Street Rehab: Bridging the Gap Between Accessibility and Rehabilitation in Delhi

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Abstract

Street Rehab aims to explore the possibility of working across the boundary of accessibility and rehabilitation. Due to the United Nations Convention for the Rights of Persons with Disability, the Sustainable Development Goals and a concerted effort by the Indian Government, there has been increased activity in India to help make cities accessible for persons with disabilities. In the UK, a team at UCL had been developing low cost sensors which when linked to a mobile phone, make a mobility device part of the Internet of Things. In Street Rehab, we teamed with local NGO's and through them wheelchair and tricycle users across the socio-economic spectrum to map areas of Delhi, whilst also capturing data we will later use to understand how people push their mobility device. We aim to use this to provide remote rehabilitation and feedback to people as they go about their daily activities. In this paper, we examine our initial findings and explore lessons learnt and our future research framework.

Author Keywords

Wheelchair; Accessibility; Rehabilitation; HCIxB; IoT; Participatory Design; Inclusive Design;

HCI): Miscellaneous;

Introduction

According to the World Health Organization's (WHO) South East Asia Regional office, approximately 20 million people who need a wheelchair do not have access to one [7]. There are two traditional, and accepted models of delivering wheelchairs to people: 1) all services are provided through a central wheelchair service, this includes assessment, training, support and referral to other services; 2) the central wheelchair service provide the basic wheelchair and follow-up support is delivered through local community level partnerships [7]. However, in India the scale of the problem of simply getting wheelchairs to people has meant that wheelchairs or tricycles are delivered via large 'camps' with cost often prohibiting the provision of training to users. The equipment provided at these camps can be life changing. The Indian Government is committed to advancing the rights of disabled people and recently passed The Rights of Persons with Disability, Act in 2016, which covers both the concepts of Universal Design of products, environments and programmes and Accessibility. We are exploring with them the ways technology can help bridge the gap between rehabilitation and accessibility.

In the higher income countries such as the U.K. or U.S.A. it is normal for a person to receive training when being given a wheelchair to prevent future injuries. Frequently, even with this training people develop upper limb injuries, due in part to the high, repetitive loads needed to push a wheelchair. This training is given as part of a package of rehabilitation, which also normally includes adaptations to people's living environments which will enable them to use their wheelchair indoors. However, injury rates continue to be high with anything from 40% to 78% of wheelchair users reporting shoulder pain and injury. In addition, much of the infrastructure in India makes pushing a wheelchair difficult.

India has recently (in 2012) established the Department of Empowerment of Persons with Disabilities (Viklangjan Sashaktikaran Vibhag) and the subsequent Accessible India Campaign was launched in 2015 [9]. These have led to initiatives aimed at improving access to the environment, transportation and ICT. One such initiative is the Disability Certificate, which people can obtain and which will classify the degree of their disability as a percentage. People with over a 40% physical impairment are then entitled free of charge to a wheelchair or tricycle through ADIP Scheme[10].

In Accessible Routes from Crowd-based Cloud Services (ARCCS) our approach has been to develop sensors which are themselves part of the Internet of Things, which when attached to a mobility device extend the ability of that device. Users can interact with the sensor data on their mobile phone via an app. They can also add geo-tagged photo or voice notes to annotate their journey. These can then be shared with other users of the ARCCS system. The system has been developed with a range of wheelchair users and other stakeholders.

The aim of Street Rehab is to co-develop a new system for delivering a service for wheelchair users, which puts everyday activities at the heart of the rehabilitation process. To do this a clear understanding of user needs, available technology and the accessibility of the city are all required. The first step is to understand the current

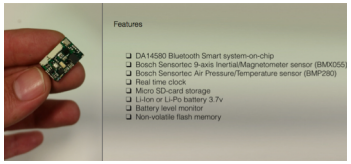

Figure 1:ARCCS sensor designed at UCL and specification

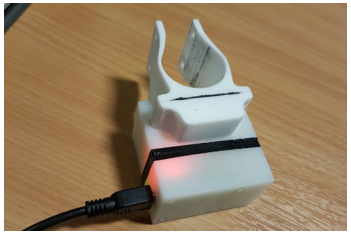

Figure 2: ARCCS sensor contained with a frame-mount and charging block

Figure 3:An electric wheelchair user testing the ARCCS sensor

accessibility of Delhi, the next to map this with the rehabilitation and livelihoods requirements of the wheelchair and tricycle users. We report our initial insights from the workshop and present our current and emerging framework of research to help tackle the problem of city accessibility for wheelchair users in lower-middle income countries generally.

HCI for Development & Disability in India

There are approximately 650 million people with disabilities in the world, 80% of whom live in developing countries [11]. It is well recognized that disability is both a cause and consequence of poverty [8]. Indeed, 20% of the world's poorest are people with disabilities. The World Bank recently completed a report on disability in India to help understand the journey from commitments to outcomes. It concludes "it will take a multi-faceted approach for persons with disabilities to reach their full individual potential and maximize their social and economic contribution to society"[5].

Basic and applied research

Schneiderman [6] suggests that combining basic and applied research (the ABC principle) to tackle immense problems produces more rapid progress. We would propose that bridging the accessibility and rehabilitation immense problem.

Our basic research lies in the development of novel sensors (Figure 1) and a data processing chain which can automatically identify features of the sidewalk or surface e.g. drop curb, camber, rough terrain. These classifications are then used to help with increasing localization of the person [1] . In addition, the sensors can be used to identify how the pushing techniques (known as push styles) of people who self-propel their wheelchair [2].

We have developed these sensors as mobile phones alone, while useful if secured in a fixed position, are not adequate when loosely placed in bags or pockets [4].

Our applied research is to find practical solutions for those who use mobility aids in India to access the services and places they wish to without risk of injury. Injuries can occur due to toppling out of a mobility device, being hit by a vehicle or developing an injury over time due to the demand of pushing/cycling your mobility device.

Method

Our methodology has been to immerse ourselves in the Indian context through collaboration with Leonard Cheshire Disability South Asia and V-Shesh, both NGO's working in India. Through these collaborations, we have conducted key stakeholder interviews and an initial workshop with stakeholders. We have also developed a collaboration with IIT Delhi to provide technical assistance in deploying the ARCCS sensors and are currently collecting pilot data from 30 wheelchair users. We will shortly follow this up with a second workshop, where users of the system can provide feedback on their user experience.

We are still analyzing the data from the interviews, workshop and the sensors, and these will be published in future papers. We provide an overview of participants in the workshops and interviews in the sidebar. However, our focus in this paper is to present our lessons learnt thus far with some key observations

Workshop attendees

Cross-section of wheelchair and tricycle users

International Commission for the Red Cross

India's primary manufacturer of wheelchairs (ALMCO)

Indian Spinal Injury Centre

Indian Institute of Technology, Delhi and Roorkee

Interviews

Cross-section of wheelchair and tricycle users

Cheshire Homes India, Delhi Unit

Joint Secretary, Government of India, Department of Disability Affairs, Ministry for Social justice and Empowerment

International Commission for the Red Cross

emerging from the workshop and interviews, and to set out our framework for future research.

Lessons learned so far

We were mindful from the start of the Street Rehab project that designing remotely for international development issues can cause both harm and good for local communities [3]. Therefore, understanding the National and local context was key to ensuring we understood how to develop a sustainable intervention. This was established through key stakeholder interviews. An example was a visit to a local charity in Mangolpuri on the edge of an informal settlement. Here we spoke to several tricycle and wheelchair users. From these interviews, we discovered:

- The main barriers to work were a mixture of the inaccessible nature of Delhi's infrastructure and social stigma attached to disability
- The major construction works being undertaken to improve traffic flow meant roads were often impassable by wheelchair and tricycle users
- Tricycles were preferred over wheelchairs as they could deal better with the uneven terrain
- No person had received any training on how to use their wheelchair or tricycle, with one person reverting to YouTube to access training videos for pushing style but also to train as an athlete (later winning National medals in shot put and Javelin)
- The main driver for wanting a tricycle was to access education and a job
- Wheelchair users didn't often make uncommon journeys, and would research well in advance any new journey with a combination of Google Maps and local knowledge

However, despite our best efforts to engage with local communities we realized that local workers, who were translating our questions and the local's answers appeared on occasion to slightly change what was being said; or answered for the local person. This has been highlighted previously by Donaldson [3] as a common mistake by researchers. However, we highlight here that even with due diligence, it is often difficult in a short-term project to overcome cultural norms in a local area, especially across multiple languages. What we hope is that by establishing a continued research agenda and projects with the local NGO teams we can help a genuine two-way learning.

Future Research Framework

Our emerging framework is one which puts the experience of the wheelchair/tricycle user at the center but with a clear connection to people who can implement policy change on a broad scale. One that includes local people who will be advocates for creation of accessible maps; and local NGOs to provide hubs of training. These will be linked to a series of YouTube videos and supported via a messaging service such as local WhatsApp groups social media groups e.g. a Facebook Page.

We would like to develop and evolve this framework with our Indian partners as well as the HCI community.

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