WeeGo: Ride-Matching Using an Online and Mobile Social Network

Adam Shahrani
Indiana University
School Of Informatics
Bloomington, IN 47408 USA
ashahran@indiana.edu

Shruti Bhandari
Indiana University
School Of Informatics
Bloomington, IN 47408 USA
sbhandar@indiana.edu

Kayce Reed
Indiana University
School Of Informatics
Bloomington, IN 47408 USA
kanreed@indiana.edu

Farzaneh Asgharpour
Indiana University
School Of Informatics
Bloomington, IN 47408 USA
fasgharp@indiana.edu

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Abstract

This study focuses on designing a web-based social networking infrastructure using mobile GPS technology to coordinate ridesharing for young adults (ages 18-22). Young American adults typically desire independence at an age when habitual commuter patterns are formed. The primary goal of this system is to stimulate young adults to travel in groups using proven social networking methods. This study evaluates the usability and effectiveness of using a mobile social network to promote ridesharing.

Keywords

Public Transit, Ride-Match, Rideshare, Social Network, GPS, WeeGo, Carpool, Economy of Scale

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. H5.2. User Interfaces: User-centered design, H.5.3 Group and Organization Interfaces, H.4.3 Communications Applications: Information Browsers

Introduction

Congestion and pollution continue to rise in the United States [19], where 43% of global daily gasoline is consumed [20]. The model American spends 1,600 hours to travel 7,500 miles in a car annually [20]. As a result, more than 40% of Americans rate traffic

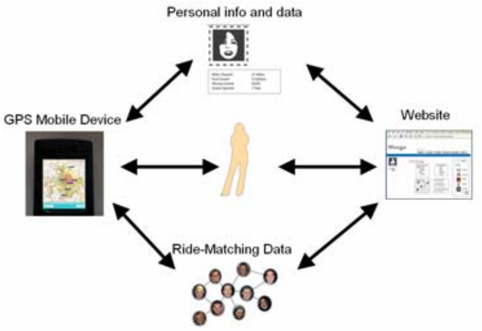

figure 1. The user can interact with both a mobile device and an online website to access the ride-matching social network data.

congestion as a problem and Americans spend an average of over $7,000 annually for automobiles. Automobile emissions are responsible for 30,000 annual deaths in the United States [1].

Why Target Young Adults?

Teenage driving habits are highly influenced by peers [14]. By age 16, most teenagers can attain a driver's license in the United States and as they mature into young adults (18-22 years old), more commuter choices are offered to them [15]. Young adults are at an age when current behavior can strongly influence subsequent behavior later in their lives [7]. Our target user group consists of 18 to 22 year olds, many of whom are looking forward to beginning their first professional career which will financially enable them to purchase a desired vehicle. By age 25, these Americans join an age group 17% more likely than the norm to purchase an automobile, making them one of the least likely groups to continue using alternative public transit [4]. Our design offers a practical networking medium for these young adults by cultivating car-sharing habits.

What works?

Public transit such as buses and trains reduce pollution and congestion by enabling users to travel in groups instead of individual vehicles. However, research reveals that "an increase in car use is a consequence of increasing car ownership, and may not be suppressed by improving public transit" [11]. Ryuichi Kitamura, a leader in travel behavior research, points out, "Car use determines transit use, not transit use determining car use" [11]. The public transit model which essentially enables users to travel in groups can be reduced to working models for automobiles to reduce congestion. Ridesharing has proven to be a working example of reducing congestion and pollution by decreasing the number of vehicles on the road [8]. This has led U.S. legislatures and businesses to sponsor cost saving incentive programs such as high occupancy vehicle (HOV) priority, awards and preferential parking spaces to increase ridesharing [18].

Rideshare programs that include incentives often reduce commute trips by at least 10% [10]. However, a major challenge faced by ridesharing programs is ride-matching because ridesharing is an economy of scale. Economies of scale require a large number of users in order to be effective [18]. In order to grow, there must be both a simple exchange of information and a growing or large network of participants [10]. We plan to create a simple way to exchange riding information and build networks to encourage ridesharing.

Social Networking, Mobile Phones and GPS Technology

Young adults aged 18-28 are statistically the likeliest users to send and receive instant messages, play online games and create blogs [16]. In addition to online social networking, young adults increasingly own cell phones [9]. One of the most recent trends in this industry is an increase in web enabled [3] and GPS phones [13]. These networks permit users to remotely share their location and send text messages. An example is Disney Mobile [5], which is a network for families. Parents can locate their child's phone on a digital map. Such GPS enabled technology is capable of monitoring common locations, habits, and proximity to other members within the network. This kind of technology could potentially be used as a transparent medium to solve ridesharing problems.

figure 2. The top display lists friends based on real-time distance from the user. The bottom display shows a map with the locations of friends on the network.

Research Goals
We are seeking to determine the effectiveness of using GPS mobile social networking for collaborating rideshares. A GPS and web enabled cell phone we call WeeGo is used in this study. Specifically, we would like to see if social networks can transparently be used as a means for sharing rides. WeeGo is a comprehensive GPS integrated system that includes a novel social networking application to assist in ridesharing. Ride-matching is the essential goal of the network, which allows users to see each other online and select riders for rideshares. The social network integrated with GPS data can encourage ridesharing by stimulating human affiliation motives which leads to individuals choosing to be with others in their network rather than alone [12]. The current design permits users to have “on demand” access to network information to ride-match, which is one of the most appealing methods for current consumers [6].

Insights and Model

Upon reviewing examples of ride-matching systems [17,2], none utilized social networking to encourage ridesharing. Ride-matching websites were often cluttered and required setting a strict schedule with strangers. Therefore, we considered a “trust” model where individuals could select which networks they would like to join.

Existing ride-matching systems have a limited number of participants, resulting in fewer possible ride-matches [18]. For optimal results in an economy of scale, there has to be a large number of users that join the system who can communicate availability. Hence, we pursued incentives for young adults to start using this system.

In addition to automatically recording and presenting driving habits, utilization of GPS technology can serve as an incentive for joining the network. From our research, we concluded that young adults spend a lot of time on social networking sites, are concerned with peer opinion, are comfortable with technology and use cell phones and text messaging. Therefore, locating friends can serve dual purposes of both ride-matching and socialization as an incentive to join the network.

Two Interfaces
A mobile interface on a cell phone will be used as an easy and accessible ride-matcher. The cell phone is used to interact with peers through text/instant messaging; something our target group is very knowledgeable and comfortable with [16].

The mobile interface is primarily an extension of the web interface, which logs data depending on the location of a mobile device. The web interface emphasizes and expands the social networking aspects of the system.

Proposed Design

Mobile Interface
As an incentive for joining this network, friends can see the locations of each other on their mobile devices in real-time through either a map interface or a listing of their closest friend’s distance (figure 2). Built into the system is a text/instant messaging display that will send a customized and modifiable message for car-matching with a simple push of a button (figure 3). Users can also see the locations of drivers while they are waiting to be picked up and may locate GPS enabled buses that have joined the network.

While the user carries their portable device, signals are sent to the central database every 30 seconds, which archives the data based on latitude, longitude and time. The data is compressed when the user remains in the

figure 3. This display allows users to send a quick text message requesting a ride.

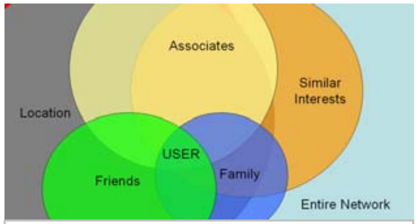

figure 4. This is a visual representation of a friend's network. Users can join a 'family' network and customize family privileges to share profile information. Other networks may also be customized.

same location for a prolonged period. The user may search for a friend's location or choose to be invisible to friends.

Web Interface
The web interface is a secure interface for viewing network user data and personal data collected from the mobile device. Information can be shared based on various visibility settings and trust levels for different categories of friends (figure 4). Hot spots and hot paths are also monitored and some may be shared. Hot spots are those locations where users spend the most time, and hot paths are the routes taken most often by the user.

Other functionality includes a display that shows the average savings, distance traveled, and pollution reduction levels while ridesharing. When the system detects two traveling users following the same path, it determines that they are traveling together and logs it as time spent traveling together. Two users can then see how many miles they traveled together and how much money was saved. The calculations are based on average vehicle emissions per mile. The more travelers there are together, the higher the cost savings per individual. Below the savings is a wishlist where the user can place items they wish to purchase. Here, friends may choose to purchase items for each other or for themselves based on the money saved by traveling together (figure 5).

Some groups in the WeeGo social network are based on location and driving habits so that users can choose to find and communicate with other travelers that take similar routes. Friends that can save the most money can be detected by the system when it compares hot spots and hot paths that overlap.

The first module of the design which runs on a web enabled GPS phone allows users to locate their friends and ask/offer rides. The second module is an informative web interface that displays rideshare events, friends made, ranking among friends, and the amount of money saved which encourages organized, efficient driving habits.

The design follows tightly with the insights we obtained from various activities including focus group interviews and two contextual inquiries. The insights showed us that people are very fond of their cars. They do not like to use public transportation due to inefficiency and inconvenience, and socio-economic stigma. However, young adults do not mind traveling with their friends, family and associates.

Evaluations

Prototypes
We performed a user evaluation of the prototypes (Figures 2,3 and 5) to find general reactions to WeeGo and to get user feedback to incorporate into the design.

Methods
Two sets of evaluations were performed, one for the cell phone and another for the web interface. The evaluations were performed by both males and females in the age range of 19-22 with an average age of 20. For both parts a low-fidelity paper prototype was used. A pre-evaluation form was filled out to gather general information about the user group. Then a set of over 5 tasks related to coordinating rideshares were given to the users for each interface. Following the tasks, the users provided us with some feedback about their general feeling and attitude about our design in an interview and by answering a questionnaire.

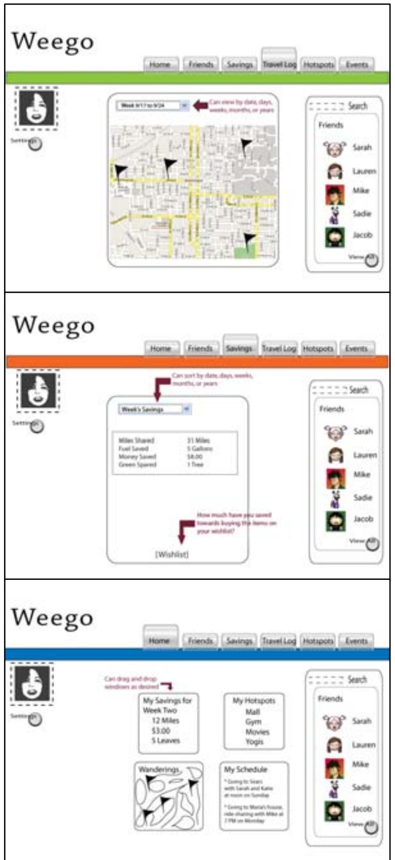

figure 5. The web interface Top: Home dashboard. Center: Hot spots; common destinations. Bottom: statistics on cost savings and pollution reduction.

Results

The evaluations revealed that most participants in the study owned cell phones, used their phones daily, and often text-messaged. While using the cell-phone interface, the majority of users found it difficult to find the visual display of a map to locate their friends. This motivated us to change the location of the map view to a more obvious location. We decided that the map should be accessible from the main menu as well as the friends list.

Through debriefing questions we realized that all of our subjects appreciated the various privacy controls. Multiple privacy settings can be set for different groups of friends. They all had the impression of working with a secure and private interface. The privacy settings allow the users to choose from a variety of visibility modes like invisible, busy, etc. One non-American user faced some difficulty with the language, and another user had difficulty navigating through one of the tasks, but in general, these were isolated incidences.

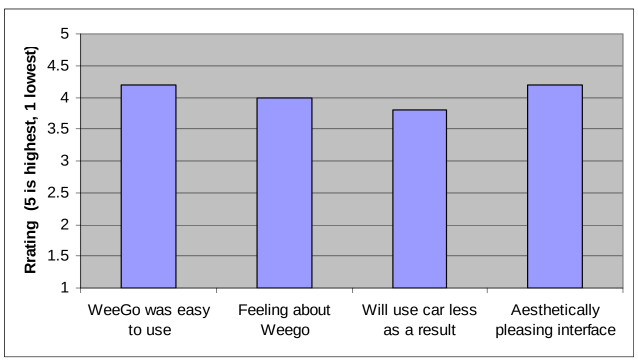

figure 6. Evaluation of WeeGo from our user study (5 is the highest rating and 1 is the lowest)

The results of the usability test on the website were used to improve the interface of the website, rename some of the tabs and buttons, and to reposition some links. The users expressed interest in the design during the follow-up interviews.

Even though we used a low-fidelity paper prototype for both interfaces, the users responded affirmatively that this system would promote ride sharing for them. The users commented that the WeeGo system makes it much easier to locate their friends within their network to ask for a ride.

Enhancements and Future study

This design permits enhancements which will assist in expanding the network of users and target specific concerns. When applied to bus and train transit systems, locations and schedules can be easily monitored. Users can find new friends on a bus who have similar interests based on each person's online profile. Bus networks may also be formed so that online profiles can be shared with other bus users.

Future enhancements include a user-specified security setting that will display the vicinity of a user instead of an actual location. Distances can also be preset so that selected groups on the network can only see individuals within a certain range. Cell phone pictures can be transferred automatically to an online album. The location, time and other users in the vicinity could automatically be labeled on mapped pictures. Existing carpool reimbursement programs, competitions, and advertising may use WeeGo for GPS accurate results also. Car-share management for multiple drivers of the same vehicle is another useful future enhancement.

Conclusion

Our design, named WeeGo, uses mobile phones to arrange ridesharing. WeeGo is a useful networking tool for facilitating car-sharing among young adults. A web-interface is also used to inform the users of changes they have made in their environment and in their own lives because of ride-sharing. Weego encourages young drivers to develop car-sharing habits which could continue throughout their lives. Our evaluation results indicated that the system is very simple to use and makes it very easy to locate friends to collaborate a ride-share.

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