PowerShare: A Mobile Application to Enforce Representative Accountability
(Technical Paper)

Influence of Voting Technology on Election Fairness in the United States
(STS Paper)

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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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Introduction

Since its inception, the United States has been a representative democracy in which citizens regularly elect representatives to implement policies on their behalf. In theory, by allowing every citizen to cast a single vote in an election for a position of power, equal representation is achieved by this style of government. The means by which citizens cast their vote, however, has been constantly evolving. One of the more recent change has been the rise of electronic voting machines, which surged in popularity in the 2000's (Garner et.al., 2005). Though these new machines have improved voting accessibility to previously marginalized groups in some cases, new problems have arisen: recent studies have demonstrated vulnerabilities which could provide malicious actors a way to unfairly influence the election process. These vulnerabilities call into question whether these advances in technology are truly compatible with our electoral system.

While fairness in elections ensures that voters can choose the candidate that they feel best represents their needs, the issue of accountability persists (Dunn et.al., 2001) – how do voters know that their elected representative is keeping the promises they made as part of their platform? Through mobile application technology, the technical portion of this capstone aims to provide a solution to this problem. The mobile application will provide a common platform through which elected officials and constituents can constructively interact to advance their communities. This will hopefully allow voters to measure how well their representatives are meeting their needs and ultimately increase their confidence in the election system. Ultimately, both problems reinforce how technology is an inextricable actor in the ability of United States elected officials to best represent their constituents.

Technical Topic

Currently, there are a limited number of channels available through which elected officials and their constituents communicate with each other. Some more informal ones include social media, such as Instagram, Facebook, or Twitter. However, since hundreds of users comment on a post or tweet by an elected official, individual comments easily go unnoticed; therefore, these social media platforms are rarely an effective means for either group to engage in communication. More traditional ways of contacting representatives include emails, phone calls, and town hall meetings. Emails and phone calls are often handled by a representative's staff, who may not always provide the most authentic response to the constituent. Town hall meetings, on the other hand, are a more reliable way for voters to directly communicate their needs to their representative face-to-face, but these events are not held frequently.

A solution to this problem would need to implement two major features. First, voters need to communicate quickly and intuitively with their representative in a way that will ensure that their voice does not get lost. At the same time, elected officials need a way to easily determine the needs of the community in real time without becoming overwhelmed by a large volume of constituent feedback.

The real-time nature of this solution points to a digital-focused path, but social media platforms are generally insufficient due to their lack of political specificity. One existing digital tool that is more politically focused is the digital application Countable (Countable.com, 2019), which allows users to "get clear, concise summaries of bills going through Congress, see what others think, then take action." To accomplish this, the application is divided into two feeds: an opinion feed, which consists of opinion pieces written by users, and a bill feed, which shows a dashboard of bills recently drafted by Congress. Both feeds implement a social network format,

in which users can vote and comment on elements of each feed. Though promising, this application ultimately has several shortcomings. First, it does not provide a new channel by which representatives and constituents can communicate; constituents still would have to email or video message their representatives. Next, the social-network format of the site, which enables users to comment on each other's posts and opinions, may be irrelevant to a representative trying to find the most important goals to pursue for their community. Because of these disadvantages, Countable does not satisfy the two critical requirements for a solution that would improve communication between a community and its representative.

PowerShare, the application our team is developing, addresses the two-part requirement by limiting the set of actions that different classes of end users (i.e. constituents and representatives) can perform. For instance, constituents can only create and vote on goals within their predetermined communities. Representatives cannot vote on goals, but they can comment on goals and update the status of the goals that they are working on. As a result, the community produces a prioritized list of goals to which the representative can easily view and respond.

In addition to meeting the problem statement, the application features a straightforward navigation path for users. First, the user creates their account, specifying their name, address, and email address. Their information is then cross-checked against voter registration records to ensure validity, and then they are sorted into their respective communities. For instance, a voter in Charlottesville, VA who creates an account would be placed into the Charlottesville city community and the VA-5 district community (among others). After logging in, the voter would be able to view and navigate to each community. Each community consists of a list of constituent-submitted goals which other constituents can vote for, as well as a function that allows users to create new goals. Representatives logging in to the application would be able to

view the community that they represent as well as each individual goal. The representative would also be able to upload information to each goal (such as completion status and media/associated files) and comment on the goal's progress or any hurdles they may face in trying to accomplish that goal. By maintaining a real-time line of communication that is convenient for both constituents and their representatives, constituents can more easily judge how well their representative is meeting their needs.

STS Topic

The 2000 United States election, in which George W. Bush narrowly defeated Democratic challenger Al Gore, was particularly notable because the result of the election was only decided months after the election was held. The primary reason this delay occurred was due to discrepancies in vote counting in the state of Florida, whose 29 electoral votes would decide the outcome of the election. At the time, a punch card-style ballot where voters had to use a hole puncher to mark their desired candidate was employed in Florida. However, many ballots had been incompletely punched, and as a result, a formal, detailed set of rules had to be devised for processing these ballots.

Electronic voting machines, also known as DRE (Direct Recording Electronic) machines, were developed in the late 1990's, and what happened in the 2000 election regarding the improperly marked ballots – referred to as the "Hanging Chads" controversy – facilitated their adoption across the United States (Garner et.al., 2005). DRE voting machines consist of an installed software that allows verified voters to navigate through a digital ballot (usually through an accessible touchscreen) to submit their vote. When votes are stored and recorded, they are written to a storage disk that exists on each machine, similar to a personal computer. This localized data storage adds a layer of security, since hackers must gain physical access to many

machines in order to significantly affect a vote count. However, the data these machines store must eventually be uploaded to some other system which tallies the votes. These election management systems, which often receive data from all DRE machines in their jurisdiction, are the prime target of hackers – by gaining access to these systems, they can have a broader impact on an election's outcome with less effort compared to physically altering data in individual machines (Moynihan, 2004).

Unfortunately, the United States has already experienced a breach of election management systems by foreign entities. In the 2016 presidential election, Donald Trump narrowly defeated Democratic challenger Hillary Clinton, amassing just enough votes to flip key states such as Florida, Michigan, and Pennsylvania – which were initially thought to be safely Democratic – and secure his presidency. While the difference in poll opinions between Bush and Gore was thin prior to the 2000 election (Gallup, 2000), the result of the 2016 presidential election shattered most predictions of the election's outcome. Now, an official government report from the Senate Intelligence Committee detail how Russian hackers were able to gain widespread access to election management systems in the 2016 election, including systems in some of the key swing states mentioned above (Senate Committee on Intelligence, 2019). Though the report also states that there was no evidence found that definitively proves vote counts were altered, that this type of breach happened in the first place has fueled discussion among cybersecurity experts and political groups alike regarding solutions to be implemented in the next presidential election in 2020.

One of the most salient solutions to improve election security is maintaining a paper trail alongside the electronic ballot (Schwarz, 2018). The paper trail is usually implemented as an internal physical receipt on which data is written every time a vote is submitted. With a receipt,

data uploaded and tallied in election management systems can always be cross-checked with a secure physical record to improve confidence in the result of a tally. However, the issue of supplementing DRE machines with a paper trail has become a social and political issue: not all states that use DRE machines employ a paper trail or even have security measures in place to secure voting and election management systems (NCSL, 2019). In further research, this acceptance or rejection of security measures as a sociopolitical problem will be examined.

The sociotechnical framework used to describe this research topic is Actor-Network theory. Actor-Network theory is an algorithm that facilitates the unraveling of links between non-human and human "actors" that could influence a sociotechnical problem. This method has been effectively used as a lens through which STS researchers have viewed diverse topics such as Wildlife Tourism in Antarctica and scallop farming sustainability in France (Rodger et.al., 2009). Due to the flexibility and holistic approach that network construction entails, this method will be the optimal lens through which I can examine complex social, technical, and political interactions that occur as a result of advances in voting technology.

One challenge associated with Actor-Network theory is that the network must be constantly maintained and re-examined as new actors or relationships are discovered. These discoveries threaten to open "black boxes," which represent abstractions of certain nodes in the network that can be expanded further. To resolve this problem, I will be focusing on developing a snapshot of the network as it exists during the Fall 2019-Spring 2020 period.

Research Question and Methods

The STS research question is: "How do advances in voting-related technology impact the integrity and fairness of the voting process in the United States?"

In order to use Actor Network Theory, Rodger, et. al. details a rough algorithm to be used as a guideline for progressively developing the network. Actors are connected through intermediaries, which serve as the starting points for building the network by defining methods by which two actors influence each other. Actors are introduced to the network through translation, which is represented by a four-step process: problematization, interessement, enrolment, and mobilization. My research will focus on defining each of these steps that could apply to various actors to elucidate how exactly they are linked.

The two methods that I will be using are historical case studies and network analysis. Historical case studies will allow me to more clearly demonstrate the problem my research is addressing by providing the context needed to understand how Actor-Network theory will be applied. Two examples of historical case studies that I will use include the 2000 presidential election in Florida and the 2016 presidential election, which have been outlined briefly in the previous section. For each of these cases, I will be able to apply network analysis by examining how each agent in the network, such as election management systems and local governments, is connected to each other. From there, I will be able to use the algorithm above to outline intermediaries and discover new actors. This method will also serve as a way of developing the Actor Network Theory-based framework I have chosen.

Conclusion

The problem that is being examined in this proposal is the lack of confidence and accountability associated with the election process in the United States. DRE machines have allowed for huge strides in accessibility and efficiency, but recent political events have demonstrated vulnerabilities in the framework they fit into. Since the methods of enhancing security in this process differ by state, this problem has gained more of a social and political

character by demonstrating differences in how different states' societies approach election security. Through the research methods outlined in this prospectus, I hope to present a clearer path forward to potential solutions by investigating the problem through the lens of Actor-Network theory. In addition, by developing the PowerShare mobile application, I hope to help increase representative accountability by streamlining the way elected officials and their constituents work together to accomplish goals for their communities. From the results of this capstone project, I aim to prototype solutions that will increase the confidence of US citizens in our democracy.

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