

qwitButt: Smartphone app that logs and visualizes users' smoking events to reduce or quit smoking

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ABSTRACT

This study researches the influence of location (place) and period of day on user's smoking habits by logging smoking events, visualizing patterns to help in reflecting on smoking habits and helping in taking actions to reduce or quit smoking. Smoking events were logged using an android app in smartphone. This app saved location (place) and period of day data along with the number of cigarettes smoked. Experiments show that users take initially 2 weeks to understand the smoking pattern to reflect on the context for smoking. After 2 weeks, users looked at the data and could identify the place and time they smoke the most and could reflect on reasons for smoking. This helped users in reducing their smoking during that day period and place and in reducing overall cigarette consumed. Experiments show that after 3 weeks there is reduction in smoking by ~10% and goal adherence improves by 20%.

Author Keywords

Personal data informatics, location data, smoking habits, smoking patterns, smoking cessation, quit smoking, reduce smoking, human factors, data visualization.

INTRODUCTION

As per WHO report [1] although tobacco deaths rarely make headlines, tobacco kills one person every six seconds. Tobacco kills a third to half of all people who use it, on average 15 years prematurely. Today, tobacco use causes 1 in 10 deaths among adults worldwide – more than five million people a year. By 2030, unless urgent action is taken, tobacco's annual death toll will rise to more than eight million. If current trends continue unchecked, it is estimated that around 500 million people alive today will be killed by tobacco. During the twenty-first century, tobacco could kill up to one billion people. Based on Fagerströms study [2] most tobacco users want to quit smoking but are unable to, because of their high dependence on nicotine.

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Multiple options as suggested by Walters et al [3,4] like e-cigarettes, behavioral therapy, nicotine replacement therapy, medication, counseling or a combination of the options could help smokers in quitting smoking. However, none of these options can guarantee success.

Technology and smartphones proliferation [5] is revolutionizing healthcare domain providing infinite opportunities to users and healthcare professionals to diagnose complex health issues and diseases. Within smoking domain, there are multiple apps as mentioned in Best quit smoking apps [6] e.g. Kwit, SmokeFree, EasyQuit, QuitTracker, MLC etc. that provides users with options, to track and visualize information in different formats, helping to reduce or quit smoking.

Current available apps, expects users to log smoking data manually, like a digital diary, with no options to log smoking events real time or automatically. Emphasis in all the apps is on the data logged by user. An assumption runs through all the apps that users would be able to remember correct data and record it with motivation all the times. None of the apps enable users, even manually, to log contextual information. As the group interviewed smokers, every smoker wanted data for one common question i.e. “When and where do I smoke the most and why?”.

This app, **qwitButt**, leverages the capabilities of smartphone apps in helping users to log smoking events, view the smoking patterns, reflect on the reasons and act. As users log the smoking event, the location (place) and the period of day (e.g. morning, evening, noon, afternoon etc.) data, is also logged. The collected information (where and when) is visualized along with events (cigarette count) to help users in reflecting on the patterns, identifying ‘why’ and determining actions to reduce and quit smoking.

Below is an outline on the related apps and research, group's approach and work, and description of the **qwitButt** app. Later is an explanation on the methods involved in testing and experimentation, user inputs, and finally presented are findings along with ideas for future work.

RELATED WORK

Since 2012, there has been a consistent increase in leveraging technology – smartphones and sensors [5] – to experiment, identify root causes and diagnose critical healthcare issues. Focus is shifting from post disease

treatment to preventive measures by daily monitoring and tracking of critical health related parameters. This approach as suggested by Abroms et al [5] allows users and healthcare professionals in identifying trends in patient's health and diagnosing issues before they become critical. Sensor technology in terms of wrist worn fitness bands has been implemented in Apple and Android watches, Fitbits and Jawbone as presented by Consolvo et al [7]. Users can track sleep patterns, pulse rate, skin conductivity, walking and exercise patterns, calories burnt, food intake, blood pressure etc. with the use of new devices.

Multiple research correlates health conditions with smoking habits. Research has proven that smoking causes respiratory problems, blood pressure, lung cancer and potential heart diseases. Krishna P. Reddy et al [8] have concluded that with one cigarette smoked there is an approximate life loss of 11 minutes.

Research has been conducted around technology supporting smoking cessation. Studies by Strecher et al. [9] where computer-tailored health letters were used to support participants' smoking cessation, found positive results towards quitting. The experiment was an attempt to overcome the low numbers (less than 0.5%) of people who access and are helped by face-to-face counseling when quitting. Strecher studies confirmed that computer-tailored content delivered through the web was more effective than non-tailored content. A web-based system 'QuitCoach' developed by Graham et al [10] provided quitting advice to users, tailored to their quitting stage. It used the Trans Theoretical Model of health behavior change.

Studies exploring the use of smartphones for smoking cessation examined "Txt2stop" by Free et al [11]. Studies observed that sharing tips through text messages to participants doubled their quitting rate in the short term.

Abroms et al.[5] reviewed 98 apps for Android and iPhone, concluding that half of them had simple features related to calculations based on entries by the user. The challenge with basing feedback on entries by users, rather than the actual event, is that data is usually incomplete, imprecise and with high error-rate. Instant real time event tracking with automated tracking of cigarettes has the potential to solve this challenge. Paay et al [12] conducted an empirical investigation with smokers to identify perceived importance of different types of help when quitting and the potential role of technology in providing such help.

Few examples of smartphone apps as mentioned in best quite smoking apps of year [6], tracks smoking consumption manually and provides visualization around health parameters e.g. life regained, smoke free hours, cost saving, oxygen levels, pulse rate, cravings resisted, risk of heart attack and lung cancer, mental health etc. None of the app logs or enables users to log events with automated logging of contextual information and tracking of cigarettes

in real time. Below is a comparison of features provided by different mobile apps in the smoking cessation domain.

Features/ Apps	Event Logging	Location/ Time Data	Urge Distraction	Tips	Goal Progress
Kwit	No	No	No	No	In paid version
Smoke Free	Manual	No	No	Yes	Virtual Rewards
EasyQuit stop..	Manual	No	Games	Yes	Virtual Rewards, Money Saved, Life Regained
Quit Tracker	Manual	No	Games	Yes	Virtual Rewards, Money Saved, Life Regained
Cigarettes Co	Manual	No	No	No	Cigarettes Consumed
MLC	No	No	No	Yes	No
qwitButt	Real time	Yes	No	No	Graphical representation- daily, weekly, monthly and yearly statistics

Table 1- Mobile apps features comparison

PROPOSED SOLUTION – qwitButt

The group studied research related to health behavior and human computer interaction. It also tested available smartphone apps helping in smoking cessation and informally contacted smokers to understand the context that leads to smoking. Currently available apps expect users to log the cigarette count manually, putting the onus on users to remember the events and the cigarettes consumed. Users lose motivation after some time and hence the resolution to reduce or quit smoking fails. Two main requirements that came out from user interviews were:

- Develop app with ability to log smoking event real time, maintaining record by adding contextual information to help users understand the reason
- Visualization of events that is easy to understand and helping users to devise quitting plan and track progress

Reasons cited by users were that contextual attributes such as time (day period), place and social situation can become conditioned cues to smoking as situations are crucial in a person's urge to smoke. Certain situations trigger strong cravings in individuals, for example, after meals, when drinking alcohol or coffee, when taking a break or in parties. Keeping track of these events and other contextual attributes could increase smoker's awareness of their behavioral patterns and assist them in devising and managing strategies to reduce or quit smoking.

qwitButt android application intends to help users with an ability to log smoking event in 3 taps. **qwitButt** objective is to exploit the advantages that smartphones provide vis-à-vis web applications in terms of convenience of use, usability, simplicity, personalization and user experience.

Once the data is updated, users could log events real time. For every smoking event, app updates the cigarette count,

period of the day and smoking place. App uses this data to visualize statistics on daily, weekly, monthly and yearly basis considering Day Period, location and goal status. Visualizations help users in identifying patterns w.r.t location, day period and adherence to goal with which they could identify reasons for smoking, devise plan to reduce or quit smoking and act.

Design – qwitButt

The design of **qwitButt** has been kept simple and intuitive. It has been a long iterative process of designing the app to achieve expected user experience. To ensure that users could log event easily and instantly, design took utmost care that app takes least efforts (3 taps) and minimal time <3 secs to log a cigarette event and provide instant feedback of successful logging. Currently the app has been developed in English and on android platform. The app comprises of 3 key functions:

Registration:

During first time download, the app requests user to log below information from the registration screen:

- Cost and cigarettes per packet
- Cigarettes (average) consumed every day
- Goal to reduce (target average count per day)
- Target date to achieve goal

This data becomes the basis of further calculations and statistics. Architecture diagram, database design and story map are part of the appendix (Figure 5, 6 and 7) for detailed understanding.

Log Smoking Event:

After first time logging and every time afterwards, users view the Dashboard screen. From this screen, users can log a cigarette event. To add an event, user:

- Taps the “ADD SMOKING EVENT” button.
- Select the location of smoking on ‘Add Smoking Event Screen’ and taps on ‘SAVE’ button

The “Cigarette Added Successfully” screen confirms that the event has been logged. In the background with every event logged, system records the number of cigarettes consumed per event, the location for each event and the time of smoking event.



Figure 1: Screen (1) for Registration; Screen (2,3,4) to Log Smoking Event; Screen (2,3,4) to provide Instant Feedback on Life Regained, Money Saved, Cigarettes consumed

Visualization:

App design ensures that users get instant and detailed feedback on goal adherence and smoking patterns. Instant feedback is provided through ‘Money Saved’ and ‘Life Regained’ parameters on Dashboard screen. The parameters are calculated automatically using the event and registration data logged and provides a quick positive feedback to users on their smoking goal adherence. This helps in building curiosity and maintaining motivation.

While logging smoking event, app provides users the current count of cigarettes already consumed in the day. Users can decide based on the count if they want to delay or continue smoking. For detailed statistics, users can tap on Statistics button and then on smoking patterns at location, day period and adherence to goal. Within specific screen, users can tap on Daily, Weekly, Monthly and Yearly tabs for patterns

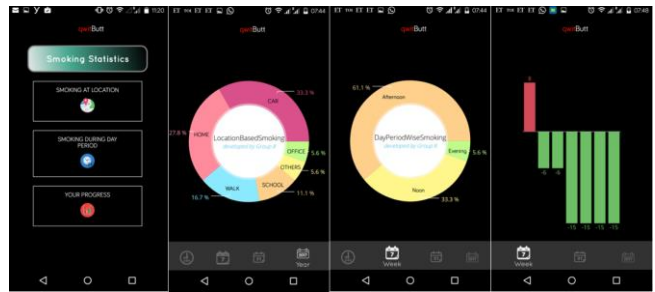


Figure 2: Screen (1) Smoking Statistics; Screen (2) – Smoking pattern for Location; Screen (3) – Smoking pattern for Day Period; Screen (4) – Goal adherence status

On viewing patterns for location (place) and day period, users could identify reasons for maximum smoking. Based on the reason, users could set a goal of not smoking or reducing smoking in identified place and period of day.

FIELD STUDY

qwitButt convinced 9 smokers who volunteered to help in identifying requirements for app, log real time smoking events, engage in weekly interviews and help with constant feedback to develop and improve the app. Objective throughout the research had been to identify reasons and context that make people smoke, identify behavioral inertia to logging events and goal adherence, gather realistic inputs for improving the app and user experience. After the initial interview to gather requirements, ‘Registration’ and ‘Log Smoking Event’ functionalities were developed. The app was built and delivered through email to participants for the first, second and third week and later it was available for download from app store.

From the 9 users, 7 were male and 2 were females. Participants age ranged from 22 to 55 with a mean of 30 and a standard deviation of 11.48. The app was developed in Android and hence all the participants had android. All the participants were curious to understand when and where they smoke and wanted this data, to reflect and act on the patterns. User group was also checked on the nicotine

dependency factor w.r.t Fagerströms test [2] of nicotine dependency and found that 1 participant had no dependency, 3 had very low dependency, 1 participant had low to moderate dependency and 4 had high nicotine dependency.

During the first 3 weeks of research period, each participant logged smoking event using the app every day whenever he/she smoked a cigarette. The group requested users to upload data from the app every week. This data was then analyzed by the group and shared with the users. Below is representation of the data in graphs as shared with users.

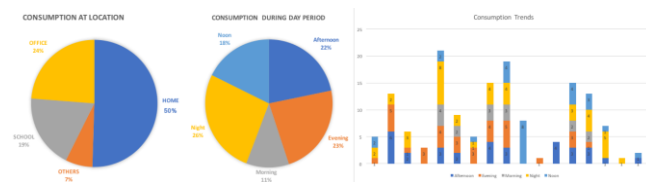


Figure 3: Data Analysis as shared with participants. Graph (1) – Smoking pattern at locations; Graph (2) – Smoking pattern for Day period; Graph (3) – Consumption trends

The same exercise was followed for 5 weeks. For the first 2 weeks, users only had ‘Log Smoking Event’ functionality, during Week-2, visualization functionality for Location and Period were introduced in the app and shared with users. During Week- 4, Goal Progress was introduced in the app. In every iteration, the earlier developed functionalities were redesigned and re-developed based on user feedback along with introduction of new features.

After 5 weeks of research, the group conducted final interview with the participants to discuss their experiences with **qwitButt**. Questions were around ease of entering data, ease of understanding data visualization, impact of the information that data provided and the overall user experience with the app. Group was curious to understand the impact of visualization while reflecting on the smoking habits and whether the users reduced or quit smoking during the study.

FINDINGS

Participants used the app quite differently ranging from 36 entries for one person to 498 entries for the most active participant in 5 weeks. There were multiple findings related to the motivation of users, technical issues with different versions of android, security settings while installing and using the app, interpretation of data, personal preferences and even usability. The findings could be segmented in three broad sections:

Platform

Android Platform	Code Name	Participants Count
Android 4.4.	KitKat	1
Android 5.1.1	Lollipop	3
Android 6.0	Marshmallow	2
Android 7.0	Nougat	3

Table 2 – Participants with different Android platforms

Having participants over varied platform versions provided opportunities to test app on different android platforms and created challenges in ensuring consistent user experience across all the versions. KitKat and Lollipop version didn’t support all the visualization libraries and it was a constant frustration with these participants. New versions of android created challenges because of enhanced security settings and many times app versions shared either didn’t install on user phones or installed without databases. These challenges constantly impacted motivation of the participants and hence needed regular follow ups from research group to keep participants engaged.

To overcome these challenges, after 3 weeks, **qwitButt** account was created on Google Play and it was officially launched. Detailed information for the app in Play Store is mentioned in appendix (Figure). This helped in ensuring that all the platform version’ expectations are met and the installation across platforms is easy. Participants engagement improved significantly afterwards however consistent challenges were faced with KitKat versions. After 4 weeks of research and user testing, it was decided to exclude KitKat and consider Lollipop as the minimum Android version supported by **qwitButt**.

Usability

When data and patterns were shared with users, many users had preference for percentage distribution vis-à-vis actual count of cigarettes consumed (Figure 3). As weeks increased and when both visualizations with numbers and percentage distribution were shared, there was a general preference for distribution of smoking events, even for daily consumption, which was interesting as initial app design had considered count of cigarettes for patterns.

Similarly, for goal progress, initially while visualizing Monthly progress, average of the cigarettes consumed per day was calculated. However, since average includes the outliers as well, in Week-4th, 2 users had a feedback that monthly goal progress is skewed because of 2-3 bad days. On analyzing the data, both mean and median were calculated and visualized (Figure 4). When these were shared with users, everyone preferred Median distribution for monthly and yearly patterns whereas actual count of cigarettes per day was preferred for weekly patterns.

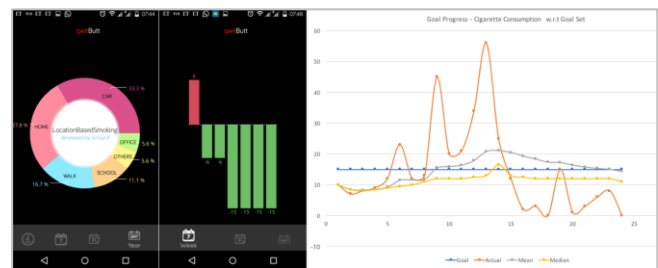


Figure 4 : Screen (1) – percentage distribution of events at location; Screen (2,3) Goal Progress – Mean and Median

Human Factor

Every human is different in terms of habits, interpretation and expectations. This factor throws maximum challenges while developing a Mobile app. After every release of the app, users needed training on new features, for using and understanding the app features. A fine balance was maintained to ensure that user's feedback is still received on feature's intuitiveness. It was still a constant challenge with different users interpreting the features differently.

Initially, tracking locations was built as an inbuilt feature in the app, however many participants were reluctant to accept location tracking, and this automatic tracking feature had to be removed from the app. This was a clear learning on personal preferences throwing challenges to app development.

Users shared interesting inputs on the way instant feedback could be improved within the app. Initial design had a very small text size for 'No of Cigarettes consumed' (Figure1, Screen 4). However, based on user feedback, the text size was increased and this improvement had instant appreciation from users. 'Life Regained' and 'Money Saved' features were also appreciated as these provided an instant motivation (Figure1, Screen 2).

Many times, users forgot or found it tedious to log event by taking out their mobile. This was the biggest challenge throughout the research. One female participant had real frustration carrying mobile with her every time she smoked and hence she missed logging event many times, even though she was very interested and motivated. She suggested to build automatic capability for logging events in app or having an android watch version for the app.

DISCUSSION AND CONCLUSION

This research contributed in identifying smoking patterns using interactive mobile technology. Through the research, positive impacts of the app features on user's smoking behaviors, were observed. A final survey to determine participant's goal progress, satisfaction level and motivation was conducted after 5 weeks. Below table demonstrate the results of survey.

Participant	Reduced Smoking By	Satisfaction Level	Motivated to continue with App
1	9%	High	Yes
2	4%	Low	Yes
3	22%	Very High	Yes
4	3%	Low	No
5	15%	High	Maybe
6	12%	High	Yes
7	19%	Very High	Yes
8	26%	Very High	Yes
9	5%	Low	Yes

Table 3: Final Survey Results

This research with the help of **qwitButt**, logged location and day period information, identified "when and where" aspects and helped smokers in determining - "Why". Users

who used the app consistently had positive impact on their goal and could reduce smoking upto 26% in 5 weeks. Logging of events (in 3 taps) was easy to use and as the app was continuously developed based on user's feedback, its impact was positive resulting in high satisfaction level.

While many mobile apps exist that helps in logging cravings and cigarettes consumed data manually, **qwitButt** automated a lot of these aspects and provided insightful information instantly for users to reflect and act on. As users identified the reasons, it broke their earlier perceptions concerning reasons of smoking. The data and patterns were eye-openers for users and motivated them to log more events, collect more data and devise concrete actions for reducing their smoking further. Majority of the users (7/9) wanted to continue using the app after 5 weeks and reduce their smoking further. This was a very positive feedback for **qwitButt**.

Users provided with lot of improvement ideas that could be possible features in future versions of **qwitButt**. The biggest challenge for user motivation would continue to be the 'ease of logging instant events'. An android watch version of the app could help in addressing this challenge and making app 'easy to use and log events'. Voice based inputs in the watch app could further enhance user experience and make it extremely easy for users to log events.

Automated distractions (games), determined by modeling user habits is another idea that could be beneficial to users. Tips on smoking impacts to health and other health parameters would be another idea to build user's awareness. App has currently been developed in Android and could be developed cross-platform for Apple users as well to reach larger groups of users.

Although many encouraging and positive results were achieved, future success of app will require involving a considerable sample of users for testing, gathering feedback, analyzing data and learning user behavior.

Demography was identified as a crucial factor determining user experience. For a mobile app delivering consistent user experience, across the world, requires testing with users from different demography and continents. This is a targeted future work for the app.

Lot of work is further needed to improve user experience, provide users with effective tools and insights and continuously help them in reducing smoking. We can however, confidently conclude that this research leveraging represents a very promising start in this domain.

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Appendix:

Distribution of Work:

As part of the group research, all 3 group members contributed equally taking the responsibility of design, user interviews, analysis and development

As part of report writing, distribution of responsibilities is as mentioned below:

- **ABSTRACT** - Sun
- **INTRODUCTION** - Sun
- **RELATED WORK** - Nur
- **PROPOSED SOLUTION** - Nur
- **FIELD STUDY** - Shishupal
- **FINDINGS** - Shishupal
- **DISCUSSION AND CONCLUSION** - Shishupal and Nur

qwitButt Architecture Diagram:

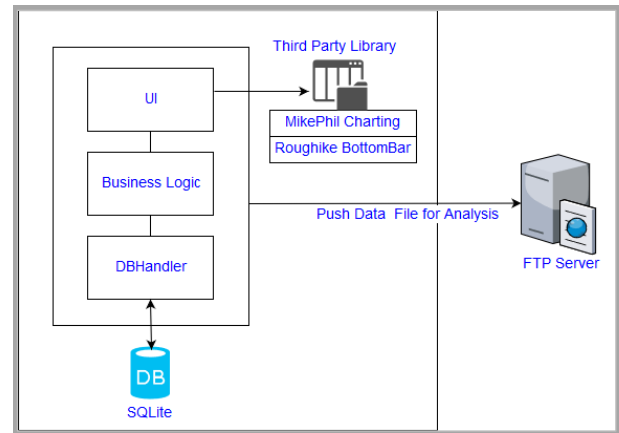


Figure 5: qwitButt Architecture Diagram

qwitButt Database Design:

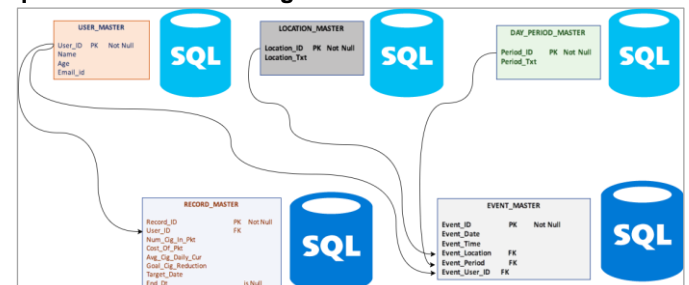


Figure 6: qwitButt Database design

qwitButt Story Map:

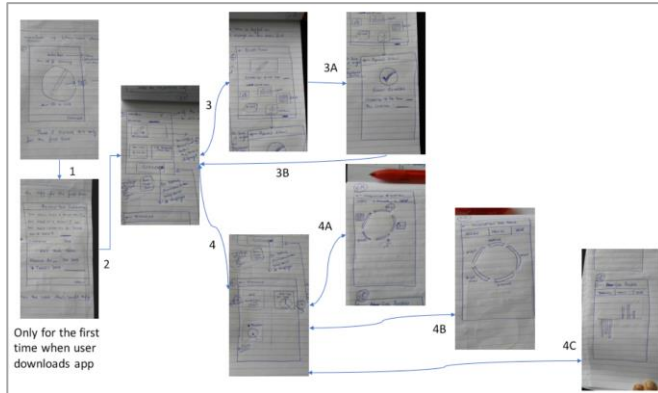


Figure 7: qwitButt Story Map diagram describing the interactions between the interfaces and low-fidelity design of screens

qwitButt Video:

Promo Video for **qwitButt** has been uploaded on YouTube. It has also been uploaded on Campus Net as part of final assignment. Link to the video: [qwitButt Video](#)

qwitButt on Google Play Store:

Version1: Basic version with Registration and Log Smoking Event functionalities

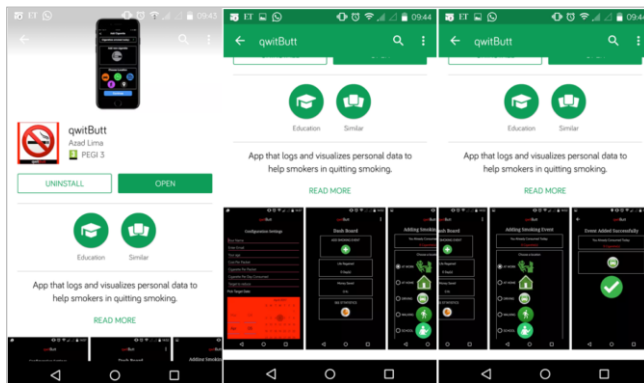


Figure 8 : qwitButt version 1 screenshot from Google Play Store

Version2: Fully developed version with all functionalities, improved usability and visualization.

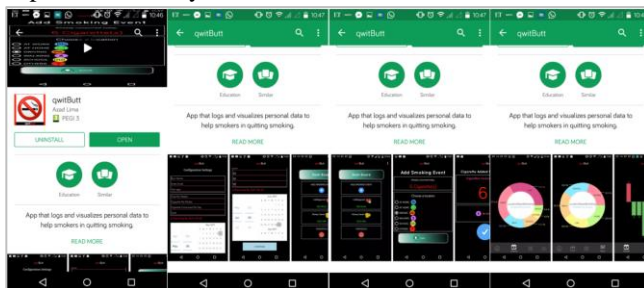


Figure 9 : qwitButt version 2 screenshots from Google Play Store

Latest app can be found at this link on Play Store: [qwitButt Google PlayStore](#)