A Guide Robot at the Airport: First Impressions

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ABSTRACT

In order to be successful, guide robots in public space require socially-intelligent navigation behaviors. Evaluation of these behaviors can be done through lab studies, though these do not always capture the complexities of interactions in "the wild". In this extended abstract we present initial results of a field trial of a multi-year project in which we developed and deployed a robot which provided guiding services to real passengers at one of the top-20 busiest airports in the world. During this field trial 9 groups of passengers were guided by the robot. We will present initial results and implications for field studies.

1. INTRODUCTION

Among others social robots are envisioned to provide guiding services in (semi-)public spaces, such as touristic sites [1], shopping malls [2] and train stations [5]. Among the technical capabilities of a robot, it is important that a social robot not only drives autonomously, but does so in a socially intelligent way. In short: the way a robot navigates improves robot acceptance, though the way by which this acceptances is improved can be defined along various dimensions, such as comfort, naturalness and sociability [3].

When evaluating and (re)designing behaviors for robots in public spaces, in particular guide robots, it is possible to test specific behaviors in lab settings, for example passing distance [4]. At the same time, behaviors in public spaces could be too complex to simulate in lab or semi-public settings such as university buildings. Therefore, it is necessary to complement user studies in lab settings with real-life evaluations, thus evaluating people's reactions to robots in the environment for which the robot was designed. An example could be through the use of a breaching experiment as conducted by Weiss et al. [7].

Over the past years an international team has worked on the development of a SPENCER; a demonstrator robot to guide transfer passengers at an international airport [6]. In collaboration with an industry partner we designed an use case relevant for the aviation industry, through which we evaluated passengers' experiences when confronted with a robot providing guiding services. Inspired by Weiss et al. [7] we used a combination of interviews and questionnaires measures to assess user experience. In this paper we will present initial results of passengers' experiences, as well as implications for field studies and research concerning guide robots in public spaces.

Figure 1: The SPENCER robot used for the field trial.

2. METHOD

In order to evaluate the capabilities of the SPENCER robot, we conducted a field study with 16 passengers. The robot platform is specifically designed to provide services to airport passengers; interaction capabilities specifically for the airport are provided through a touchscreen and boarding card reader (Figure 1). Instructions were provided on the touchscreen in English; verbal messages were only provided when the path of the robot was blocked by other passengers. The robot used four RGD-B cameras and two SICK LMS 500 laser scanners for navigation and motion planning. See [6] for more details about the platform.

Airport passengers walking through one of the airport lounges were invited by project staff to participate an evaluation with a guide robot, for which they were instructed to use the robot to go to a gate. After having identified themselves to the robot with a fake boarding card, the robot started guiding the passengers. The passengers were instructed to follow the robot. The robot autonomously drove a distance

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of about 430 meters while guiding the passengers. The robot first led passengers through a crowded area with shops and multi-directional passenger flows. This area was followed by less congested areas featuring long hallways. During evaluation tests, technical support staff as well as airport staff followed at a distance so as not to influence the participants. Two researchers followed the participants at a closer distance, took notes and recorded events. Afterwards, participants completed a 14-item feedback questionnaire and participated in a semi-structured interview.

The sample consisted of 10 males and 6 females, aged between 26 and 54 (M=36.81, SD=9.01), divided into 9 groups. Nine participants indicated the purpose of their journey was business, 7 participants indicated pleasure. All participants indicated they had experience with flying.

3. RESULTS

In general participants seemed excited to experience a robot-guided tour to get to their gates: some participants even referred to the robot as "cute" and were pleased with the design and basic functionalities of the robot. We took care into emphasizing we were looking for their opinion and feedback, though we can not be totally sure participants' were overly positive to please the experimenters. In the semi-structured interview we asked 13 participants if a service like the robot would improve their customer satisfaction; 12 participants answered positively to this question, one participant was undecided. Three participants stated that it was a good thing that the airline invested in new technologies.

Compared to other semi-public spaces, this study was particularly resource intense, as extra staff was required at the airport due to safety and security concerns. There were three main insights we gathered from this field study, which we could not have gathered if we would have conducted an experiment in a lab.

The first insight we received related to the speed of the robot. Three participants who followed the robot indicated the robot could have driven faster, these participants followed the robot when it was not very crowded in the terminal. Five other participants indicated the robot drove too fast, especially if the robot were to guide a family around.

The second insight related to the target user group of the robot. Participants indicated the robot was very useful, although not specifically for themselves. One of the reasons some participants provided was that they had previously been on the airport, and knew their way around. Especially elderly people and families with children were considered by the participants to be helped with a robot service. We did not actually have the opportunity to recruit participants with these demographics in order to validate these statements.

The final insight related to the general driving, and in particular the collision avoidance behavior of the robot: participants liked the fact that the robot stopped when people were too close to the robot. However, especially in more crowded situations this happened too often. Coupled with the fact that re-planning was perceived as taking quite long, participants' general impression was that the robot was less suited for guiding passengers in a congested area, especially if they were under time pressure. At the same time, or perhaps due to the fact that the robot did not drive as fast as a person could walk, participants indicated the robot should provide additional services, such as shop recommendations or the location of bathrooms.

4. DISCUSSION & OUTLOOK

In this paper we have presented initial results of a field study conducted with a robot which provided guiding services to small groups of passengers. Limitations we encountered relate to difficulties in selecting a representative sample (avoiding a sample of convenience) and covering relevant situations. Even though we tested the robot in a representative environment with different levels of crowdedness all data was collected within a specific period of time. We did not experience situations with calamities or delays due to bad weather.

Despite the limitations and challenges outlined we still believe field studies are important to complement lab studies. The most accurate representation of a public space, with all its diversity of people, objects and external factors, is public space itself.

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