Palpable computing in a health care environment

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Abstract

Mark Weiser first coined the phrase “ubiquitous computing”. In ubiquitous computing computers exists everywhere and are not necessarily visible, meaning humans may use them without being aware of it. This scenario will require devices to adapt a flexible communication technique. Real scenarios involving ubiquitous computing has been investigated. The PalCom framework[1] has been used and evaluated as well as the developed prototype.

1. Introduction

At the University Hospital in Lund, USIL, just like any other hospital, there are many complex distributed systems in use (with over 20 000 different electronic devices). Health care today depends on many electronic devices such as X-ray machines and also pure software systems like record keeping systems (USIL has at least 14 different record keeping systems in use today).

Since all these systems are developed and maintained by different manufacturers there is a problem with interoperability. There is both the problem of understanding any existing communication interfaces and to actually use information from one device as input to another device. Two scenarios, found in this environment, has been investigated in this thesis.

This thesis has been concentrating on medical pumps. These are electronic devices that will medicate a patient with a given drug during a period of time.

2. PalCom

PalCom is a reference framework for palpable computing. Basically electronic devices, or pure software systems, are supplied with PalCom services. These services consist of in and/or out -put commands with zero or one parameters. These services can be combined in an Assembly. The assembly will gather devices and services. It will trigger on output commands and can use the parameter values as input to other commands or store them in variables.

A manufacturer can create a device and allow communication through a PalCom service. The point being that the end user can create an assembly and use the device in ways that the original manufacturer did not think of.

3. Offline scenario

The pumps contain a log file. This log file contains data on how the pump has been used. As the pump devices are expensive USIL needed to take care of this usage data and use it to make statistics. The main task has been to determine how many different pumps are used each day and how many pumps are used simultaneously each day.

Three PalCom services has been developed to deal with this situation. A lightweight user interface has been developed to allow the end user to publish raw log data in the PalCom world. A parser service has been developed to parse raw log data and produce normalized logs. A storage service has been developed to store normalized log data. A web application has also been developed to present statistics.

4. Online scenario

Whenever a nurse is preparing a pump for an infusion session he or she will enter such things as what drug to use and the amount. The nurse will then note that same thing on a peace of paper and go find a PC running a journal system, the nurse will then enter the same information into that journal system. It would be beneficial if the pump device could talk directly to the journal system, that way the information only has to be entered once. There is also alarms that can be triggered during an infusion, such as the AC adapter becoming unplugged or the battery level becoming low.

A device developed by Cardinal Health called Alaris Workstation has been investigated. It allows multiple pump
devices to be attached to it and provides an XSLT (XML Schema Language Translation) interface for communication.

A PalCom service has been developed for this workstation allowing alarms to be triggered if for example the battery is running low. It also provides status information upon request, such as what drug is used in an ongoing infusion session.

5. Conclusions

The project has resulted in some opinions on palpable computing and PalCom (the reference framework). The PalCom framework is experimental but still it has been working well. A few bugs has been found and adjustments has been made, which are further discussed in the report.

The offline scenario did not gain alot from using PalCom. One advantage would be if the parsing process would require alot more CPU capacity. In that case it could be a good idea to run the parsing service on a rather fast computer. To use PalCom in situations like this is still good for the PalCom project since whenever it is used, there is a chance for evaluation.

The online scenario gains alot from using PalCom. It is clear that Cardinal Health has reflected the fact that there customers will want to combine its functionality with other systems and therefore providing the XSLT interface. But XSLT is advanced and requires a software developer. The PalCom interface developed is working great and there will probably be another thesis focusing on extending this part. For example if an alarm is issued, the nurses cell phone could start vibrate and the nurse would get a message saying where the alarm was triggered as well as what triggered it.

References