Chapter 10

WayFinder:
A Navigational Interface for Visitors and Blind Students on Campus

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ABSTRACT

Navigating a university campus can be difficult for visitors and incoming students/staff, particularly those who are blind or vision-impaired. Universities around the world, including University College Cork (UCC), generally rely on physical sign-posting and map-based information (available as a download from the university Website) to direct visitors, staff, and students. These methods are not appropriate for those with vision-impairments. Mobility training is provided by UCC’s Disability Support Service (DSS) to enable blind/vision-impaired staff and students to safely and independently navigate campus, but the training is route-specific, time-consuming, and expensive. A navigation solution that facilitates all campus users, both sighted and vision-impaired, could be provided via mobile and wireless technologies. Research has been conducted to assess the needs of those navigating campus, to evaluate relevant technologies, and to assess the state-of-the-art in regard to the provision of navigational information. The results suggest that no off-the-shelf solution exists that fully meets the requirements of UCC. Existing systems fall short in various respects, in particular in the accuracy and reliability of the localization information and the nature of the feedback provided to the user. This chapter summarizes the results obtained from the review. A system is described which has been designed, in the light of the review findings, to enable visitors, staff, and students (both sighted and vision-impaired/blind) to safely and independently navigate the campus using a smartphone. This system has potential for use at other universities and institutions. The development and initial testing of the user interface layer of the system is described.

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INTRODUCTION

Navigating around a university campus can be difficult for visitors and incoming staff and students, and is a particular challenge for those with vision impairments. A large number of visitors and new students traverse the UCC campus each year (See Table 1).

Universities around the world rely on physical signs and map-based information to direct visitors, staff and students around campus. Maps are generally displayed in billboard fashion on campus, and may also be available for download from a university’s Website. This represents the main method of guiding people around campus. Visual signage is not necessarily the best way of helping people who are unfamiliar with routes, and maps in particular are not appropriate for those with vision impairments.

University College Cork (UCC), like other universities, currently relies on signage and map-based information for campus navigation. However, the campus at UCC presents particular problems as it has an undulating topography and no linear structure to its layout. This is compounded by the continued spread of campus, with many of the newer buildings are located outside the main campus boundary. There are also problems within buildings, where navigation between rooms and service locations can be difficult.

Table 1. Visitors and new and disabled students traversing campus at UCC 2010/2011

<table>
<thead>
<tr>
<th>Campus User</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average annual visitors:</td>
<td></td>
</tr>
<tr>
<td>Visitors taking tours through the Visitor Centre</td>
<td>15,000+</td>
</tr>
<tr>
<td>Glucksman Gallery visitors</td>
<td>70,000+</td>
</tr>
<tr>
<td>Visiting students</td>
<td>1040</td>
</tr>
<tr>
<td>International students</td>
<td>2400</td>
</tr>
<tr>
<td>Adult &amp; Continuing Education students</td>
<td>1988</td>
</tr>
<tr>
<td>Blind students:</td>
<td></td>
</tr>
<tr>
<td>Totally blind students</td>
<td>10</td>
</tr>
<tr>
<td>Vision impaired</td>
<td>28</td>
</tr>
</tbody>
</table>

Mobility training is currently provided by UCC’s Disability Support Service (DSS) to those staff and students who need it. It is designed to enable blind and vision-impaired staff and students to safely and independently navigate campus. However, the training is time-consuming for all parties involved, is expensive to provide, and is not available to visitors. The training is also route-specific, which means that staff and students may need re-training when changes are made to course timetables.

Mobile and wireless technologies offer a potential solution to the problems faced by those navigating UCC’s campus. Such a solution could facilitate all users, both sighted and blind/vision-impaired, whether existing/regular users or new/one-time users. Using smart-phone technology would allow people to use their own mobile devices for navigation purposes on campus. Information could be provided in an appropriate manner for each individual user: visual, auditory, haptic (or combinations of these) based on the needs of the individual user. Device features, for example the compass and accelerometer, could be combined to accurately identify the user’s location on campus. However, there are challenges in implementing such a system at UCC, including the spread of campus across an increasing number of sites, the non-linear layout, and the undulating topography. This is compounded by the problems faced when navigating inside buildings.

This chapter reviews relevant wireless technologies to assess their potential for use in a campus navigation system. The state-of-the-art in relation to navigation systems for vision-impaired users is also reviewed. Results from a study of the needs of blind and vision-impaired campus users are presented. On the basis of the reviews and user-needs assessment, the design and development of a prototype navigation-based system for such users is described, along with studies to assess its usability.