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Senior Project Proposal
UNDERGRADUATE

Project Title:	Mobile Application of Empirically Supported Smoking Cessation Treatment
Organization:	RIT – Department of Psychology
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(Instructions for completing this proposal can be found at

http://www.se.rit.edu/~se561/CourseInformation/ProposalInstructions.pdf)

Background Information

Smoking related disease continues to be the number one cause of preventable death in the US[1]. Approximately 18.1% of the US population smoke[2]. Quitting smoking is difficult with the best current treatments (e.g. combination counseling and medication) only helping about 30% of smokers who try to quit remain abstinent at 1-year post quit date. A recent call has been made in the field[3] to increase the use of mobile technology in smoking cessation treatment. This proposed project aims to implement current empirically supported treatments for smoking cessation into a mobile app with innovative features to improve current treatment modalities.

Most empirically supported treatments for drug addiction (in this case smoking cessation) are based on a combination of cognitive and behavioral based theories, and are referred to as cognitive-behavior therapy (CBT). The cognitive approach to treatment has patients learn to identify maladaptive thoughts and irrational thinking patterns and use exercises to counter act them. For example, a patient trying to quit may consistently and automatically have the thought that they are a failure and always will be each time they relapse. This will negatively impact their ability to quit, likely leading the person to not even try. A cognitive therapy technique would have the person challenge this thought instead of automatically accepting it as true. The behavioral approach focuses on helping patients identify behavioral patterns and triggers for drug use and using this information to change behavior in a way that reduces the likelihood of relapse.

The proposed project would incorporate CBT in an interactive application that could serve as a self-help treatment tool, adapting to the user's inputted data to drive the content that is presented to the user or as a therapist tool that interacts with a therapist version of this app for in-person therapy with a therapist. In the latter situation, working with a therapist using a cognitive-behavioral based treatment, patients are typically asked to complete homework assignments outside of therapy and these homework assignments play a significant role in the treatment outcome[4]. One major problem that often arises in treatment is that patients tend to have low homework compliance. This leads to either failed treatment attempts or extended treatment duration. The proposed app would aim to address this issue as well (see project description below).

Project Description

The goal of the project is to have two applications that can interface with each other through an internet connection. One will be the client (patient) application which would run on mobile smart phones providing empirically supported CBT treatment elements. The other would be the therapist application that would run on a tablet. The overall applications would be scalable and provide a framework that would allow content to be easily changed so that the applications can be applied to the treatment of other psychological conditions that CBT is typically used (e.g. anxiety disorders, depression).

Client Application. The client app would serve both as a standalone self-help application and as a therapy tool in the context of the patient seeking counseling. In both cases, the main function of the application would be to provide the CBT treatment elements. These elements would include:

Assessment: Assessment is a very important part of treatment as it provides information to assess treatment targets, treatment progress and helps in motivating the patient. Some examples of items for assessment would be smoking behavior, i.e. tracking the number of cigarettes smoked, when they are smoked and the situation they are smoked in; ratings of mood and cravings; and smoking triggers or cues that lead the person to experience urges to smoke. The client app would then use this information to drive feedback given to the patient through the other elements, such as displaying graphs of treatment gains to improve motivation or to prompt users to complete an exercise to boost their mood and avoid relapse.

Motivation: The app would have a motivational element that would incorporate motivation exercises such as having the patient list reasons for quitting, listing benefits of quitting, and prompting users to remember these reasons when they indicate they are tempted to smoke.

Cognitive exercises: This element of the app would provide cognitive exercises that prompt users to assess antecedents to smoking behavior and the consequences of that specific behavior. This is a common CBT homework assignment, where the antecedents to identify would include things like the person's thoughts or triggers in the environment (e.g. work stress) that leads to smoking, then has the person identify the consequences of the behavior (e.g. smoking reduced stress), then to have the person identify alternative behaviors to take the place of smoking that would have the same consequence.

Psycho-education: Another element of the app would provide educational material on addiction, the negative effects of smoking, the benefits of quitting and information on the pharmacological treatment options that patients can talk discuss with their doctors.

Feedback: The app would provide regular feedback to the user to indicate things like their progress in treatment through graphs of select assessment data, making the user aware of the times when they are more likely to crave a cigarette and providing tips for avoiding relapse during these times, etc.

One aspect of the patient app that would make it innovative is the app being able to 'predict' when the patient was going to smoke and pre-emptively get the patient to complete the therapy exercises when they are most needed (particularly the assessment, motivation, and cognitive exercises). To do this the app would combine temporal data with GPS data collected during an initial phase of smoking behavior assessment (when and where the patient typically smokes).

This could be expanded to include using map data to have the app aware of when a person is at a new high risk location for smoking (e.g. a bar).

Therapist Application. The companion therapist app would be another innovative component of the project from a psychological therapy perspective. This app would address the issue of patient homework non-compliance. As mentioned above, a major component of therapy is the homework assignments given to patients by their therapist. For many reasons, including lack of motivation (a typical effect of many psychological disorders, including addiction), patients often have difficulty with completing assignments. Furthermore, when patients do complete their assignments therapists don't see the results until the next session where they have to quickly decipher the homework data and use it in that therapy session. The therapist app, in this initial incarnation, would be designed to collect assessment data from the patient app through a network connection and provide easy to use data summary tools, such as creating assessment total scores and graphical displays of the data. This app would allow the therapist to 1.) be aware of the patient's homework compliance in-between sessions, 2.) provide summaries of the homework data for efficient analysis, and 3.) provide a system for tracking patient progress through treatment (e.g. graphing assessment data over many weeks to see trends in symptomatology).

Project Scope

This proposed project entails creating two applications. As stated above, the client application would need to utilize GPS data combined with user input data to predict the user's future behavior which would create prompts for the user to complete specific therapy related exercises included in the application. The client application would need to be able to securely send data via the internet to the therapist application. This connection would need to be secure in such a way to protect the patient's identity. This connection would also need to be configurable so that when the patient application is used in conjunction with the therapist application the data is sent to the correct therapist (the idea is that the applications would be widely disseminated in the future and so there would be multiple therapist-patient pairings). The therapist application would need to be able to collect and store data from a number of patients and be able to perform simple summary functions (e.g. summing scores, adding frequencies, displaying data in graphical form, etc).

Dr. Baschnagel (contact person) is an expert in the content domain (CBT and smoking cessation) and will work with the software team to ensure the appropriate content is included in the application.

The current project would focus on creating the applications for a specific content area, smoking cessation treatment. However, it would be ideal for the applications to be designed so that the framework can be applied to other content areas, such as CBT treatments for anxiety or depression. This would require an easy way to change the content (e.g. change the assessment questions, or text of the cognitive exercises) on the patient app. Additionally the application should be scalable to add additional elements, such as the ability to integrate Google Glass and Bluetooth connectivity to data collection hardware. Dr. Baschnagel has a pair of Google Glass and though not a part of the current proposal, integrating this particular hardware with the applications could be added to this project if there is time and interest on the part of the software team. Finally, it is expected that the applications will be created for use on devices using the

Android operating system but it would desirable to be able to port the applications for use on iOS devices in the future.

Project Challenges

Possible project challenges include:

1.) Creating a user friendly application that can be used by a population of users that will likely widely vary in their tech savviness.

2.) Creating applications that maintain the security of the patients' data.

3.) While Dr. Baschnagel is an expert in the content domain, he has limited knowledge of software engineering or programming. As such, there may be technological challenges that are not identified here.

Constraints & Assumptions

There are few predetermined constraints and specific constraints can be determined with the team at the beginning of the project. The main assumption is that at the end of the project there will be 1.) two working Android based applications that at the very least can incorporate a few of the elements described above and 2.) the software will be designed and well documented so that future teams can expand open the applications.

Sponsor-Provided Hardware and Software

The sponsor can provide an Android based phone and tablet if needed for development purposes.

Project Search Keywords

Smoking cessation; psychotherapy; behavior prediction; mobile health application

Department of Software Engineering Required Deliverables

1. Project website holding all work products and project artifacts maintained in the project account on the se.rit.edu web server.
2. Project plan, schedule and process methodology definition prepared by the end of week 3 of the first term.
3. Tracking report for time/effort worked on the project, and at least two other product/process metrics appropriate to the project and development methodology. Tracking reports updated on the project website at least every two weeks.
4. Interim status and final project presentations
5. Project poster and presentation at "SE Senior Project Day"
6. Project technical report

Sponsor and Project Specific Deliverables

1.) Well documented code for each application that can be used by future software engineers to expand the applications

2.) A working patient app that contains at least the assessment and feedback elements.

3.) A working therapist app that can perform the basic data summary functions outlined above.

Sponsor Availability

	Availability for Weekly Project Meetings
X	Sponsor personnel will be available to meet with the team once per week during the standard class time of Tuesday and Thursday from 5:00 – 6:15pm Eastern US time. We will give a strong selection preference to proposals whose sponsors are available during this time.

Proprietary Information

There is no proprietary information for this project.

Project Agreements and Assignment of Rights

RIT policy gives students full ownership of any work done as part of coursework which includes their work on senior project. As the sponsor of a course project, you can select one of three approaches for dealing with ownership of project artifacts and intellectual property, and the disclosure of proprietary information. If you seek assignment of rights, the individual team members will sign a project agreement based on the rights that you want.

If you are requesting that the team assign project rights to you, please get any corporate and legal clearances that you feel are needed to use the **unmodified** project agreement, before submitting your project proposal. Indicate that this has been done with an **X** in the left box below.

	Corporate and Legal Clearance of Project Agreement
X	This project will either be an Open Source Project not requiring assignment of rights, or we have the necessary approvals to use the **unmodified** project agreement. (Note: The project agreements are cleared for RIT internal projects.)

Select one of the following approaches for assignment of the project artifacts and intellectual property, and the disclosure of proprietary information by placing an **X** in the box to the left of the appropriate paragraph below.

	Assignment of Full Rights
X	If a team is assigned to this project, all students on the team will sign a standard Student Course Project Intellectual Property and Non-Disclosure Agreement. This agreement assigns the rights to the team's project work to the sponsor, and describes

	the process whereby the project sponsor can reveal proprietary information to the team. For non-RIT projects, the faculty coach will sign a standard Faculty Course Project Non-Disclosure Agreement which describes the same process for revealing proprietary information.
___	**Assignment of Limited Use Rights** If a team is assigned to this project, all students on the team will sign a standard Student Course Project Limited Use and Non-Disclosure Agreement. This agreement assigns the sponsor rights to the team's project work for internal or non-commercial use by the sponsor. The sponsor may maintain and extend the project but not transfer it to a third party or use it in a commercial product. The project team will retain patent and commercialization rights. The agreement also describes the process whereby the project sponsor can reveal proprietary information to the team. For non-RIT projects, the faculty coach will sign a standard Faculty Course Project Non-Disclosure Agreement which describes the same process for revealing proprietary information.
___	**Open Source Project** If a team is assigned to this project, the team will develop this as an open source project and will publish all artifacts via an open source mechanism agreed upon through discussions with the project sponsor. The sponsor will gain access to project artifacts only through this open source repository. No rights need to be assigned exclusively to the project sponsor, and there will be no transfer of proprietary information.

The agreements and policies can be found at:

- Student Course Project Intellectual Property and Non-Disclosure Agreement
  http://www.se.rit.edu/~se561/CourseInformation/StudentCourseProjectAgreement.doc
- Student Course Project Limited Use and Non-Disclosure Agreement
  http://www.se.rit.edu/~se561/CourseInformation/StudentCourseProjectLimitedAgreement.doc
- Faculty Course Project Non-Disclosure Agreement
  http://www.se.rit.edu/~se561/CourseInformation/FacultyCourseProjectAgreement.doc
- RIT Intellectual Property Policy C3.0. The project agreements are consistent with section C3.0(5)(B)(2)
  http://www.rit.edu/academicaffairs/policiesmanual/sectionC/C3.html

References:

1. *Smoking-attributable mortality, years of potential life lost, and productivity losses--United States, 2000-2004*. MMWR Morb Mortal Wkly Rep, 2008. **57**(45): p. 1226-8.
2. Agaku, I.T., B.A. King, and S.R. Dube, *Current Cigarette Smoking Among Adults - United States, 2005-2012*, in *Morbidity and Mortality Weekly Report*. 2014, Center for Disease Control and Prevention. p. 29-34.

3. McClernon, F. J., & Roy Choudhury, R. I am your smartphone, and I know you are about to smoke: the application of mobile sensing and computing approaches to smoking research and treatment. *Nicotine Tob Res, 15*(10), 1651-1654. doi: ntt054 [pii]10.1093/ntr/ntt054
4. Mausbach, B. T., Moore, R., Roesch, S., Cardenas, V., & Patterson, T. L. The Relationship Between Homework Compliance and Therapy Outcomes: An Updated Meta-Analysis. Cognit Ther Res, 34(5), 429-438.