) Inversion
6) Eigenvalue and eigenvector calculation

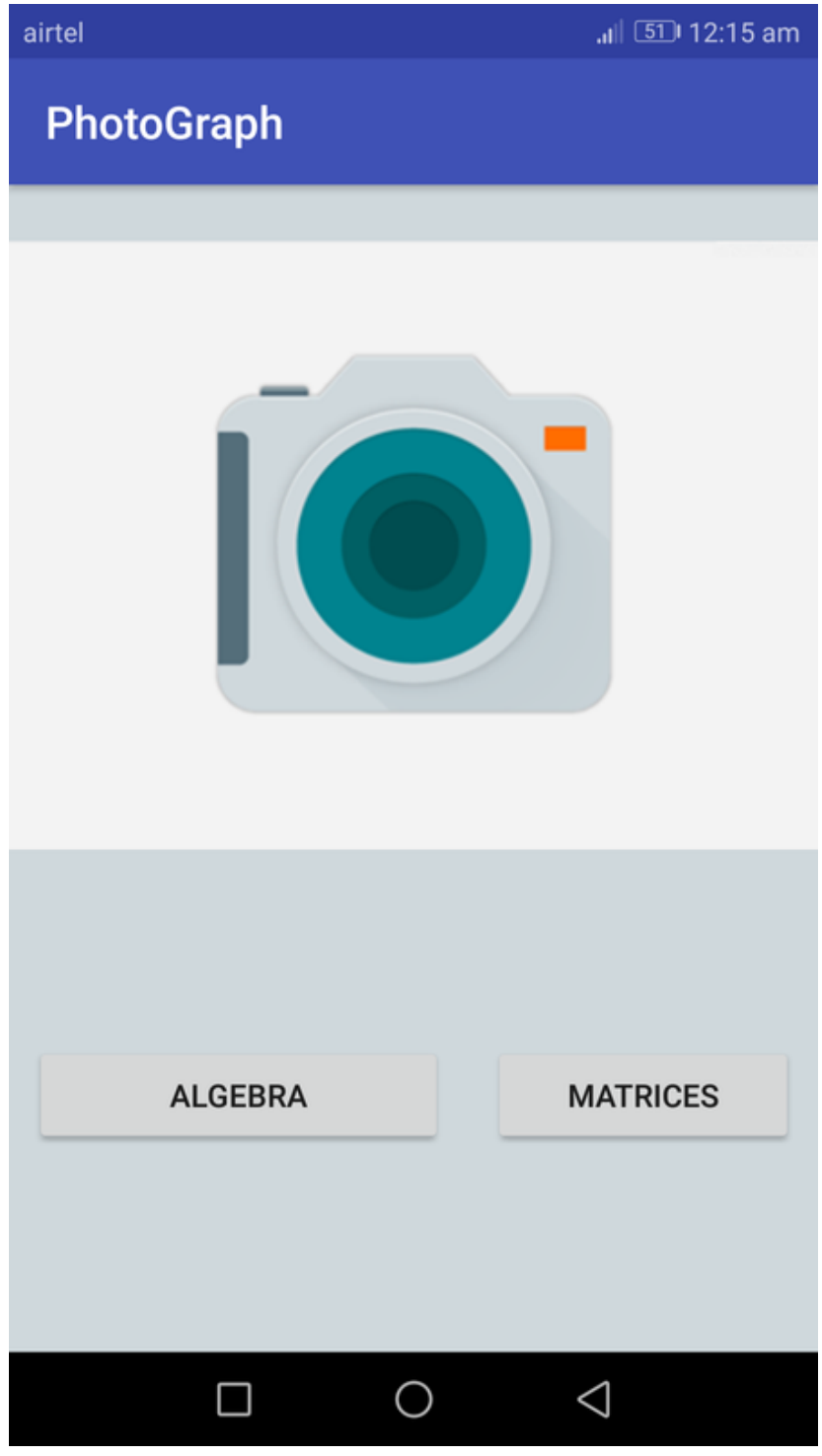
In case an unsupported input format is encountered, the admin is notified via e-mail and the user is shown the output from the WolframAlpha webpage.

THE MAIN PAGE

The main screen provides two buttons which allow access to the two main fragments of the app, "AlgebraFragment" and "MatrixFragment".

"MatrixFragment" handles all the matrix-based functionalities. It allows us to scan multiple matrices and perform the aforementioned operations on them.

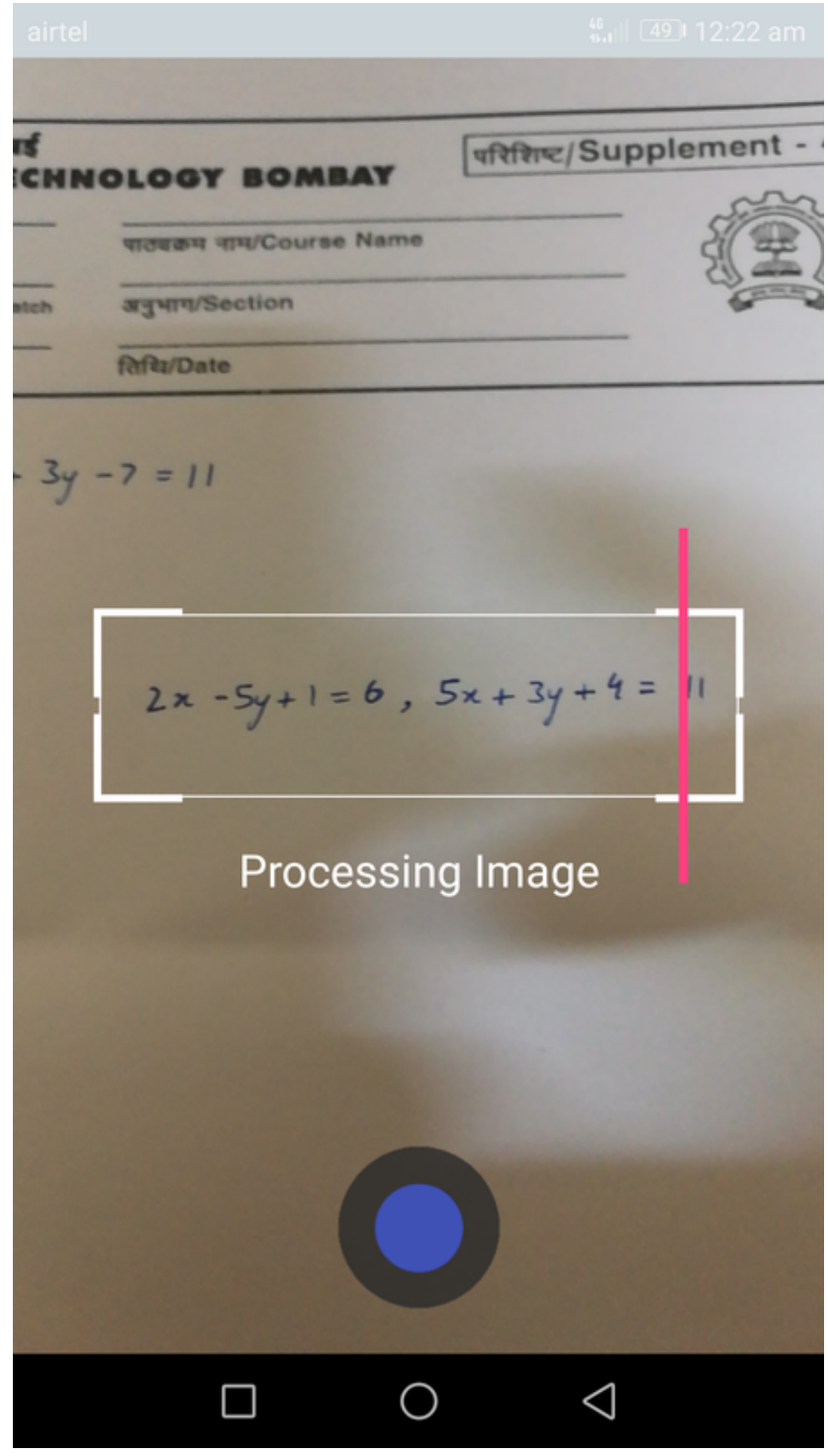
"AlgebraFragment" handles all the other regular functionalities. We can scan single mathematical equations or simultaneous linear equations and solve and graph them.



THE SCANNER FRAGMENT

The Scanner Fragment handles the OCR functionalities. This is crucial for both the Algebra and Matrix fragments as their input is generated by this.

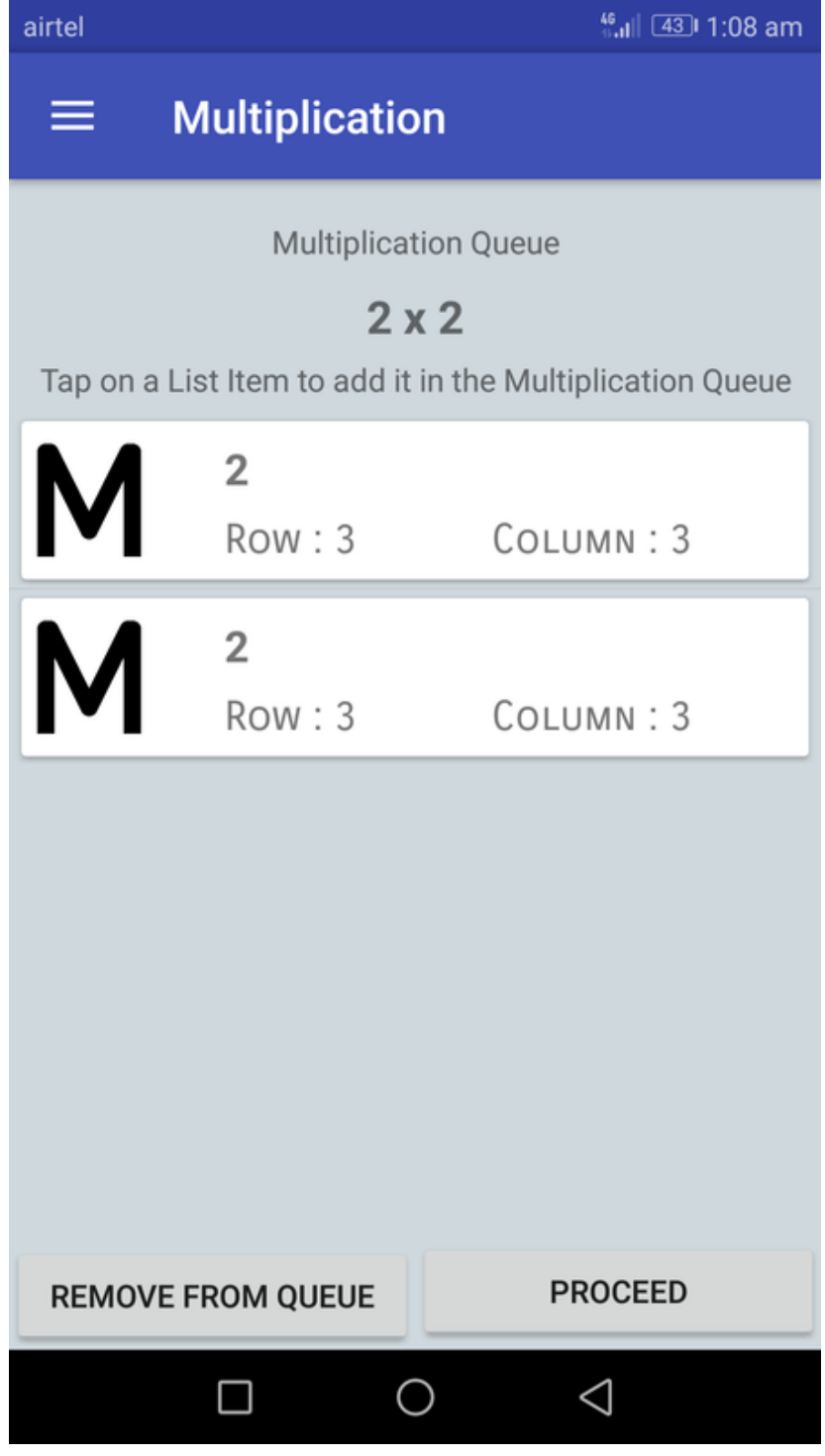
After an image of the expression is captured and cropped, a request is sent to the MathPix API. The API returns a Latex string representing the input. This is then passed on to the appropriate fragment.



THE MATRIX FRAGMENT

On pressing the "Matrix" button on the main screen, the MatrixFragment is launched.

The MatrixFragment allows us to scan multiple matrices and store them in memory. They can be deleted from the list by long-pressing on the entry. Once the desired number of entries are obtained, we can perform any of the numerous supported operations on them.

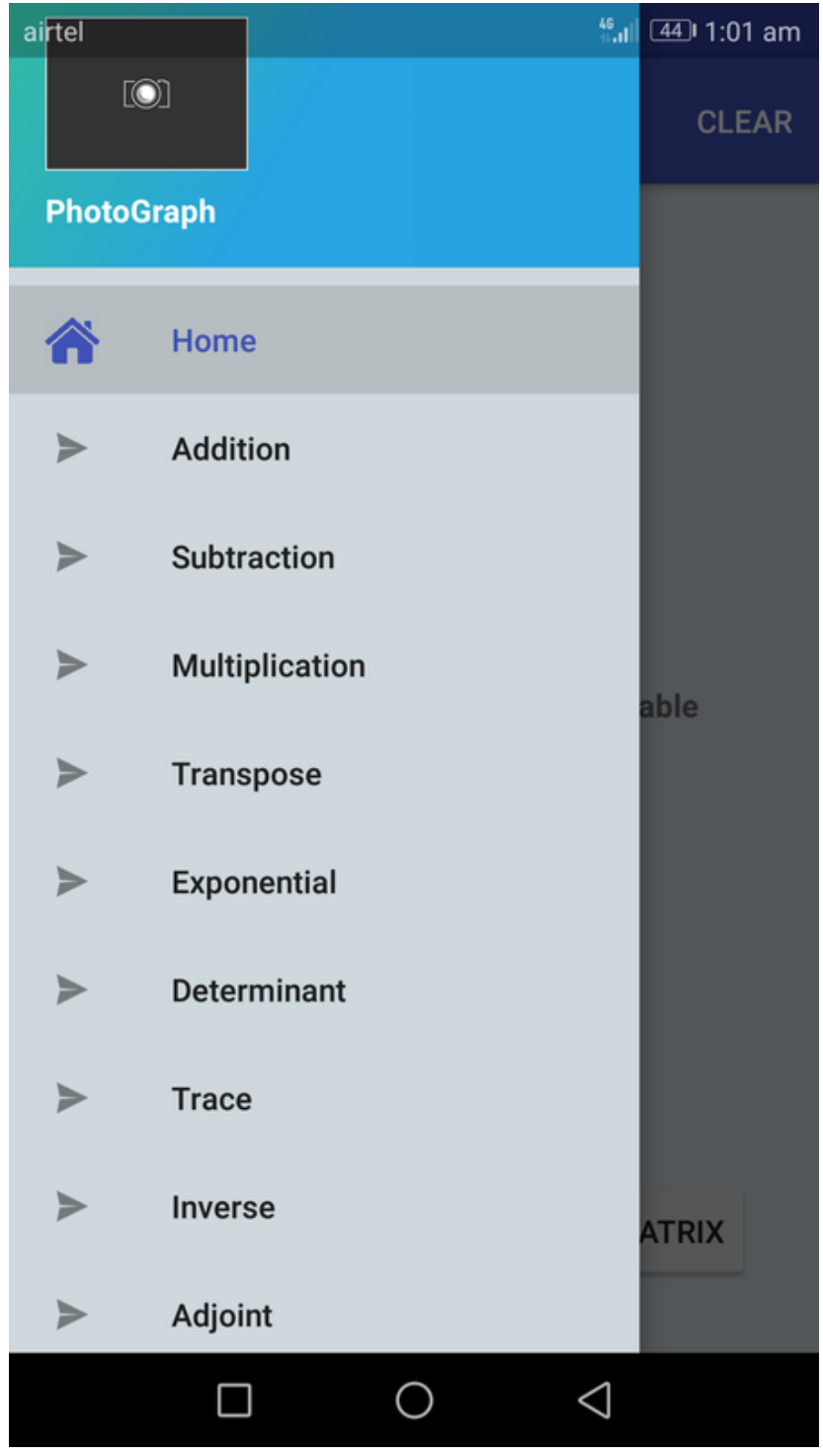


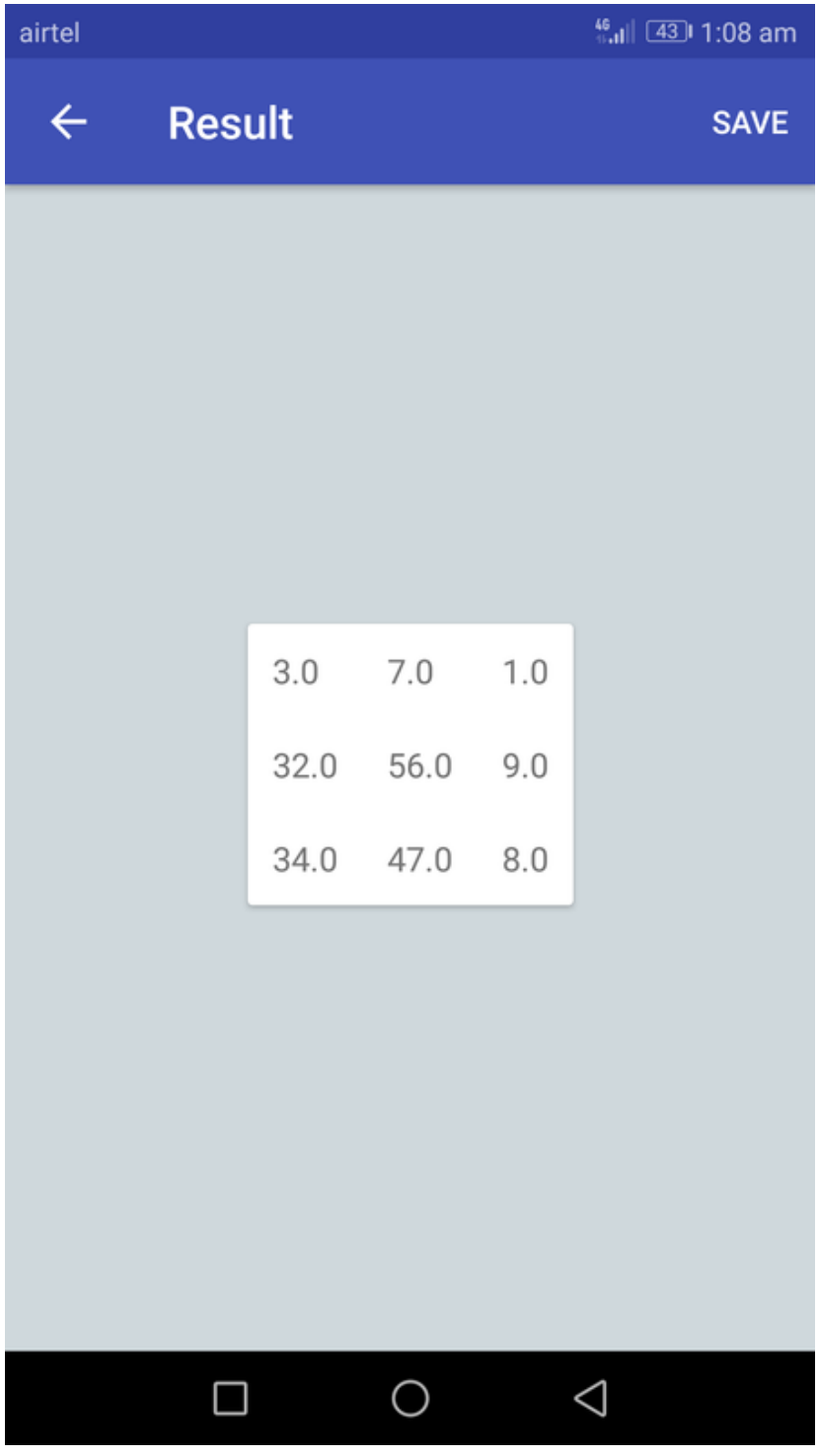
Accessing the drawer from the left side of the screen allows us to choose a suitable operation,

After selecting one of the operations available, we can select the arguments from any of our saved matrices.

The same operation can be applied to multiple matrices as the current app state is saved.

The output (number or matrix) is then displayed on the app screen.





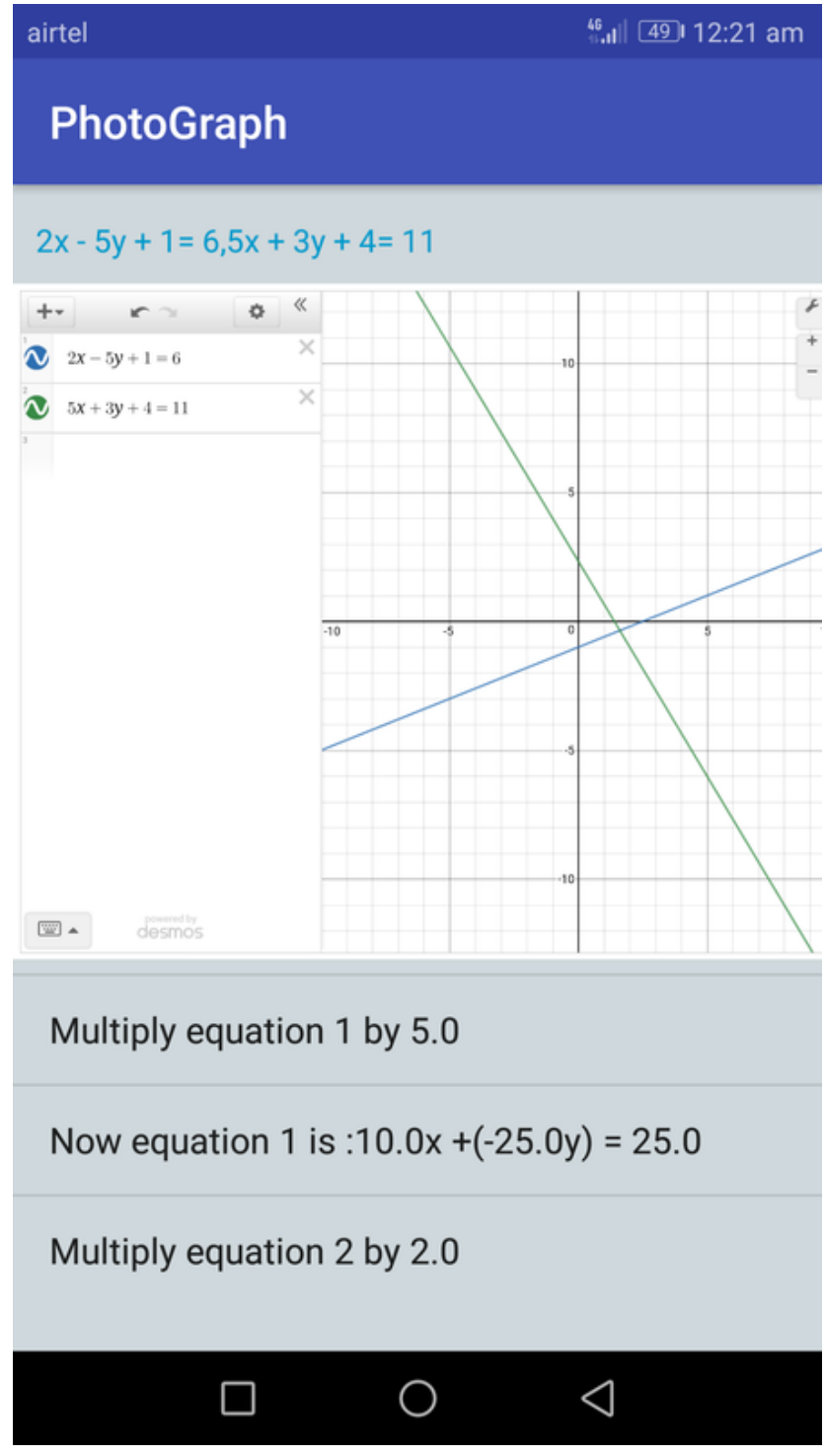
The output is then displayed on the app screen. It may be in the form of a number or a matrix depending on the operation.

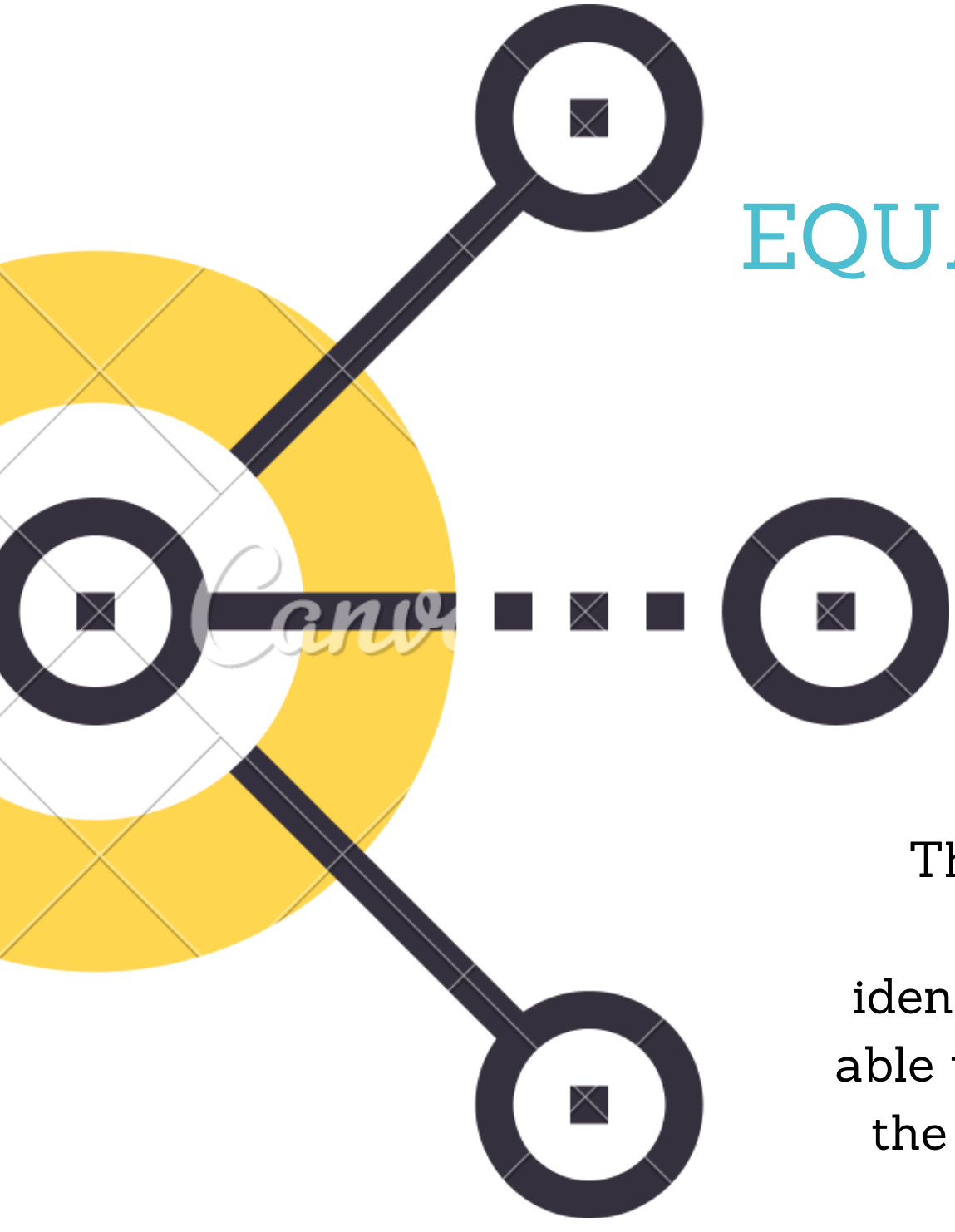
THE ALGEBRA FRAGMENT

On pressing the "Algebra" button on the main screen, the AlgebraFragment is launched following the ScannerFragment.

The AlgebraFragment processes the input string to identify the type of expression represented by the input string. It then launches the appropriate activity that handles the input suitably, producing graphs and step-by-step solutions whenever possible.

Currently, quadratic equations and system of linear equations are supported.



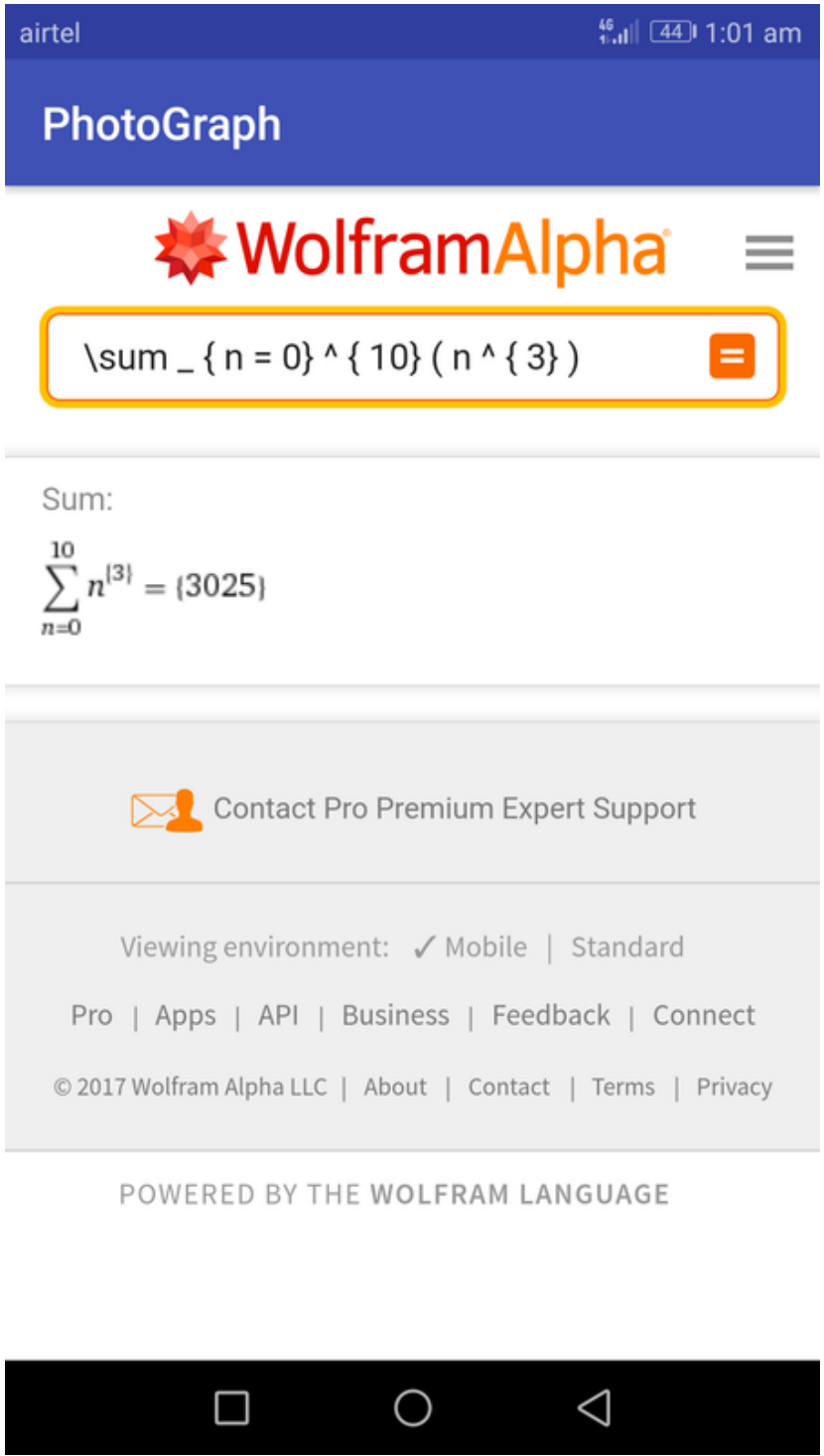


THE EQUATIONSOLVER

The regex template matching is performed by this activity to identify the equation format. If it's able to do so, it directs the input to the relevant activity, else it sends the input to WolframAlpha.

IN CASE THE TEMPLATE ISN'T RECOGNIZED...

If the input of an algebraic expression is in a format that isn't recognized by the equation solver, the app allows the user to send a request to the admin to update the app to support said expression. It then redirects the user to a WolframAlpha page.



THE WOLFRAMALPHA OUTPUT PAGE

The user is shown the output generated by WolframAlpha in a WebView after the query is sent to the admin. He/she can then choose to return to the main page and continue using the application