Final Year Project Report

Using RFID to Remember

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Abstract

RFID has shown to be a useful technology in recent years, especially in areas such as wearable computing. As this technology becomes more common, applications are being developed to benefit people in everyday useful ways. This project proposes to use this technology to aid human memory, and specifically to help people find lost items. Losing a wallet or a mobile phone is a common occurrence for most people. Most people could benefit from a system which can help them locate lost items. Using the system is simple, the project consists of a bag with a built in RFID system which reads tags on items placed inside it. This data will be used to help people locate lost items by interacting with a lost and found application, which is based on human readable cues. For example, The user last took their wallet out of their bag at 12:00 along with their car keys. The cues are developed based on when items are identified and in what combinations with other objects. Users could interact with these cues through a webpage and also receive alerts on potentially lost items. The cues are developed based on when items are identified and in what combinations with other objects.

Acknowledgments

In your Acknowledgments section, give credit to all the people who helped you in your project.

Chapter 1: **Introduction**

Chapter 2: **Background Research**

2.1 An Introduction to RFID Technology

In recent years RFID has become increasingly recognised for its many potential mainstream applications and uses. There are many types of RFID available each suited to different types of these in applications. From the highest level RFID can be divided into two classes, active and passive [1]. The system I am implementing is based on passive RFID, whereby the RFID tags do not require their own power source but are instead activated by the reader using magnetic induction. Active RFID would require each individual tag to have its own built in power supply which would prove impractical in the context of this project. Using the passive technique the reader can power the tags and allow them to transmit a signal corresponding to its unique binary ID [1].

2.1.1 Chatchayanuson's Kitchen Tracker

Chatchayanuson et al.'s Kitchen Tracker system systems goal is to aid everyday tasks, specifically grocery shopping [3]. The system consists of stationary RFID readers in a kitchen and tags placed on key grocery items within it. As items are removed from the kitchen, i.e., used or thrown away, the RFID readers are used to identify these items. This data is used to assist in grocery shopping indicating key items that are needed in the kitchen through real-time synchronisation with a phone or PDA. These implementations are based on smart home concepts [3]. One important point raised by this implementation is that such technologies should be unobtrusive and blend naturally into our environment.

2.1.2 Ubiquitous Memories

Kawamura et al.s Ubiquitous Memories is an innovative system designed to augment human memory through interaction with objects [4]. From a hardware perspective the system consists of a head mounted display over the left eye for displaying video to the user. This eye piece also incorporates a camera to record users activities and experiences. There is an RFID reader on one wrist to read tagged objects. These are both connected to a remote control for the system which connects to a hip mounted wearable computer connected to wireless LAN. The system records the users experiences and activities and passes them to a server to be stored in a video database. Objects related to specific events are RFID tagged. When a tag is read the system replays a video related to that object, mimicking the behaviour of human memory. When people touch objects they often recall associated memories [4]. Ubiquitous Memories was tested using memory and recall techniques using different memory aids, one of which being the Ubiquitous Memories system. This essentially determines the effectiveness of the system in aiding human memory and also offers insight into alternate ways of achieving this. This knowledge could be potentially used to refine or augment the system in the future. Like the kitchen tracker it is important to point out that such a system needs to be unobtrusive and feel natural in our environment.

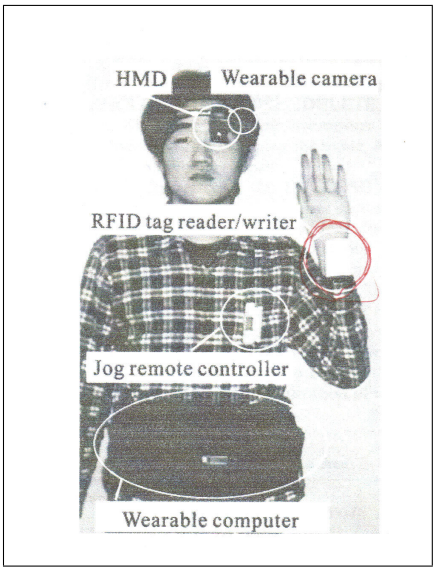

Figure 2.1: 'Ubiquitous Memories' system

2.1.3 Schmidt and Gellersen's RFID glove

Schmidt and Gellersen's RFID glove explores the area of wearable computing where there is often difficulty in providing computer input if systems carry high cognitive loads or performance problems in its deployment [7]. Schmidt and Gellersen explore this concept of human computer interaction using an RFID based system in an attempt to overcome the inherit shortcomings of wearable computing. The main concept is based on implicit human computer interaction. Implicit interaction is described as actions which are not primarily intended to be used as computer input but can still be used as such in some useful way. Their implementation consists of a glove with an integrated RFID reader. The reader is connected through a serial connection to a wearable computer. RFID tag IDs are mapped to a specific URL which increases a counter each time a tag is read. This system is more of a proof of concept then one with a specific purpose. They conclude that such an implementation effectively overcomes the traditional problems associated with user input in wearable computing, and propose that such a system would form a sound base for implementing practical applications of the technology [7].

2.1.4 Intel Project

In building useful applications with RFID technology a technique is required in order to allow the computer to correctly interpret its inputs. How can a task be identified from a set of RFID readings? In the Intel Seattle iGlove research project the concept of recognising and interpreting an individuals activities was explored. Their system prototype was again an RFID enabled glove with the antenna located in the palm. This is connected to a reader with radio capabilities for communicating with a computer. The glove components are all housed in a plastic box on the outer side of the glove, which overall makes the system compact and unobtrusive. One difficulty their system faced was interpreting 'variety, for example the same task could be completed in different ways or in a different order of steps. The proposed solution was to represent tasks in a sequence, or probable sequence, of the objects used, which resulted in a high level of system accuracy and performance [2].

Figure 2.2: Intels 'iGlove'

2.1.5 Lustig's RFID glove

Lustig and Coyle developed a similar RFID glove system to the iGlove designed to identify specific tasks carried out by a user [**?**]. This project is a continuation of this research attempting to build upon the work already achieved while focusing on a related but slightly different goal. A glove design was implemented with an RFID reader built into the palm. This was connected to a Gumstix computer with wireless capabilities. The Gumstix can connect wirelessly to a server which in turn can update a database of tag reads and pass this information to a webpage. The system is designed to recognise individual tasks by associating each one with a number of relevant tags. As my work utilises similar technologies to this project it will prove useful to take into account the results and findings of their work.

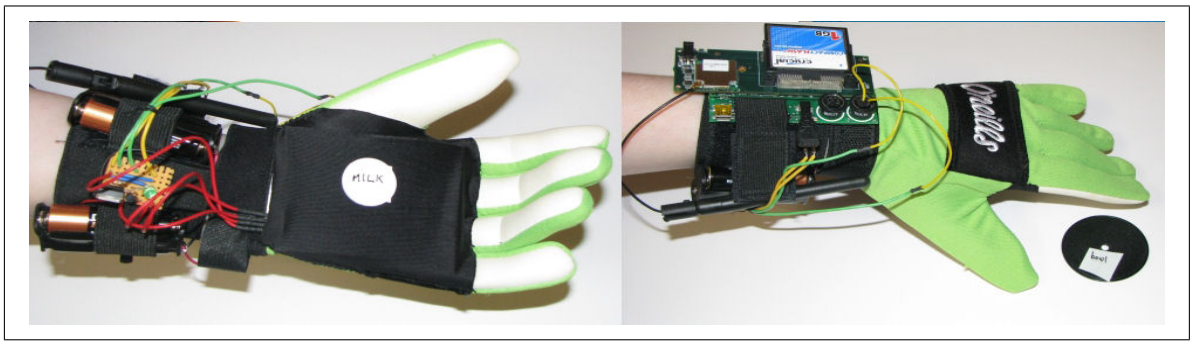

Figure 2.3: RFID glove

2.2 Conclusions

Much of this previous work in RFID applications offers some guidance for my own work. One important point raised by many research papers is that such systems need to be unobtrusive, feel natural to a user, and blend naturally into our environment. Ubiquitous memories and Chatchayanuson et al.'s kitchen tracker are good examples of this. There are often many problems in wearable computing systems, as discussed by Schmidt and Gellerson, such as problems with performance. While this is true, it is suggested RFID offers a sound base for implementing practical applications of these technologies and overcoming such associated problems [7]. Lustig and Coyle found their RFID system to be very restrictive [**?**]. This project will explore an alternative form factor in order to overcome these disadvantages. This project will use the same proven hardware and technologies as Lustig and Coyle's earlier work, but with a different implementation and application of them.

Chapter 3: **System Implementation**

3.1 Hardware Design

3.2 Data Processing

Chapter 4: **System Testing and Evaluation**

Chapter 5: **Conclusions and Future Work**

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