

APPLICATION NOTE

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StanXY: standard curve app for Android

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StanXY is a free standalone native Android application. It is developed to provide convenience and efficiency to graph plotting. By simply downloading the application, StanXY provides the portability to easily plot graphs on the go as compared to manual plotting and desktop graphing software. The StanXY generates a best fit line based on a set of coordinates entered by the user. The equation of the line ($y = mx + c$) and its coefficient of determination (R^2) are calculated and displayed. With the generated line of best fit, the application allows users to enter a known X or Y coordinate to determine the corresponding unknown Y or X value. Its customisable features include 2 graph colour display and line thickness. The StanXY application allows plotting graphs and calculating unknown values on-the-go in a convenient and efficient way.

Introduction

Line graphs are indispensable visual representations of linear relationships between variables. Commonly used in science to quantify unknown concentrations in samples from known standards, it plays an integral role in biomolecule/chemical quantification (e.g. Bradford assay for proteins). It is also used to display trends and data changes, or even extrapolated to predict outcomes. As such, its use extends beyond experimental sciences and statistics to school education. While computers can do the graph plotting accurately, much improvement remains for its portability and accessibility. This is particularly useful for outdoor field tests (e.g. environmental monitoring) where desktop access are limited. Thus StanXY is an efficient and portable solution that speeds up the graphing process and reduces human error.

Smartphone applications making data gathering and analysis easier have become increasingly popular in research (www.biospectrumasia.com/biospectrum/opinion/220592/use-smartphone-apps-biomedical-research). They can be exploited to plot graphs quickly with full portability, thus boosting productivity. Other examples of apps that improves research productivity include DNAApp (Nguyen et al. 2014), GelApp (Sim et al. 2015), the latter

transforms the smartphone into a Gel-Documentation equipment and improves accuracy of experiments (Ling et al. 2015). These applications are not only used for on spot graphing analysis by scientists and engineers, but also applicable in educational institutes for science students.

Riding on the smartphone and mobile devices, StanXY conveniently, efficiently and accurately plots graphs with a minimalist user interface. Users need to only key in the known X and Y coordinates and the unit labels for both axes and press the “Tabulate graph” button. StanXY will plot the points and generate a straight line graph (Fig. 1). Users can zoom in and out by pinching in and out on the graph. Unknown values can then be keyed in and the unknown determined immediately. Both the equation and coefficient of determination of the line of best fit are also provided for reports, all within a few seconds. For better visualization, users can customise the graph by changing the thickness of the line and the background colour of the graph based on the 2 available themes (default/contrast). This can then be captured using the screenshot function of the mobile devices and be included in reports.

To ensure functionality regardless of internet connectivity, these features are all built into the app without the need for a mobile network/WIFI or access to multiple websites.

Material and methods

StanXY for Android was developed using version 4.2 of the Eclipse Integrated Development Environment, Juno,

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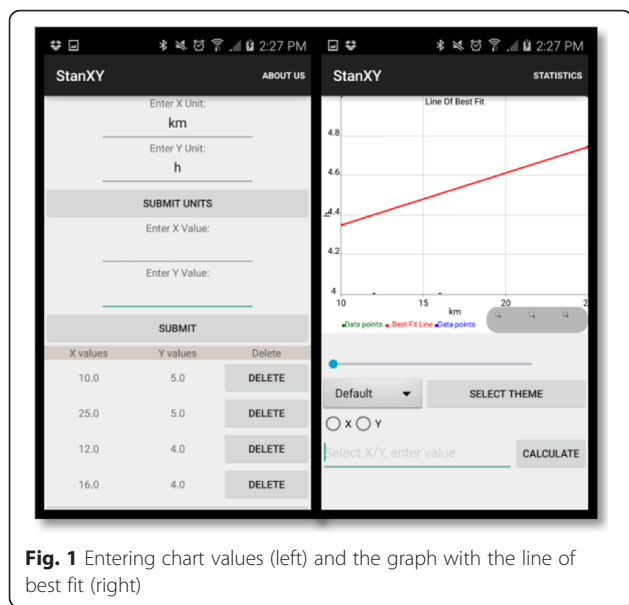


Fig. 1 Entering chart values (left) and the graph with the line of best fit (right)

and 'AChartEngine, developed by 4ViewSoft (<http://www.achartengine.org/>). 'AChartEngine' is licensed under the Code Project Open License ((CPOL) 1.02).

The coefficient of determination (R^2) is calculated based on the formula:

$$(n\sum xy - (\sum x)(\sum y) / (\sqrt{n \sum y^2}) (\sqrt{n \sum x^2}))^2$$

$\sum x$: Summation of all the X values

$\sum y$: Summation of all the Y values

n: Number of X/Y values

Line Equation and R^2 values

With the generated line of best fit, it is possible to determine the unknown Y value by entering its corresponding X value and vice versa (Fig. 2). The unknown value is plotted on the graph in a different colour. The application also calculates the equation of the line and coefficient of determination (R^2) of the graph which is shown by tapping on the top right "Statistics" button. The equation of the straight line is shown in the form of $y = mx + c$ where "m" is the gradient/slope and "c" is the y-intercept. R^2 has a value between "0" and "1", and shows how well the line of best fit fits the coordinates. The closer the value is to "1" indicates that the standard coordinate fall well within the line of best fit.

Customizable features

The graph generated by StanXY is customisable based on the user's preferences. Users can easily change the colour scheme of the graph (default/contrast). The

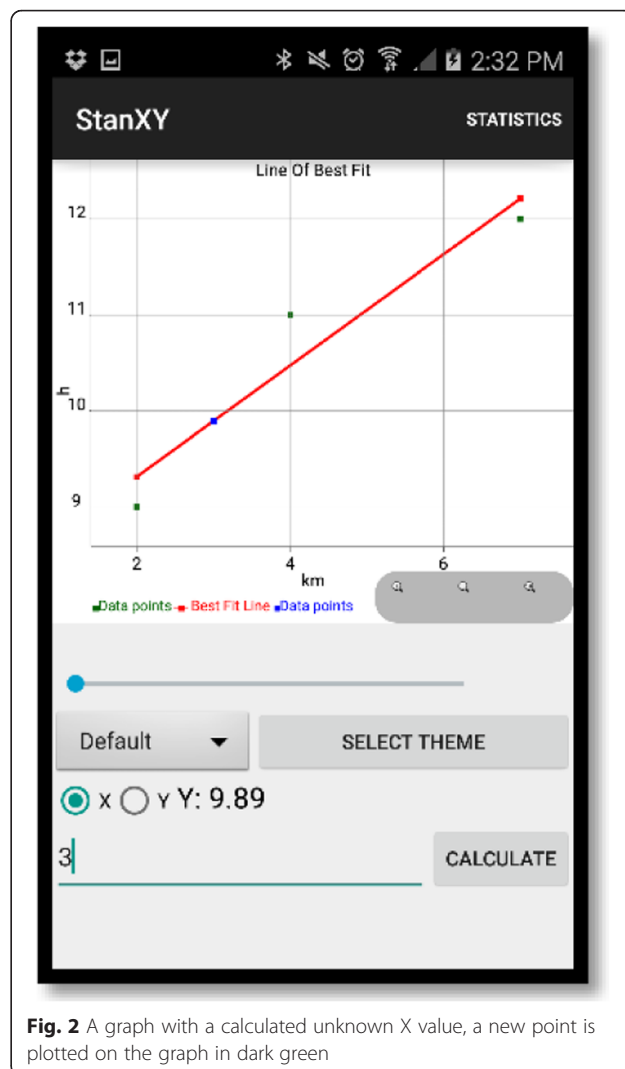


Fig. 2 A graph with a calculated unknown X value, a new point is plotted on the graph in dark green

thickness of the points and line of the graph can also be adjusted with the slide bar (Fig. 3).

Uses and Applications

StanXY can be used with common biomedical and chemical lab quantification experiments that require plotting of standard curves. These includes Enzyme-linked immunosorbent (ELISA), Bradford, Folin-Lowry and many others. The app can be used in schools in science classes and also as a guide for plotting lines of best fit.

Conclusion

StanXY is a standalone Android application that brings convenience, efficiency and accuracy to graph plotting. It does not require internet connectivity to support its features and allows users to easily plot graphs on the go without the expense of accuracy and time.

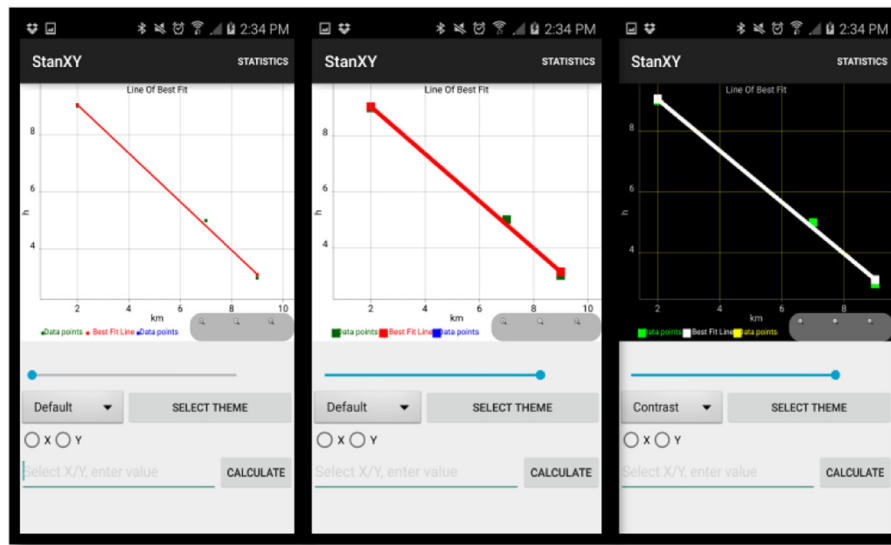


Fig. 3 Default graph (left), increased thickness of points and line (middle) and graph with the contrast theme (right)

Availability and Resources

The StanXY application is developed for the Android platform and is freely available on the Google Play Store. More details on the app can be found at www.facebook.com/APDLab; www.bii.a-star.edu.sg/research/trd/apd.php

The StanXY user guide is available at <http://tinyurl.com/StnXY>, and a video tutorial is also available on the Google Play Store.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

IH and CF wrote the codes underlying the app. PV provided assistance in the implementation of the graph. SKE conceived the idea and directed the design of the app. All authors read and approved the final manuscript.

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