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Adam , Postula
University of Queensland

Matthew D'Souza
University of Queensland

Montserrat Ros
University of Wollongong, montse@uow.edu.au

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Intuitive Community Digital Assistant User Interfaces based on Wireless Devices

Adam Postula¹, Matthew D'Souza¹, and Montserrat Ros²

¹ School of Information Technology and Electrical Engineering,
The University of Queensland,
Brisbane, Australia
{adam, dsouza}@itee.uq.edu.au

² School of Electrical Computer and Telecommunications Engineering,
University of Wollongong,
Wollongong, Australia
montse_ros@uow.edu.au

Abstract. We present the concept, implementations and capabilities of Community Digital Assistant (CDA) a wireless home infrastructure supporting easy interaction. Our goal was to explore input and output devices to CDA that eliminate the standard computer-like interface which can be difficult to use for the elderly or small children. Another idea was to use physical objects to allow a user to interact wirelessly and enable this way an intuitive and seamless interaction of users with the communication computer (CDA). We experimented with and integrated into the CDA commercial devices such as digital pen, digital notepad, handheld scanner and also developed a prototype of a novel interface device "fridge magnet" using RFID tags to enable physical objects to act as computer interface.

Keywords: intuitive interface, wireless devices, wireless interaction.

1 Introduction

The Community Digital Assistant (CDA) is a conceptual device supporting electronic interaction of family members, neighbourhood and a wider community. As such, it should serve users with very different levels of technology awareness. CDA based only on a phone or tablet will inevitably be limiting the user interface to the screen and keyboard. It can easily become yet another computer gadget at home. We treat CDA as a concept; the implementation is through a number of easy to use devices.

Our goal is to explore input and output devices to CDA that eliminate the standard computer-like interface which can be difficult to use for e.g. elderly or small children. CDA interface, even if 'implemented' on computer screen should use everyday objects or objects easily identified with actions. Another idea is to use physical

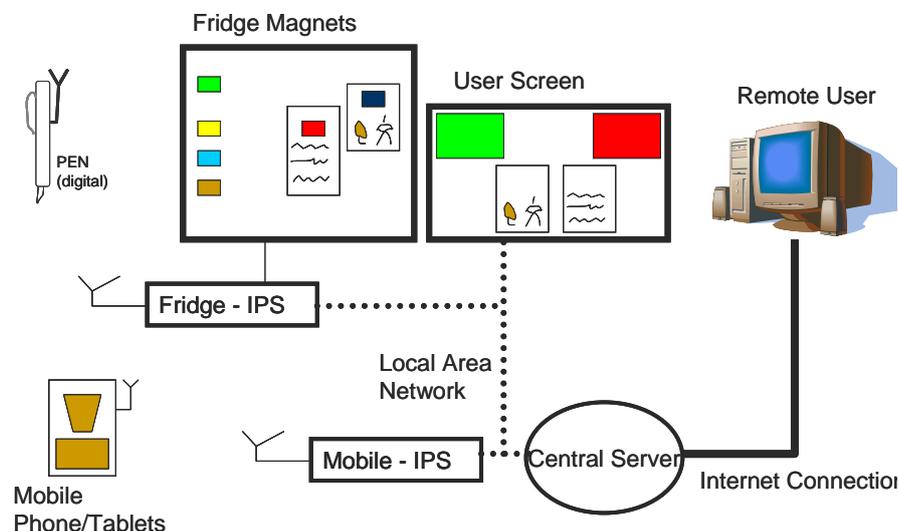


Fig 1. Community Digital Assistant Network

objects, provide them with electronics to interact wirelessly and enable this way an intuitive and seamless interaction of users with the communication computer (CDA).

There are many situations when using paper and pen is a more natural way to make notes, leave messages or just express your state of mind e.g. in a drawing. A note on fridge door is sometimes the most often communication in busy families. If the same note can be electronically posted seamlessly through (invisible) computer interaction then we can expect people using it for communication.

If a child's drawing is electronically posted on family or community web page without any more effort than just drawing and putting the paper in a particular place e.g. fridge door or a 'special' drawer (scanner) then we can expect our small people using this opportunity for wider communication. If we enable 'paper and pen' as inputs to CDA then many elderly people might find it enough user friendly to communicate more with others in the community. There are technological ways available now to make the above happen and electronic communication can benefit from removing 'standard' computer as an input and control device.

Wireless communication between devices can enable seamless user interaction with standard computer controlled devices or special interface devices. As shown in Fig 1, well known devices equipped with wireless and also some new devices like 'fridge magnet' (described later). All the devices are battery powered and recharged by plugging in mains. All are portable and their temporary location within a house can be easily changed. All communicate seamlessly and need absolute minimum of user actions. Communication is wireless and controlled by a home hub computer.

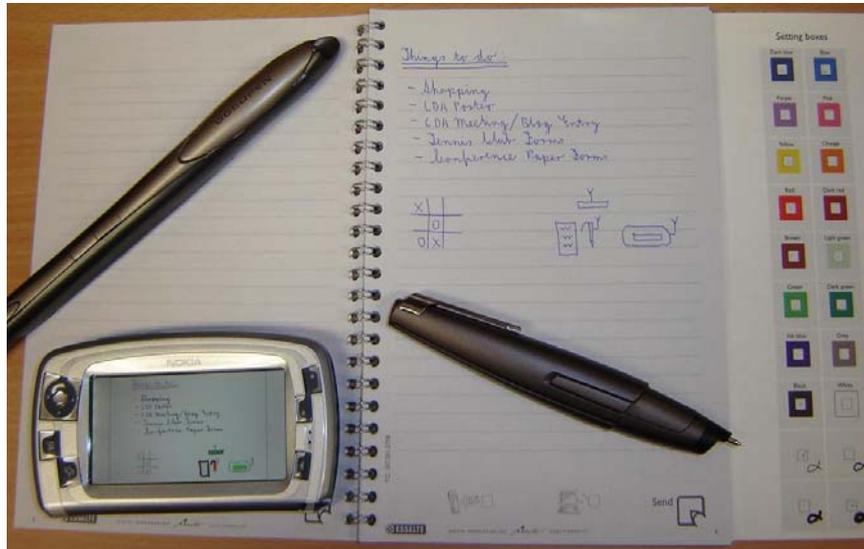


Fig 2. Usage of the digital pen and paper

2. Related Work

There have been previous projects that have explored the use and facilitation of mobile services with different wireless technologies and mobile computing devices. Intuitive input/output devices have also been explored for use in e-work and instrumentation applications. Belotti et al. [1] describe an experimental platform for the investigation of interaction and information access and delivery within a mobile context. To that end, they developed a web publishing platform (OMSwe), mobile client controller and cross-media server (iServer).

Interaction with the mobile client is via the use of the Digital Pen and Paper as well as responses via audio, though other interfaces such as PDAs, tablet PCs and head-mounted displays are mentioned. The client communicates via Bluetooth with the Digital Pen, Wifi for internet access and contains a GPS device for the provision of a "Where am I?" service. Belotti et al. [1] sight lightness, robustness, price and ease of annotation as strong arguments for using digitally augmented paper as an interaction device within a mobile environment.

In the paper by Siegemund and Flörkemeier [2], Bluetooth and RFID technologies are used conjointly to enable users with mobile phones to interact with smart objects via SMS. The authors categorise the interactions as being initiated by either the user or the smart objects and use an implicit pre-selection of potential smart object partners by way of monitoring behaviour using RFID. Scenarios discussed include Smart Product Monitoring, Remote Interaction with Smart Devices and the Smart Medicine cabinet. However requesting and receiving data is via the SMS channel. This requires either memorisation of the mobile phone numbers assigned to the smart

objects as well as interaction commands, or the transferral of phone book entries and sample SMS templates to the mobile phone first.

D'Souza, et al [3] explored the use of localized services with mobile computing devices for a context aware multimedia guidebook application. A network of Bluetooth information point stations were placed at locations of interest. The information point stations allowed user's to connect and receive information content via a Bluetooth file and serial transfer.

Recently, a Near Field Communication (NFC) initiative takes intuitive interfaces closer to commercialization and standardization. NFC [4] is an effort by Philips, Sont and Nokia joined by about 40 other companies. The aim is to define applications and standards for augmenting mobile phones with wireless interface in 13.56Mhz allowing to communicate seamlessly with RFID tags and other devices. Applications ranging from e-commerce to data exchange with embedded devices are being explored. The interface can be defined in such a way that putting a phone close to the receiving/transmitting device triggers the action without any need from the user to use the phone keys.

There are commercial developments in this area using paper and pen for communication with computer. The Nokia SU-B Digital pen [5], DigiMemo Pad [6] and miniature scanner [7] are examples of this trend. So far we have not seen reported an integrated environment for home and community use as our CDA Intuitive.

3. Scenarios

The main assumption in designing CDA infrastructure is that it should be easy to use for everybody in the household including children, elderly and computer illiterate. Scenarios below are examples of use, illustrating our emphasis on seamless interaction.

Four year old Annie drew with crayons a colourful picture for her dad. Unfortunately dad is away on business trip attending a meeting. Annie put her drawing into the scanner, closes the lid and her picture appears on the tablet screen. When Annie touches the tablet, the drawing goes to the background and Annie sees large colourful communication buttons. One of them has dad's photo. When pressed, this button emails picture to dad, who can watch it on his phone. Another button can put the drawing into the family drawing collection, yet another places drawing on community web page, children contribution area, or sends it to Annie's preschool. The precious original can be filed in a family vault.

A hand written note to an old friend a world away or to a friend living in the same town can be send exactly the same way. A cooking recipe from the best cooking book can be easily attached. Write a note, on paper with the digital pen, to your 13 year old that you have to go out and will be late home but the meal is of course, ready in the fridge and he/she should be back home 9.00 pm at the latest. Fix the note with 'fridge magnet' to a particular place on your fridge and off it goes on email or SMS. If not read as email/SMS it still has some slight chance to be read on paper. Tap the tablet screen and you see your cook book. Choose a recipe and when you put your dish in an oven, tap the tablet and it will set the alarm clock for this particular dish.

4 Fridge Magnet interface

This device is 'physical', is easily fixed to (and removed) e.g. fridge door. It is a RFID tag reader built into a flat board with different areas for different actions. It has a number of colour magnets (RFIDs, may be with pictures) similar or same as those on the tablet interface in the children scenario. But now the magnets are physical objects with attached meanings (e.g. Dad, Mom, friend, etc.). If a paper drawing is scanned or photo made with camera or note written with digital pen then the data goes to the hub and placing a magnet in a particular action field (e.g. email, web posting, etc) will trigger the particular action. The number of combinations of use is almost unlimited. It can become either a fun device or additional/parallel device to the tablet. Using this device for planning busy family working week is also advantageous since any changes are clearly seen in the 'physical' but also annotated to the computer version.

The fridge magnet interface shows easily actions but must be augmented with other devices for data input and output. The digital pen allows users to send written notes or hand-drawn sketches as messages. The digital pen used is the Nokia SU-1B digital Pen [5]. It electronically records handwriting strokes as an image file. Special digital paper is required by the SU-1B pen to record handwriting strokes. The digital paper has a series of commands imprinted into it which allow the SU-1B pen to send the recorded image file to the File transfer AP. The SU-1B pen and digital paper can be seen in Fig 2. Colours can be accommodated but will not be seen on the paper, they will show only on the computer screen receiving the pen written document.

The digitizing tablet uses plain paper and the movements of pen are recorded through RF interface. The main disadvantage is that the paper must be placed on a tablet which is of a shape and thickness of a note book. The advantage is the use of plain paper. The tablet can be seamlessly interfaced to home computer through modified wireless interface. The miniature scanner [7] has the advantage it can easily handle colours. The scanner is hand held, easy to use and can communicate wirelessly. Its use would be mainly in emailing e.g. pages of books, magazines, children drawings, etc.

Fridge magnet is by definition limited to displaying only paper notes and taken actions through positions of its magnets. In some situations it would be advantageous to extend this capability by using a small tablet size screen. The screen would be used mainly for displaying incoming messages, but if equipped with touch interface can also augment input interface functionality. This combination was not yet fully

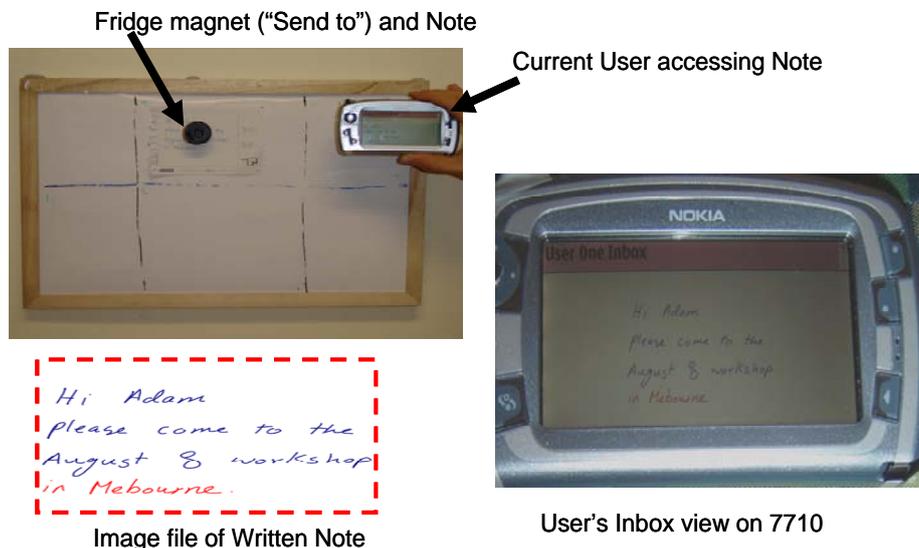


Fig. 3. Fridge Magnet Board Interaction – Send Function

investigated and implication for the user interface explored.

There are currently two main functions that the user can perform using the Fridge Magnet Board: Send/Inbox and To do list. In Send/Inbox users are able to send scanned images and other media items to other users. Received media appears in user's inbox. An example of the Send Function can be seen in Fig. 3. In to do list the users are able to upload scanned images and other transferred media to their "to do" list.

5 Community Digital Assistant Network

The Community Digital Assistant Network consists of Bluetooth enabled Information Point Stations (IPS), Fridge Magnet Board and User Screen. Each IPS can be accessed by a local area network. The Fridge IPS is used to control and respond to commands that the user issues using the Fridge Magnet Board. The User Screen allows the user to view their actions. The server is used to store each user's inbox and to do files and preferences. The Fridge IPS also received the output of the digital pen. The Mobile IPS is used to receive content uploaded by a user's mobile phone and can also be used to access the CDA Network.

The structure of the Fridge Magnets can be seen in Fig 1. RFID tags is used to identify users or objects. An RFID reader antenna is embedded into the IIB. Each RFID Fridge Magnet corresponds to a particular service command. Once the RFID tag has been detected by a particular antenna, the RFID reader will transmit the RFID tag ID number and the antenna number to the Bluetooth serial profile module. This will then be received by the file transfer AP.

6 Conclusions

The presented wireless infrastructure has been developed to explore the concept of intuitive interface augmenting or replacing keyboard and screen in daily interaction with home information environment. Wireless technology and RFIDs make possible to not only free the interaction device from physical connection to a computer but also enable various physical devices to be used as information input. Our fridge magnet interface is an example of using a device – fridge magnet – already having some connotation with sending information as an intuitive user interface for home. The prototype of this wireless infrastructure is implemented and was tested in the laboratory environment. We plan to test a more robust version in user home environment soon.

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