
Express Location: Supporting Coordination of Mobile Delivery Work

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Abstract

This paper introduces *Express Location*, a mobile web application, supporting drivers in delivery service in the daily coordination of work. Remote communication and cooperation takes place on a shared map view around the drivers' locations and next stop, through a drawing/doodling tool and multiple visual object representations. The aim is to understand the working situation and the use of locations in the daily work to better support the coordination of mobile delivery work.

Keywords

CSCW, visual representations, workspace, delivery service, drivers, location-awareness, drawing, field study, express location, mobility.

ACM Classification Keywords

H.5.3. Group and Organization Interfaces: Computer-supported cooperative work.

General Terms

Design, Human Factors, Experimentation.

Introduction

Coordination of mobile work between city drivers in delivery services are challenged by a spread out workspace; difficulties sharing applicable knowledge

concerning colleagues work situation and the inability to view each other's ongoing activity and location. These problems are due largely to the fact that workers are located at remote places. Although drivers are able to communicate with support of radio communication, Global Positioning System (GPS) and various information systems these problems remain. The issue is not the technology at hand, but the lack of mobile software that combines the existing technology and emerges from the users daily work situation.

To address these problems we have built a prototype, *Express Location*, a mobile web application where remote communication and cooperation takes place on a shared map view around one's locations. Through a drawing/doodling tool and multiple visual object representations the users are able to collaborate and coordinate the work around their locations. To test it we have conducted a pilot study with drivers at Lillebud, a delivery service company active in Stockholm, Sweden and surrounding cities. The goal of this research is to create and test a design that facilitates the coordination of work among drivers in mobile delivery service, by making the users location visible as well as enabling multiple possibilities to communicate visually with each other on a shared map view. We will observe how users interact and perceive the design concerning the described problems.

Related/previous Work

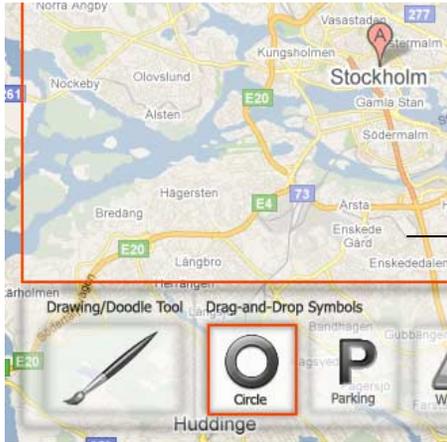
Much research has been conducted on cooperation in mobile workgroups in traffic, e.g. bus-drivers and road inspectors [2,4]. The findings show that locations, created and maintained by the mobile workgroup, strengthen a sense of shared workplace. As one travels through the environment this becomes a collaborative

resource [2]. Bus-drivers generally start collaboration by trying to map the location of other drivers, and it's mostly pursued visually. When a driver wants to collaborate with other drivers out of sight, it is difficult identifying them and establishing a link [4]. MacEachren stress the potential visualization has, particularly for remote collaboration, as a mechanism for supporting coordinated activity [5]. In a prototype they have studied crisis situations and how visualization tools help to get a comprehension of the geographic context, assess the situation, determine key tasks and coordinate individual parts of the joint project. The prototype has however not been tested and validated.

There are some existing applications centered around visual communication on maps. Scribblemaps [7] is a flash based online application with possibilities to draw, make shapes and place markers on a map. The maps with drawings and markings are saved and sent with a link or exported as images, KML or GPX files. The web application Quikmaps [6] has many similar features, but has a different purpose. After a map has been scribbled and annotated on, an html code is generated for display on website. Neither Scribblemaps nor Quikmaps are multi-cursor drawing surfaces for real-time remote collaboration. Being able to view ongoing activity from remote places isn't possible.

Express Location

Express Location is built around a canvas placed on the map with tools, buttons and icons situated along the sides (see figure 1). The communication takes place on the map view around the drivers' current locations, as calculated by GPS, and next stop (see figure 2). It is a multi-user application, where multiple users can control the editing cursors independently [3]. The application's



When the contact is displayed as *online* communication can begin. The drawing/doodling tool and drag-and-drop symbols are each assigned/unassigned by a click/tap.



The *drawing/doodling tool* along with *drag-and-drop symbols* makes it possible to explain, collaborate and discuss routes, places to visit, parking spots etc.

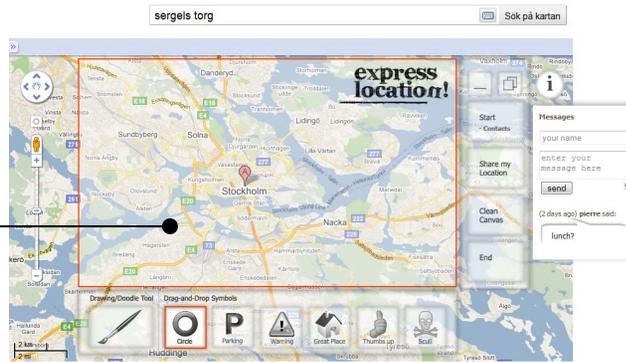


figure 1. The communication starts with pressing *start* and choosing a colleague, traffic control or a new contact from the *contacts list*.

main function is to facilitate coordination of work. Instead of drivers being stalled time and again asking each other where they're at or where they're going, it intends to enhance collaboration and movement along to next route.



figure 2. The drivers are able to share location, text messages, draw and drag-and-drop objects on to the canvas.

Design Criteria

In the design we have listed the criteria Express Location should possess: 1) Activate visual cooperation, 2) support real-time as well as asynchronous collaboration, 3) be designed for mobility, 4) location-aware and 5) internet-based. The first criterion is one of the backbones of the application, because of the importance visualization has in traffic and in remote collaborative settings [4,5]. The second criterion is necessary for making the usage safe and secure in traffic. The application is designed for situations when the car/truck is standing still, because of the risk of accidents when used in a driving situation. The driver should be able to read and do light interactions while driving, but more actively draw/doodle and use visual representations when parked. Consequently, drivers can't always collaborate in real time, so it is also designed for asynchronous collaboration. It is among other things achieved with the message box with a time stamp on each message. The third criterion relates to the context of the work setting and is therefore designed for laptops, tablets, PDA's and smart phones. The fourth criterion is represented by animated truck symbols (see figure 2), which each user is in control of. The fifth and last criterion is included to ensure the application's availability on many devices.

The making of the Prototype

The Express Location prototype is built with HTML5, CSS1-3, JavaScript and JavaScript libraries. JavaScript makes it possible to among other things assign the various tools and drag and drop items on to the canvas. Through HTML5 the canvas element is utilized making it possible to draw/doodle. The canvas element in HTML5 is supported by all latest versions of browsers except Internet Explorer.

Evaluation

User tests were conducted in the field. Two delivery drivers at Lillebud were interviewed and audio recorded while driving around in Stockholm city on a working day. The application was tested on a Sony Vaio laptop with 15" screen and a mobile broadband with a usual bit rate of 100-200 kbit/s outdoors in the streets. The tests were video recorded and the interviews lasted for about 90 minutes each. The users found the application interesting and emphasized the applicability of seeing the location of colleagues. Driver 2 (d2) even showed several previous text messages from colleagues on the information system, consisting only of questions about locations. The drivers used the drawing tool as to call for attention to a certain area by usually circle in the area. Concerning the drag-and-drop symbols a parking sign was not seen as a useful expression, since they never have trouble finding somewhere to park for a short while when running to deliver a package or letter. Driver 1 (d1) expressed a need of representations to call for petrol stations, ATMs and lunch places. D2 called for attention to display biogas stations since those are few, difficult to find and used by many of the drivers. D2 also mentioned lunch places as common in the daily communication. When delivering to/from places of further reach, it often requires more coordination between drivers with sharing the workload. The ability to see the whereabouts of colleagues and decide meeting points to share the workload would facilitate these tasks. Another thing is that many addresses in the delivery system are regular and the specific knowledge drivers have of each place regarding the exact delivery spot, door code and other specific information would be useful to store and retrieve for both experienced and new drivers.

Conclusion and future Work

The application makes it possible for drivers to see each other's locations on the map and cooperate around them. The field study indicates the usefulness of the design and how certain places are important for coordination of work between drivers. Future work will consist of implementing visual routes of colleagues and examine what weight it has on cooperation. Much research has been done on seeing each other face-to-face in remote settings to enhance the communication, and even how it affects users in a drawing setting [1]. Implementing it in Express Location and studying the affect on coordination of work will raise new interesting questions.

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