

Prospectus

**Indoor mapping and navigation for an autonomous 3D printed
robot**

(Technical Report)

Encouraging public online discourse for an online storytelling application

(STS Research Paper)

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Introduction

History comes in many forms, ranging from seemingly minor personal anecdotes to grand events of old. However, much of human history goes by unrecorded. This could be due to any number of reasons. Maybe an oral myth slowly dies out over the years. Maybe an event was thought to be too minor at the time to be worth sharing, or at least not worth writing down. Or maybe those in power to be making history see the happenings of others as irrelevant, inconsequential, or even worth hiding and suppressing.

Whatever the case, retelling local stories and history, both small and large, helps build community and promote understanding to others within the community. This fostering of connections and spreading of ideas ultimately helps promote community members to enact positive change. My STS project focuses on designing an application centered around the sharing of such local stories that can happen closeby every day in Charlottesville, Virginia. My individual work will focus on how we can design the application to encourage users to read, and contribute towards such an application, especially from those who may otherwise feel disinclined or discouraged from doing so.

My technical project will focus on enhancing the capabilities of 3D printed unmanned ground vehicle developed by the MITRE Corporation. The primary use case is for indoor intelligence, search, and reconnaissance missions. Intended features include increased mapping reliability, more flexible human operation, and greater autonomous features.

Technical

There has been increased interest in autonomous and semi-autonomous unmanned vehicles for military applications in recent years. The use of unmanned systems use allows for reduced risk to human life and more efficient operations, while autonomous and semi-autonomous components allow for human operators to be assisted or replaced for certain tasks and be useful elsewhere in the operation. One such type of operation where autonomous wheeled vehicles have been used is for intelligence, surveillance, and reconnaissance missions. The vehicle can be sent into adversarial environments to gather information before any human enters.

As a result from previous University of Virginia capstone teams, an unmanned ground vehicle prototype was designed entirely from 3D printed or commercial off-the-shelf parts. This provides the benefit that the vehicle can be easily constructed in the field at low cost, and can be later repaired or modified on the field to meet unforeseen mission requirements. A possible mission could involve deploying the vehicle in an indoor environment, where GPS localization may be less reliable and latency between the system and a human operator is increased. The prototype was further developed to improve for such operation in indoor environments: implementing object avoidance to compensate for lag between the operator and system, as well as simultaneous localization and mapping (SLAM) using LiDAR. They also implemented capability to autonomously navigate back to a set base location using the generated map.

However, the existing prototype has its issues. The SLAM is unreliable: after some use, the map to becomes distorted and/or correct localization is lost. We plan to improve upon the existing system's features by integrating additional sensors to aid the LiDAR in localization and map generation.

We also aim to allow more remote use of the vehicle. The current prototype requires line of sight from a human operator. The addition of an analog camera, for instance, can be a low latency solution to allow human operation of the prototype from outside of the operator's immediate view. We ultimately hope to produce a prototype capable of autonomously exploring an unknown area and identifying points of interest, while a human operator is capable of monitoring, taking control, or sending commands to the vehicle at any time.

STS

Introduction

Storytelling provides numerous benefits for community building and development. In social movements, storytelling is used for constructing agency, shaping identity, and motivating action. Narratives are also useful for community development. The story itself allows for sharing and learning from each others' life experiences and building connections with each other, while the method addresses typical barriers to knowledge transfer in the face of social change. By uniting under a purposeful narrative, diverse communities can be motivated into building social capital and working towards positive change (Prasetyo, 2017).

In some cases, a community might not be offered the chance to develop their own narratives. Vinegar Hill was a neighborhood in Charlottesville, Virginia that acted as a principal area of commerce for its African-American community, and was destroyed in the 1960s as part of an urban renewal campaign. Under the narrative of clearing a derelict slum, the city produced "the nearly wholesale destruction of a neighborhood that was uncommonly rich in its own heritage, traditions and lore" (Schwartz, 2005).

As part of an STS group project, we envision creating an application providing a platform for residents and other users to share their own stories or narratives. Instead of solely focusing on content deliberately sought out and familiar to users, focus will to their immediate surroundings, allowing users to be able to learn more about what may otherwise go unnoticed in everyday places around them, as well as contribute with their own knowledge and experiences.

In order for someone to be willing to share a potentially intimate and personal story with another, there must exist some layer of trust between the storyteller and the listener. Even if the storyteller does not believe the listener has their best interests at heart, it would be reasonable to assume that the storyteller has some trust that the listener will not (or cannot) use the information they choose to disclose against them. For example, anonymous online posters often mask or alter names, companies, or other specific details that could allow their audience to identify them and negatively affect their lives. Among other things, trust has been described as a willingness to accept some vulnerability (Beldad, De Jong, & Steehouder, 2010). Even when enough intimate autobiographical details are divulged for it to be called "confessional art," Smith (2017) argues it is more akin to a performance, where much of the

impact is due to the audience connecting with a seemingly authentic persona, over the actual veracity of the claims. Even there the artist still maintains a sense of separation from the audience, choosing to deliberately disclose some personal information while withholding others.

For my individual STS topic, I will be looking into how we can best design our platform to encourage users to engage, read, and share their own stories. Without that basic level of trust, newcomers may feel disinclined or discouraged from participating as neither part of the audience nor as a “performer”. They may initially feel that the platform or its users are uninterested or do not have their best interests in mind. Along with not repelling potential users, encouraging current users to continue participating of their own accord is also important.

Literature Review

Usability describes how well a user is able to operate a system. Flavián, Guinalú, and Gurrea (2006) describe the ease of understanding a system’s structure as observed by the user, speed of finding intended items, perceived ease of navigation and execution of actions, and sense of user control as factors that go into usability. After surveying internet users about websites where they often make purchases, they found positive relationships between how the users rate their chosen site’s usability and customer trust and satisfaction, as well as positive relationships between trust and satisfaction and customer loyalty. Perhaps ensuring the perceived usability of our platform across our intended users can help encourage them to participate. However, a majority of those surveyed by Flavián et al. (2006) were young, highly educated, frequent internet users, and Spanish speaking. They acknowledge different relationships can exist across different nationalities. Other subjective elements of a website’s design, including graphical aesthetics, social presence, and capacity for customization have also been shown impact trust (Beldad et al., 2010).

An example of how cultural background of users can affect how they interpret a subjective measure such as usability differently comes from Frandsen-Thorlacius, Hornbæk, Hertzum, and Clemmensen (2009). Upon questioning users born, raised, and currently living in either Denmark or China, they found significant differences in what aspects of usability users found important. Some of the significant differences include Danish users tending to find effectiveness and non-frustration more important, while Chinese users tended to attach more importance to visual appearance, satisfaction, and fun. This gives at least one concrete example of how users of different backgrounds may come to expect different experiences from the same application. When designing our online application, it will have to be considered that different interfaces and workflows may appeal differently to different user groups.

Framework

Some preliminary user groups identified include longtime residents of Charlottesville, University students, and short-term visitors, each of which would likely be interested in both creating and viewing content to some degree. Meanwhile, other groups, such as historical societies, would probably be primarily interested in educating others with more factual and historical information, and thus be more inclined to take a creator role. These user groups are not exhaustive, subgroups within them can likely be identified based on an individual background, age, personal interests, etc. Depending

on how these users socially construct our platform, what use case they may find for themselves, if any, can change.

When discussing how content should be moderated, a graduate engineering student from Tsinghua University suggested voting on user generated content. This was also the same approach initially suggested within the STS project group. Clearly, this would allow for the most popular content to be more visible and promoted. However, promoting the most popular stories can encourage the sharing of others like it, while not necessarily promoting the stories most conducive towards building diverse communities and inspiring positive change. Voting will also likely use some kind of score or “likes” system awarded by votes from fellow users. This shows how university students could value using such a platform for the satisfaction from socialization with others and the acceptance from others as they make positive contributions.

Methods

Social media, particularly Twitter, have played an increasing role in journalistic practices. It is both used as a source of real-time news as well as gathering audience perspectives (Lăzăroiu, 2014). A similar Chinese microblogging site Sina Weibo seems to have played a similar role, having “revolutionized Chinese social media by providing a platform for public discourse,” at least until the Chinese government “cracked down on this form of expression by targeting influential public opinion leaders” (McLauchlin, 2017).

I will interview potential or current users familiar with either Twitter or Weibo, two microblogging sites that have been described as providing platforms for expressing and discussing opinions, in order to learn such things as how they view the sites and why they do or do not use them.

Discussion and Next Steps

Interviews related to Twitter, Weibo, or any similar online platform with widely shared contributions still need to occur. As the storytelling application will share those aspects, learning how these popular, broadly similar platforms are enjoyed (or not) in different cultural and political landscapes will hopefully guide us in the creation of our own.

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