

Undergraduate Thesis Prospectus

Managing Anxiety through Mobile Application Training Suites

(Technical research project in Computer Science)

The U.S. Nuclear Energy Debate

(STS research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem

How can high-tech/low-tech hybrids better meet needs than high or low-tech alone?

Technological solutionism is an ideology that sees complicated social issues (politics, education, public health, etc.) as “neatly defined problems with definite, computable solutions... that can be easily optimized—if only the right algorithms are in place” (Morozov, 2014). They believe that powerful computer hardware paired with efficient algorithms will trivialize problems once thought to be uncomputable.

Technological solutionism is contrasted by a belief that the full spectrum of tech must be considered when approaching problems. However, considering the number of US patents filed has more than doubled from 2000 to 2015, technological solutionism is becoming more pervasive than this measured, hybrid ideology (USPTO, 2016). Combining high-tech and low-tech may be more successful in managing complex societal issues.

Managing Anxiety through Mobile Application Training Suites

How can a mobile application training suite relieve the user's anxiety?

Our capstone team will be working on this project under Professor Ahmed Ibrahim of the Computer Science Department. We will work with MindTrails, a UVA research initiative, to create an application that can collect data from the user's phone through accelerometers, GPS, and heart rate sensors. This data will be used in addition to the existing data collected by MindTrails to create training that prepares the user to better handle their anxiety. MindTrails provides cognitive bias modification interventions in order to relieve a patient's anxiety.

According to MindTrails, cognitive bias is the tendency to “pay attention to, remember, and interpret things differently when processing information tied to your emotional responses” (MindTrails, 2019). By setting up a suite with small training sessions, participants can change their cognitive biases to help prevent anxious thoughts. The American Psychological Association analyzed the effectiveness of short training sessions on anxiety and found that “after just eight 15-minute sessions... 72 percent of patients in the treatment group no longer met diagnostic criteria for social anxiety disorder, compared with 11 percent of patients in the control group” (Weir, 2011).

Currently, MindTrails offers their training sessions through a website platform. While the MindTrails team has had success with getting users to register for the study, they have faced problems retaining users until the end of the study. They have tried to fix this by sending email and text reminders and by offering gift card rewards for completing multiple sessions. While this has moderately increased returning users, it does not keep enough participants to warrant the cost of the gift cards. Another problem that MindTrails has faced is meeting the user’s needs during spikes in anxiety or stress. Accessibility to the website in these situations is not always perfect, as participants may not have access to a web-enabled device or Wi-Fi network. Due to the structure of the MindTrails training suite, having constant access to sessions is key to the overall success of the program.

Application Design

In order to solve these problems, our capstone team has been tasked with creating a cross-platform mobile application for MindTrails. The goal of this app is to better address the

problems of user retention and session accessibility that MindTrails currently faces. The retention rate can be improved through system notifications that remind the user of their available sessions. These notifications would lead the user directly to their current sessions. This would improve upon the current process that requires the user to check for an email or text message, log into the website, and then navigate to the desired sessions. The app will resolve accessibility problems by storing the user's current working sessions locally, allowing them constant access to MindTrails in the absence of an Internet connection.

Application Requirements

Gathering requirements is essential for the overall success of our project, as the requirements we gather will determine the work done within the time frame of the capstone project. Quality requirements are important to ensure that we resolve the problems that originally created the desire for a mobile MindTrails app. Since MindTrails personnel will maintain the app after our capstone project completes, it is important that our build is aligned with the overall goals and skills of the MindTrails development team. Our requirements are broken into three sections: minimum, desired, and optional.

Minimum Requirements: Functionality required by the end of the Fall 2019 semester

- Authenticate users using login information
- Perform any tasks available on the website within the mobile application
 - Be able to complete questionnaires
 - Be able to complete quizzes

- Be able to complete training
- Give users reminders for available training modules
- Cross-platform availability (iOS and Android)
- Have user information remain private and secure

Desired Requirements: Functionality required by the end of the Spring 2020 semester

- Notify users when an intervention may occur
- Have access to training and intervention sessions without Internet connection and sync information with the cloud upon reconnecting to the Internet
- Have the application read mobile sensor data (GPS, accelerometer)
- Optimize the user experience for mobile platforms
- Optimize screen layout for both portrait and landscape views
- Utilize the same API endpoints to supply data to both web and mobile platforms
- Utilize the Sensus API to collect sensor data

Optional Requirements: Functionality that is wanted, but not required

- Integrate with wearable technology
- Login using fingerprint or face ID (on applicable devices)
- Give users the option to manually sync progress between web and mobile platforms

The US Nuclear Energy Debate

How do energy regulators, nuclear power companies, climate activists, and renewable energy proponents compete to influence the future of nuclear energy in the US?

Nuclear energy is a low-carbon candidate to replace fossil fuels as the main source of power for the US. According to the World Nuclear Association, if fossil fuels had been used in place of nuclear energy in 2018, 1,959 million additional tonnes of CO₂ would have been produced (WNA, 2019). However, recent incidents such as the 2011 Fukushima Daiichi disaster have damaged public trust in nuclear energy. This disaster caused 2,129 deaths, of which 1,368 were directly related to the nuclear power plant (Tokyo Shimbun, 2016). The environmental benefits of nuclear power must be balanced against its safety risks, and its alternatives, such as renewable energy.

Participants in this problem are the US Department of Energy (DOE), climate activists, energy think tanks, nuclear power companies, and environmentalists.

The DOE educates, regulates, and administers federal subsidies to nuclear energy. It has funded “multiple domestic advanced nuclear technology projects” in order “to advance the state of U.S. commercial nuclear capability” (DOE, 2019).

Advocates, such as the Union of Concerned Scientists, evaluate nuclear power as a mitigator of climate change. It found “the possibility that the nation will replace existing nuclear plants with natural gas and coal rather than low-carbon sources” raises concerns about the nation's ability to cut carbon emissions (Clemmer et al., 2018).

Nuclear power plant owners, such as Dominion Energy, note the environmental and economic benefits of nuclear power. Dominion Energy claims that their Millstone Power Station

in Connecticut “produces over \$1.5 billion in annual economic benefits” and “supports almost 4,000 jobs” (Dominion Energy, 2019).

The International Energy Agency (IEA) evaluates energy sources and promotes those it finds to be safe and cost-effective. The IEA found that nuclear energy can be “competitive with other electricity generation technologies, including new solar and wind projects” and that a decrease in its use would “threaten energy security and climate goals” (IEA, 2019).

Environmentalist opponents of nuclear energy, such as Greenpeace, favor renewable energy over nuclear energy. Greenpeace claims nuclear energy is a “dangerous and expensive choice,” not a “viable low-carbon alternative to clean energy” (Leonard, 2015).

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