CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: "Clean My Campus" mobile application	
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Project Overview:

An unfortunate consequence of the emphasis on convenience and hygiene in our modern consumer society is an explosion in the amount of trash produced. Although advanced economies like the United States have well-developed trash collection infrastructures, lots of little bits and pieces – what is typically called "litter" – still escape to pollute our urban landscapes. As a small city in and of itself, the NAU campus is no exception. As a result of the occasional overflowing trash containers, human litter, and the high winds in Flagstaff, NAU's campus often has small to large pieces of litter around campus. NAU is working on multiple initiatives to address this issue. From a recent million dollar investment in outdoor landfill and recycling receptacles to new efforts to recycle at home football tailgating events, recycling and waste management is a top priority for NAU. We often say, "Recycling is the gateway drug to sustainability." Once people start being better stewards of their land and better managers of their material resources, they become better stewards of less tangible things like water, electricity, and natural gas.

One of the specific missions that NAU has taken on is to find novel ways to reduce the amount of litter across campus to maintain an aesthetically pleasing environment. The fact is that, in the modern budget-constrained context, there simply are not resources to pay an army of hired cleaners to circulate and collect trash. This project proposal is based on the idea that they best way to have a clean campus is to explore a novel way to use mobile computing technologies to motivate and organize campus users themselves – those who benefit directly from enjoying a clean campus – to work together to keep our campus clean.

What is needed is a relatively simple, easy-to-use mobile app, paired with a matching web-based backend, that together support an online community of NAU faculty, staff, and students centered around keeping our campus clean. Specifically the CleanMyCampus app would motivate, incentivize, and organize the regular cleaning up of campus. There are already many resources in place: Green NAU has good engagement from 200+ Energy Mentors, multiple building managers, and environmentally conscience clubs and students that are always interested in advancing sustainability. If we could provide an organized way for these individuals to collectively get engaged around cleaning campus, we could see beautiful results!

Core functionalities for a minimum viable product (MVP) will include:

- A fully functional mobile app for Android and/or iOS. Ideally, the app should be based on a cross-platform framework like Ionic or React Native so that the same codebase could be used to easily deploy *both* Android and iOS versions.

- Must support registration of new campuses by a university representative, who becomes the site administrator for that campus.
- App must support registration of individual users and their connection to registered campuses.
- App must provide a well-designed GUI that allows users to view areas of their campus based on when someone (other users) has last patrolled/cleaned each area; it should provide a way for users to select an area to clean and indicate that they have cleaned that area.
- Must provide some sort of point or reward system in which users score points for cleaning areas.
- A rudimentary website that allows registration of new campuses, basic user management, and a way to gather statistics/reports of cleaning of individual campuses.

A "comfortably-equipped" solution that is truly usable would build on these minimum requirements with:

- Would allow users to "report a facilities problem" by sending an email or picture to Facility Services highlighting a broken bathroom stall, leaking irrigation head, over flowing trashcan, etc.
- Would allow users to flesh out their user profiles with pictures and other information, providing avenues to meet and learn more about others using the app on their campus.
- Would allow registration of subgroups within campuses, e.g., "the Math Club" or individual dorms, to allow users to form "teams".
- Explore more sophisticated "gamification" strategies to help motivate users to engage. Examples include, scoreboards show standing of user/team scores, ability to place "bonus" points in particularly high-priority or hard-to-reach areas of campus, etc.
- A fully-developed web-app that provides a nice admin interface for registering new campuses in the system, managing subgroups (teams) within those campuses, viewing campus cleaning results, downloading reports of cleaning activities, and other system admin activities.

Stretch goals could include:

- Exploration of setting up "competitions" for some set timeframe where users/teams can compete for prizes or rewards.
- Exploration of ways to support accountability, e.g., using geo-location and/or uploaded snapshots as they check in while cleaning, to show that it really happened.
- Exploration of connection to social media, e.g. Facebook and Snapchat to share cleaning accomplishments directly from the app.

Ultimately, creativity is highly-desired on the part of the team, and the team is encouraged to contribute their own ideas and extensions as the concept is developed.

The impact of this solution could be significant. If successfully tested at NAU, this webapp will be deployed next in the University of California's 10-campus system and from there, on to other universities, towns, counties and beyond. Although this project is aimed primarily at campuses (imagine if hundreds of campuses across the United States registered their campuses on an app that you built!), there is no reason the same app, with minor extensions, couldn't be used for cities themselves! If designed right, this has potential for tremendous impact!

Knowledge, skills, and expertise required for this project:

- Creativity. Ability to analyze end-user needs and psychology and design appropriate features in the product.
- Interest/experience in web app and mobile app frameworks, especially in use of cross-platform frameworks that support both Android and iOS apps.
- Ability to design and configure cloud-based computing infrastructures. The system should be hostable on traditional resources (e.g. the linux box in the corner) as well as, just as transparently, on a cloud-based virtual infrastructure like Amazon EC2.

Equipment Requirements:

- There should be no equipment or software required other than a development platform and software/tools freely available online.
- Sponsors will work to provide some sort of hosting solution (likely NAU server, possibly AWS).

Software and other Deliverables:

- A fully-functioning mobile application for either Android or iOS platform (or ideally both, i.e., cross-platform developed); plus backend server hosted as specified by client.
- Complete users manual for the mobile app, written for non-technical users. Could be done as web-based document if desired.
- A “system administrators” manual that details step-by-step how the system can be installed on a platform of the client’s choice, as well as how to perform basic configuration and maintenance.
- As-built report (required of all CS capstones), that carefully documents requirements, design decisions, and implementation details. Should allow future team to easily pick up where left off.
- Professionally documented source code.