

# Mobile Ad Hoc Voting

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## ABSTRACT

When building mobile ad hoc network applications designed for collaboration, one must consider the impact time and location has on an individual's ability to express opinions and make decisions. This paper proposes building a distributed ad hoc voting application, which allows users to spontaneously vote on issues across a mobile network. The application will be used to study issues of human judgment and decision making within varying decision contexts.

## Keywords

Mobile ad-hoc networks, voting, CSCW, judgment and decision-making

## INTRODUCTION

Mobile ad hoc networks provide exciting opportunities for collaboration among distributed groups of people by providing a means for gathering preferences and opinions across time and space. With this potential, there is the possibility of alleviating the frustration often associated with real-time, face-to-face meetings: laborious discussion of multiple opinions, lack of consensus, and the feeling of "wasting time." Voting mechanisms, as a means of preference gathering, also offer an option for quick, instantaneous information gathering amongst groups of people, alleviating the time required for more free-form collaboration. Incorporated into a mobile ad hoc network, voting applications can be implemented easily across a network of distributed individuals, presenting a tempting alternative to time consuming, inconclusive meetings.

This paper proposes building a voting application across a network of individual mobile devices. This application will allow groups of people to spontaneously voice opinions on issues, and immediately see the impact of their vote on the

decision, either through the application or through the immediate impact on their environment. Imagine these three distinct decision-making scenarios:

- The ambient noise in a public setting is determined through a group-controlled interface. Individuals entering the space and are prompted to vote on their choice of ambient noise (or silence). The tallied votes result in a gradual shift in noise level over time.
- Political opinions are gathered on urban development issues within the urban space to be developed. When individuals are in the vicinity of the urban space, they are able to vote on issues related to budgeting, development, and spending priorities.
- A group of co-workers are simultaneously asked to choose representative employees to be sent to a meeting later in the day. Over a short time frame, each employee can cast a vote and surveys the results over the network.

Each of these scenarios presents a situation in which voting would allow for efficient gathering of individual opinion across distributed locations and time periods. We plan to build an application which would enable each of these scenarios.

Often times, such as in the scenarios given, time and location are not crucial factors in making the voting decision. Each of these decisions could be made at a polling booth or through static, paper ballots. Therefore, initially, it is not clear why it is interesting to build a mobile ad hoc voting system. While we do not think the mobile and distributed nature of voting participants *should* affect the impact or opinion of individuals, we believe it does and is worth studying.

Our objective in building a mobile voting application is to develop a platform for understanding the behavioral effects time and location have on individual decision-making behavior. For example, imagine the second scenario involved voting on whether or not to increase toll rates, and individuals could vote at home or while they drove through a tollbooth. Instinctively, we know that individuals at the tollbooth will be more resistant to toll increases because they are currently aware of the cost of each toll. Yet, also by asking voters at the tollbooth their opinion, the level of interest and participation of voters will be much higher than those at home because of the current relevancy of the question.

As this example of voting on toll increases illustrate, we believe there are influences of time and location on individuals' decision-making ability. With a distributed voting application in place, we plan to run experiments with different ballot questions and formats to formalize our understanding of contextual influences on group decision-making.

### PROPOSED APPLICATION

We will be building a mobile application for voting which allows individuals to create ballots, alert participants of new ballots, cast votes on ballots, and see tallied results. The communication between participants and the mobile network is presented in a general diagram in Figure 1. An important aspect of the diagram is that there are two types of voters: active and passive. An individual can be either active or passive, depending on the role he/she plays in ballot creation.

This application will allow for multiple configurations of ballots, including different types of voting schemes such as ranking and point allocation. Additionally, information about how participants voted can be revealed during the election process, either anonymously or identified. Election results may be presented on the client devices or may be expressed through the implementation of the group decision (for example, an adjustment of the ambient noise in a public space).

We are considering mobile phones or network-enabled PDAs as the client-side device. These devices would network within a configurable mobile ad hoc network (MANET). We are currently

researching different options for an appropriate MANET. We will aim to incorporate this voting application with other voting interfaces we are developing which examine other modalities and behavioral effects.

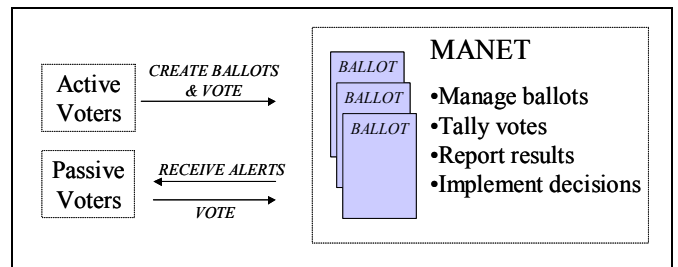


Figure 1. Proposed Architecture

### BEHAVIORAL HYPOTHESES

The field of cognitive psychology demonstrates that when individuals make decisions under uncertainty, they use environmental cues and the context of the question to frame their decisions [3]. Individuals are influenced by their surrounding environment, for example, using events such as the weather to determine their level of life satisfaction [1] and using the format of the question to assist them in determining which issues are important to them [2]. These behavioral factors are important to consider in the design of any application for decision-making and collaboration. We believe time and space have an impact on individual decision-making. Our two hypotheses involved an individual's desire to vote and an individual's final choice.

*Hypothesis 1: A voter's participation increases when the ballot issues relate to the voter's current time and location.*

One of the frustrations of the United States government is the nation's lack of voter participation. Many voters claim issues are "not relevant" to them. Taken within the context of mobile ad hoc networking, when an individual is within a time and location that is highly related to the ballot's issue, we predict that they will be more likely to participate in the voting process. We propose to first test this hypothesis with our application.

*Hypothesis 2: When making a voting decision, an individual will over-weigh the importance of his/her*

current context, resulting in decisions driven by short-term goals.

We hypothesize that individuals will be more shortsighted when their current time and location relate to the issue they are voting on. The converse of this hypothesis is: voters will have a longer-term perspective when removed from the issue's context. An example of this would be asking drivers on a toll road to vote on a toll increase as they drove through the tollbooth. While longer term issues such as highway development and government funding may be important social concerns for the individual, at the moment of paying the toll, these social goals are less relevant than the act of paying the toll. Our prediction is, when asked questions that involve a specific location or action, such as paying a toll, individuals will be more influenced by their current, short-term goals than their long-term objectives.

While these hypotheses remain to be tested with our application, there are several implications of these effects. If individuals are voting on issues that involve numerous long-term issues, then individuals should be removed from the context of the issue, so as to not be unduly influenced by shortsighted objectives. Yet, the first hypothesis indicates that in order to increase voter participation and individual involvement in group decisions, it is best to build applications which presents issues at the moment they are most salient in individuals' minds. The design ramifications for mobile ad hoc voting systems are complex, and in the course of running ballot experiments we hope to attain an understanding of when MANET applications are appropriate for voting decisions and when not.

## CONCLUSION

Voting, as a method for groups to efficiently express preferences on timely issues, is well suited for a MANET application. MANET technology can enhance a voting experience by incorporating time and location into the decision-making process. This paper proposes building such a voting application designed for distributed decision-making.

While this application will be a useful tool for ad-hoc group decisions, more importantly, this application will provide a platform for studying the impact of time and location on individual behavior. Particularly within the context of a political election,

it is commonly thought that individuals' preferences are well thought out and stable over time. This is often not the case, as shown by cognitive psychologists. Our proposed application and subsequent experimental study will demonstrate the impact of context (time and location) on an individual's participation and goals in making decisions.

This application study will result in implications for the development of any MANET application. If our study successfully demonstrates that decision-makers are influenced more by short-term motivations when they are brought to focus, then any tools built for collaborative work need to be aware of the impact a user's context. Our two hypotheses taken together indicate that voters will voice their short-term opinions more readily and more frequently than their long-term goals. While for certain decisions this may be ideal, for decisions which involve social welfare or longer term visions for the group, spontaneous, distributed voting may not be beneficial.

One recommendation for designing MANET applications is to consider re-framing ballot questions in terms of context. By drawing individuals out of their current framework of time and location, questions can be rephrased to encourage longer-term perspectives, while still encouraging participation by connecting to the near-term relevancy.

With the results of our experimental study, we aim to develop more recommendations for MANET application development.

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