

GoAlcoholGo - A mobile app for behavior modification with regards to Alcohol Consumption

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Abstract—Excessive consumption of alcohol is a very common practice among young adults. Research has shown that in addition to having a severe impact on their physical health, drinking habits exceeding recommended levels can also lead to psychosocial outcomes. Novel interventions to enhance temperance in people with alcohol use disorders have proven to be effective and are also gaining popularity. Interventions coupled with motivation and goal-setting techniques can further ameliorate one's commitment toward behavior modification. Since the usage of smartphones has become widely accessible, especially among young adults, mobile applications can be utilized as an effective channel to help them create low-risk drinking habits and enhance their overall health. However, existing mobile applications lack in providing a holistic platform to achieve this goal. In the current project, we aim to develop an android-supported smartphone application that provides features such as intervention, motivation, tracking, and goal-setting to combat excessive alcohol consumption using a graphical and easy-to-use interface.

Index Terms—Mobile Health Application, Mobile Health, mHealth, Alcohol Behavior Modification, Alcohol Use Disorder

I. INTRODUCTION

Heavy alcohol use is widespread over the world, especially among young individuals. According to current estimates in the United States, about 15 million people fit the criteria for past-year alcohol use disorder (AUD), with more than a quarter of adults reporting binge drinking in the previous month (SAMHSA, 2019) [1]. Heavy drinking is linked to the 1825 fatalities, 599,000 injuries, 696,000 physical assaults, and 97,000 sexual assaults that occur each year among college students in the United States. [2] Thus, it is evident and established that excessive consumption of alcohol not only impacts the physical health of the individuals but also leads to disruption of mental and social stability. A number of individuals who take initiation and put efforts to overcome this habit, often succumb to the temptations of relapsing. Even the resources available to channel their commitment and act effectively towards their goals in terms of consumption of alcohol are scarce. Traditional methods for behavioral interventions, though effective, are not readily accessible to everyone and can in turn be expensive and exhausting.

Young adulthood is an important phase in an individual's life as they make major life choices and take up new responsibilities. Thus, it should be one's priority to have healthy psychical and mental health. However, excess alcohol use among young adults would disrupt both mental and physical

health impacting several areas of functioning. Alcohol as a depressant is found to impact the brain's chemical balance affecting an individual's behaviors, emotions and thoughts [3]. Though alcohol consumption makes an anxious person feel at ease initially, the effect seems to wear off soon and might lead to increased tolerance if used regularly.

Alcohol is also closely associated with depression, suicide, and self-harm behaviors as it plays a prominent role in mood regulation and impulsive behaviors. Acute intoxication and withdrawal of alcohol are known to cause psychosis that involves symptoms such as hallucinations and delusions. There are several existing studies that found the negative impact of alcohol use on brain, heart, liver, and pancreas functioning while also pointing towards the possibility of causing cancer [4]. While alcohol use and dependence cause a lot of physical and mental damage themselves, alcohol withdrawal has its own set of symptoms that include anxiety, gastrointestinal issues, insomnia, physical imbalance, seizures, increased blood pressure, heart palpitations, etc.

Optimizing the efficacy of alcohol interventions and delivering these interventions through accessible platforms is an important goal. However, it is also important for these platforms to provide an all-encompassing set of features that also help in motivation, goal-setting and finally behavior modification and status tracking. Delivering such platforms through accessible channels is also a challenge in itself. The voluntary involvement of the user in the process is extremely essential and can only be achieved if the platform is engaging in addition to being efficient. All this should be achieved using minimal cost and effort for the solution to be widely accepted and used.

Several techniques have been incorporated to address the behavior modification in alcohol abusers and excessive consumers. These techniques range from Cognitive-Behavioural approaches in a therapeutic setup to simple and motivating web-based information portals. Each technique is effective in its own ways and yet has certain deficits. However, a major drawback of the existing methods is accessibility. Therapeutic techniques, in addition to being stereotyped and lacking motivation in participation, often are not readily available to the users. These techniques also suffer from a lack of trust and confidence and take a few sessions to get established as a congenial setting for the individual. The financial costs

associated with therapeutic techniques can vary depending on the reputation of the counselor and can often be unaffordable for lower-income young individual groups where the issues pertaining to alcohol consumption are highly prevalent. Other intervention techniques often involve a lot of external factors such as family and friends, rehabilitation centers, medication, etc. These approaches might not be feasible for all individuals. Furthermore, none of the approaches leverage low-cost hardware technologies and sensor-based approaches for monitoring and evaluation of alcohol consumption and sobriety levels. These limitations point to the need for the development of a solution that is accessible, trustable, and easy to use.

Nowadays, young adults have easy access to smartphones and the mobile applications on these devices can be leveraged to achieve many amazing things. We aim to utilize this effective platform to develop an android-based smartphone application that provides awareness, learning, planning, reminders/warnings, and completes the loop of support by rewarding the users for accomplishing their goals. Our app ‘GoAlcoholGo’, as the name suggests, helps the users in their journey to combat alcohol addiction. It provides the user with features such as tracking the duration of sobriety, motivation through enriching quotes and philosophies, setting goals, prompting alerts, and also keeping tabs on other essential activities such as drinking water, exercising, reading, etc.

The major advantage of using our app is that it provides a holistic platform bundling all the features required in one’s journey against excessive alcohol consumption. Even though there are several applications available on both ‘Android Play-store’ and ‘Apple Appstore’ that accomplish each of the above-mentioned features individually, only a few apps are on-par with the required all-rounded implementation. The available apps can be majorly categorized as timer-based apps, motivational apps, tracking and monitoring apps, alerting apps, and Rewarding apps. Using separate apps for each of these tasks can be very inconvenient and ineffective. We have developed GoAlcoholGo in such a way that the user is provided with an engaging interface that is easy to learn and understand even without any explicit training or documentation.

In this report, we provide the motivation behind the mobile application. We then elaborate on the background work through case studies and literature reviews. We also deep-dive into the technical aspects of the application along with a brief explanation of each feature. Finally, we conclude the report by proposing extension ideas that we can work upon in the future to further enhance the application.

II. MOTIVATIONS

We were motivated to develop GoAlcoholGo because we identified a lack of options in the mobile health market for applications which holistically support users to curb alcohol consumption. Before the introduction of digital and mobile health resources, traditional treatments were the only option for addicts struggling with alcohol abuse and dependency. Traditional treatment primarily consists of mental counseling and even medical intervention in extreme cases [5]. While

these preexisting resources have proven helpful for many individuals battling addiction, they are inaccessible to many people. In 2020, 28 million Americans, 8.6% of the country, went without health insurance [6]. With more than 6% of American adults having reported alcohol use disorders, this means that at least 1,680,000 went without access to necessary treatment for alcohol abuse in 2020 alone. In addition to these struggling adults, there are another 623,000 between the ages of 12 and 17 with alcohol use disorders. While these statistics in themselves are staggering, they are just a peek into the true extent of the problem. Less than 7% of those with alcohol disorders seek treatment. This suggests the scale of alcoholism in America is much larger than we know [7]. Mobile health applications like GoAlcoholGo provide a much more accessible, efficient, and effective way to achieve sobriety for individuals like these who have no other options. Our application has the potential to positively impact a significantly larger population than traditional alternatives. GoAlcoholGo gives anybody with a mobile device the tools to stop alcohol abuse.

III. CASE OF STUDY

We researched case studies to analyze the overall potential effectiveness and efficacy of mobile health resources concerning alcohol abuse. We found one study in particular which analyzed a composite of 94 separate articles about the effectiveness of mobile apps and telehealth in treating alcohol use disorders (AUDs) over the past 10 years [8]. The study filtered these articles to find and compare statistics on participants, methods, and outcomes. Analysis of these data points led Clemens Kruse and his team to a common statistical theme of effectiveness, efficiency, and quality in mobile health applications addressing AUDs. After applying further exclusion criteria to the initial 94 articles, the study identified 35 specific instances of comparable statistical outcomes. These measurements concluded that telehealth and mobile health resources addressing AUDs resulted in an 11% reduction in depression, a 9% increase in patient satisfaction and accessibility, and a 6% increase in quality of life on average. Concerning alcohol consumption specifically, 46% found a statistically significant reduction and a 17% increase in overall mental cognition. Finally, the study found 77% of articles identified positive effects of mobile health treatment, while 23% found no improvement and none saw reduced effectiveness.

The statistics are seen in this study communicate the effectiveness of mobile health in treating AUDs. This tells us our application has a very high probability of positively affecting the lives of users in both reducing alcohol consumption and increasing quality of life as a whole.

We also looked at existing applications addressing alcohol consumption to see the successes and shortcomings of popular programs already being used. We found that many apps such as DrinkControl and Less mainly focus on logging the number of drinks consumed over time [9], [10]. The common theme in these apps is to display the cumulative effects of consumption to the user in the form of financial cost and calorie intake.

This is a good start in monitoring the user's consumption, but it could be improved upon. To discourage consumption as a whole we decided to not include a drink counter, but rather to implement counters for healthy alternatives. Daily reminders from GoAlcoholGo bring the user back to report when they feel the urge to drink and reward them for choosing healthy alternatives. This is a feature we did not see in any other existing application which will give users a more positive outlook on their progress.

IV. PROPOSED MOBILE APP SOLUTION

The GoAlcoholGo app mainly focuses on providing monitoring, goal-setting, motivation, tracking, and alerting features with a reward-based paradigm. Hence, it is a holistic approach for a user aiming to regulate alcohol consumption levels. The main idea behind our focus on developing an all-inclusive platform was the lack of availability of such applications in the current market. The existing free-tier applications tend to provide limited functionality in a specific domain of the above-mentioned and incorporated features. The graphical interfaces of these existing apps also have been majorly disappointing. The chances of engaging the user are high when all the required features are accessible from one place. The app follows a simple and intuitive flow with graphic-enriched screens which further adds to the user-engagement goal of the app. The app also encourages the user not to relapse, thus engaging the user in the loop of betterment.

A. App Structure

The app follows a simple architectural design. Keeping the naivety of some users and also the limited development time-frame in mind, we came up with a basic, self-explanatory design that addresses all the requirements.

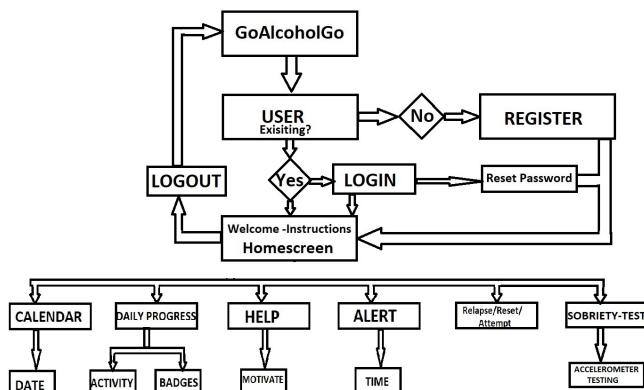


Fig. 1. Architecture Diagram of GoAlcoholGo

The app launches to display the login and register screens based on the existence of the user in the system. Upon successful registration followed by login, the user is prompted with a welcome screen. The welcome screen takes the user to an instructional screen that gives them an idea of

the different functionalities of the app. The app is also equipped with a password resetting functionality integrated with email authentication. This is useful in case the password is misplaced, forgotten, or needs to be renewed. After the instructions are comprehended, the user can move to the home screen of the app. This is where all important features of the applications can be accessed. We can broadly categorize the features into following domains of the requirements:

- **Monitoring:** The timer on the home-screen depicts the left-over duration of the user's sobriety goal. This can be set/reset using the Calendar option.
- **Evaluation:** The sobriety test option provides a sensor-based evaluation of the balance and physical stability of the user. This helps in assessing if the user is intoxicated and under the influence of alcohol.
- **Motivation:** When the user feels that they are going off-track, the Help button can be used for motivation and encouragement.
- **Alerting:** The Alert button can be used to set Alerts on the app. These alerts will be prompted on the notification panel of the user and can act as timely reminders.
- **Rewards:** The rewarding program is based on performing daily activities that enhance the user's personality and also keep away the temptation to consume alcohol by urging the user to substitute the desire with a health-building activity.
- **Continuity:** The Attempt and Relapse buttons encourage continuity towards the goal even on failure. This also serves as the encouragement aspect of the application.
- **Functional:** The logout, Reset and Relapse options work as functional features aiding in the processing of other features of the app.

B. App Development

The application has been built on Android Studio IDE used for android application development. The code is written in the JAVA language since it is widely used and developer-friendly with numerous libraries. The application uses Firebase v19.5.1 as a backend database and Firebase-ui-database v7.0.0 for UI. The reason for using firebase is its wide support in the android community as well its compatibility with Google android applications. The application uses built-in accelerometer of the smartphone device to achieve sensor-based evaluation. The unit testing was done using the Junit framework. The interface was developed using basic android inbuilt layouts. Heavy third-party UI frameworks were not taken into consideration to avoid complexity and to keep the application light-weighted. Since the deadlines and time constraints played a major role in deciding the technology stack, easy-to-implement and easy-to-use technologies were given priority over complex and fancy methods.

Application Walkthrough

Following are the screenshots depicting the various functionalities of GoAlcoholGo.



Fig. 2. Launching screen with app-icon

Launching Screen : The app launches with a soothing icon that symbolizes meditation to convey the goal to the user.

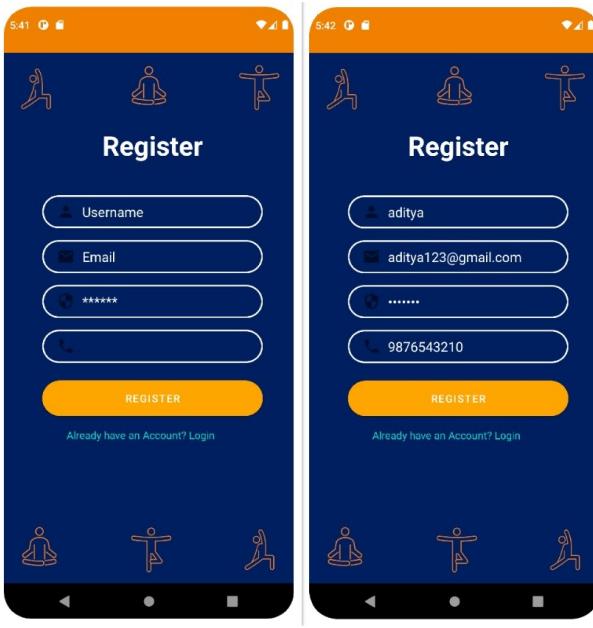


Fig. 3. User Registration Screens

Registration Screen : Users can register themselves on the application by providing details such as Username (to be created during registration), Email, Password (to be created during registration) and Phone number. If the user already has an account, they can redirect to the Login page.

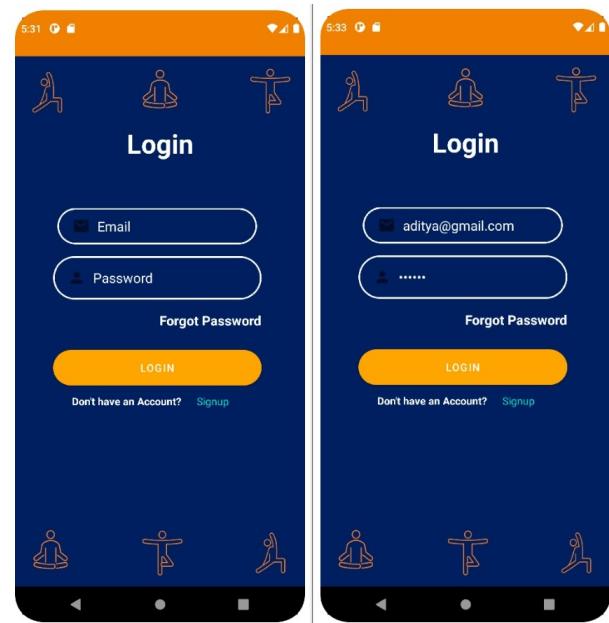


Fig. 4. User Login Screens

Login Screen : Registered users can login to the app using their email-id and password. If they did not register previously, they can redirect to the Registration page.

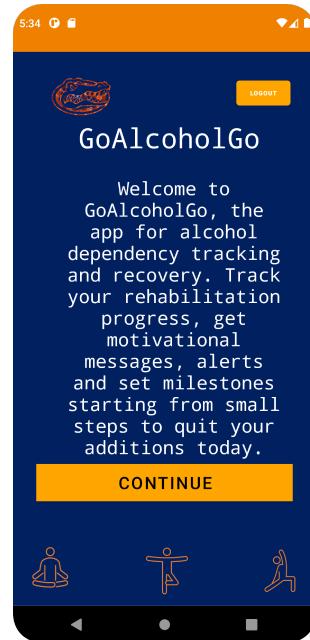


Fig. 5. Welcome Screen

Welcome Screen : Upon successful login, the user is greeted by a Welcome screen that provides information about the app.

Instructions Screen : This screen provides instructions to the user on the usage of the applications and the functionalities of different features within the application. Once the user understands the process, they can start using the main



Fig. 6. Instructions Screen

application by clicking 'Let's Start' button.

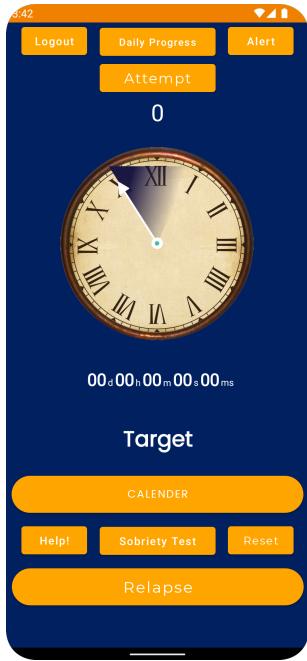


Fig. 7. Home Screen

Home Screen : This is the main screen of the application where all the buttons and the functionalities of the application are displayed.

Calendar : The calendar button enables the user to set a goal to remain sober till certain date and time using a date picker. Once a goal is set, the clock and the timer on the home screen are triggered to start. They depict how far the user is

away from their goal.

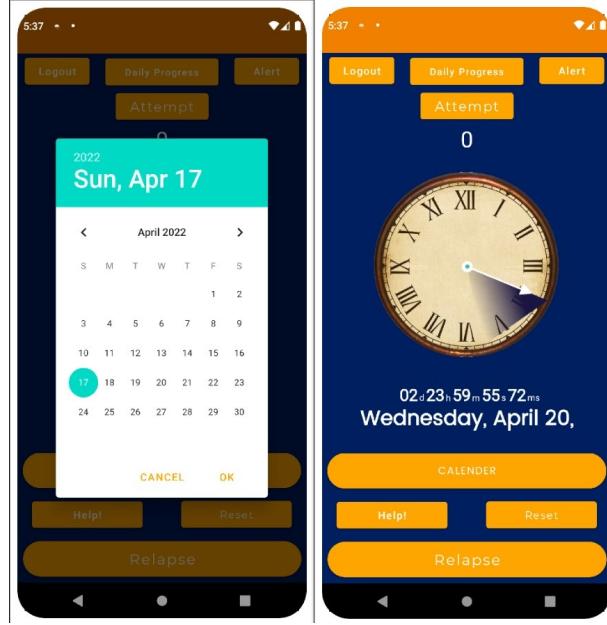


Fig. 8. Calendar and Goal Setting

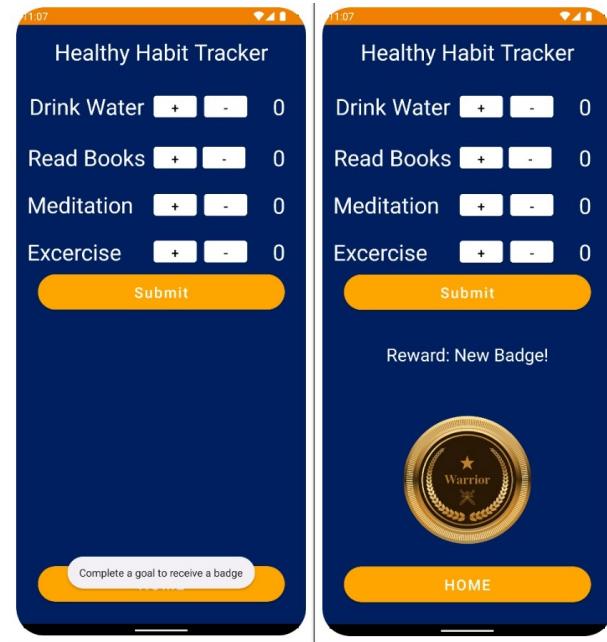


Fig. 9. Daily Progress and Achievement Badges

Daily Progress and Rewards : The Daily Progress button shall be clicked to record activities and receive achievement badges for each activity. Whenever the user has an urge to relapse or resume drinking, they can go to this tab and perform various activities such as 'Drinking Water', 'Read Books', 'Meditation' or 'Exercise'. Upon completion of each activity, the user is rewarded with an achievement badge based on the accomplished task.

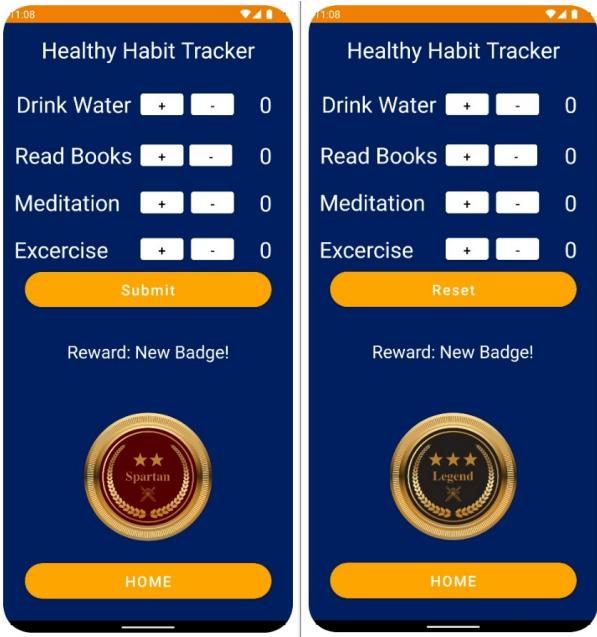


Fig. 10. Achievement Badges

Sobriety Test : The Sobriety test redirects the user to an evaluation page where the user can read the instructions before starting the test. The sobriety test leverages the in-built accelerometer sensor to monitor the movement along x,y and z axis. The sensor is calibrated and the individual averages are calculated for 10 seconds. If the calculated averages result to be out of the threshold values, the user is declared as unstable and possibly under the influence of alcohol.

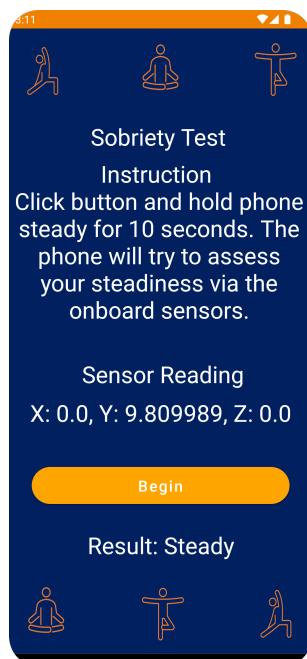


Fig. 11. Sobriety Testing

Alerts : The Alert button redirects the user to an alert setting interface using a standard time-picker. Once the alert is set, the app displays a reminder using audio notification on the notification panel of the user's smartphone. This notification comes along with an encouraging message to motivate the user to stay on-track towards the goal.

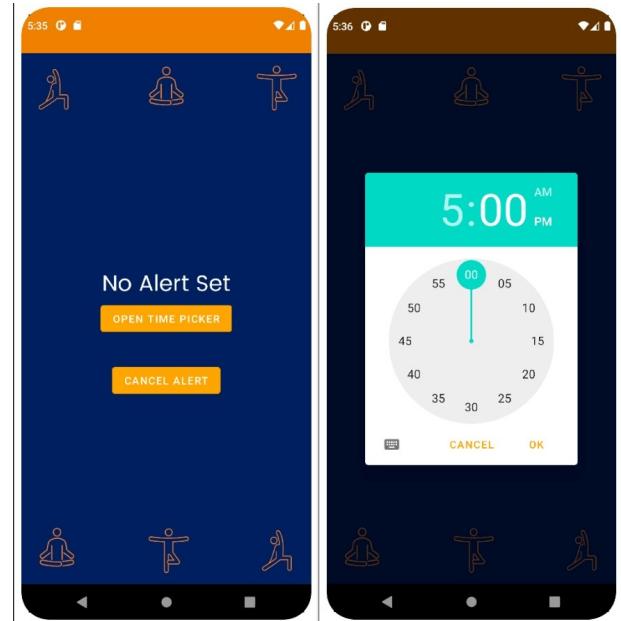


Fig. 12. Setting Alerts

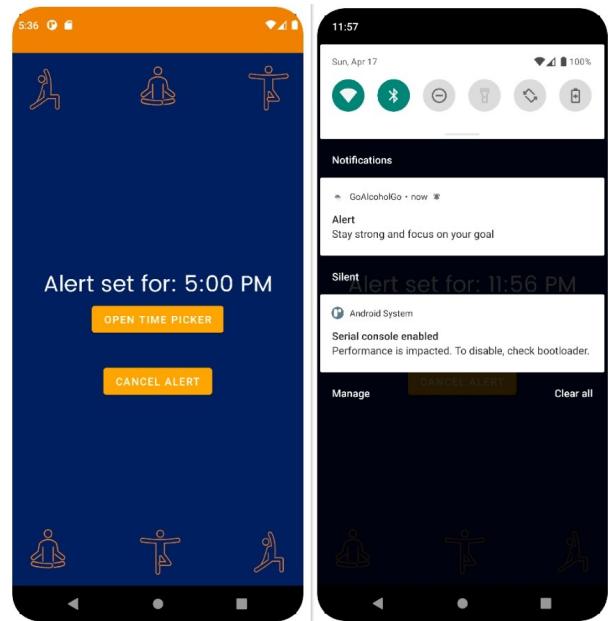


Fig. 13. Alert on Notification Panel

Help and Motivation : The Help button redirects the user to a motivational page with inspiring quotes. The user can continue getting inspired using the 'Inspire Me' button to get

new quotes or return to the home screen motivated to stay on-track.

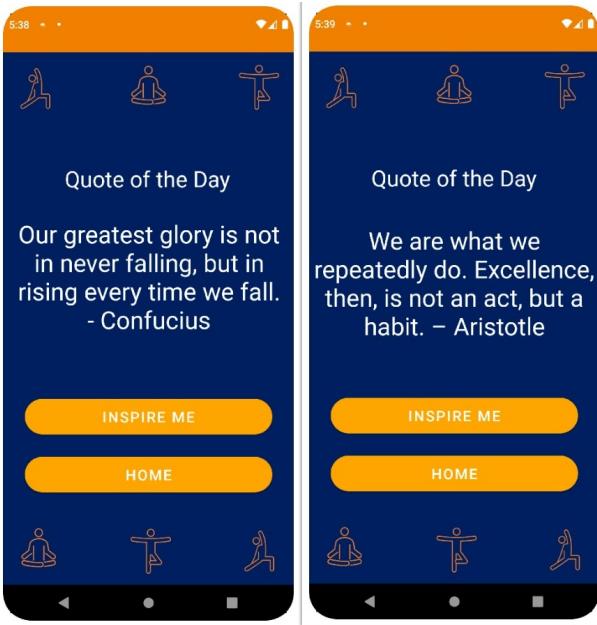


Fig. 14. Help screen

Attempt : The attempt button calculates the number of attempts the user takes to achieve the goal. It also prompts an encouraging message to keep going and work towards progress.



Fig. 15. Attempt with motivational alert

Reset : The Reset button resets the number of attempts to 0. This allows the user to start fresh.

Relapse : The relapse button pauses the goal timer and also prompts the user with a message to stay on track and encourages to refrain from getting derailed from the progress.



Fig. 16. Relapse

Logout : The Logout button allows the user to log out of the application.

The application is predominantly based on the intuitiveness of the user. The options on the app were aimed to be kept simple and comprehensible. The major goal was to develop a single-screen interface with all the major features readily visible and available to the user. We decided to avoid any additional re-routing that would complicate the app and degrade the user-friendliness. This was decided considering the possibility of usage of the app even by older adults who are less exposed to smartphone applications. All features follow standard Android-based UI implementations such as standard date-picker, timer, etc which ensures that the app follows generic standards and thus eliminates the requirement of training. The color scheme was intentionally kept bright and appealing to achieve user engagement and mood enhancement. The time-based sobriety test leveraging the sensor gives a good idea of the person's balance and physical stability status. Making all features available on the home screen could make the screen look clumsy, yet, we handled the positioning of the buttons in a very tidy fashion, without causing any confusion to the user. The interface also went through several stages of feedback from classmates and developers and was finalized based on a majority acceptance scheme, thus ensuring appropriate acceptance in a real-world scenario.

Below is the YouTube link to a visual demo of our app GoAlcoholGo.

Digital Health Project: GoAlcoholGo Application Demo — Nitin — Aditya — Srikar — David

Below is the Github link to the code-base of our app GoAlcoholGo.

<https://github.com/nitinrameshuf/GoAlcoholGo>

V. DISCUSSION

The idea of influencing behavior modification using technology is highly effective due to several reasons. The most important reason is the prevalent use of smartphones in our daily lives. Another noteworthy reason is the number of features one can be provided with using a smartphone as a platform to deliver health diagnosis and rehabilitation in digital mode. Finally, as a future scope, these mHealth applications can be coupled with the user data and usage patterns to achieve many more functionalities with higher accuracy than the medical methods which have access to limited data.

The GoAlcoholGo app successfully addresses the need for a holistic platform for alcohol behavior modification. It acts as a well-designed amalgamation of technology and therapeutic ideas. The app is readily available, easy to use and at present, does not include any subscription costs. Features such as Help, Relapse and Reset go beyond the traditional ways of monitoring and tracking and motivate the user to be in line with the goals and hold on to the path of progress. The sensor-based evaluation is a very effective and creative way to determine the sobriety state of a person. In terms of persuasive power, our app has an advantage over a real person. The degree of anonymity provided to users is also a big advantage. Furthermore, the app also exhibits the scope for further development and enhancement and hence is readily scalable.

An interesting feature that we aim to incorporate in the future is the integration of the app with access to a real-time health counselor. This feature is similar to the Help feature currently existing in the app. However, intervention from a real person can prove to be more effective and logical. Another feasible development is the integration of breath-based alcohol detection sensors with the mobile smartphone. This technology, if incorporated, can perform live tracking of the user's breath to detect alcohol consumption and can alert the user if they are on their way to relapse. Furthermore, it is important to refer to various studies on behavior modification and in turn conduct more studies to procure statistics on the lacking domains. This can act as a motivation and also provide relevant data for efficient development which was a deficit and hence a major challenge during the development of this project.

VI. RELATED WORK

With the widespread use of the internet and the development of smart devices, a variety of applications are now accessible to aid in the treatment of alcohol use disorder. There is a plethora of apps that are available on platforms such as Appstore, Play-store etc and can be easily downloaded into one's smartphones. In this section, we address these smartphone applications and contrast them based on their design, quality, rating and user feedback. Based on online comparison studies [11], we

assessed and evaluated the deficits of these applications to understand the current requirements of our development as well as the market. The existing applications can be broadly divided into two categories:

- **Self-Control Apps:** Sober Time [12], HabitBull [13], Clean Time App [14], AlcoChange [15]
- **Motivational Apps:** Rehapp [16], Daily Reflections [17]

Mubin et al. [11] developed a MARS app quality rating to rank these mobile health apps pertaining to alcohol behavior modification. The ratings for the above-mentioned apps have been summarised in this section.

| App Name | App Quality Mean Score | App Subjective Quality Score |
|--------------------------|------------------------|------------------------------|
| Sober Time | 4.43 | 3.75 |
| HabitBull | 4.88 | 4.75 |
| Clean Time App | 3.11 | 1.75 |
| AlcoChange | 4.20 | 3.25 |
| Rehapp | 4.33 | 2.75 |
| Daily Reflections | 2.66 | 1 |

Fig. 17. Table summarising MARS ratings.

VII. CONCLUSIONS AND FUTURE WORK

Self-guided mHealth smart apps can promote healthy living and can act as an appealing and effective option for Behavioral Interventions in case of addictions such as excessive consumption of Alcohol. However, these technology-based therapies are still understudied and often incorporate poor and deficient approaches. In comparison to several existing applications in the market, we hypothesize that the GoAlcoholGo mobile app will effectively lower drinking levels and motivate individuals towards sobriety. If successful, our intervention might be a low-cost, scalable public health intervention to alter young people's drinking behaviors. Our implementation also holds the potential to include useful and noteworthy features such as expert consultation and sensor-based breath detection.

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