PDA Interface to GPS Receiver

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Outline

- Introduction
- Background
- Proposal
- Development Tools
- Schedule
- Challenge
- Conclusion

Goals & Objectives

- To learn & design an interface for a PDA that not put functionality over usability.
- To learn and develop an application using different development approach than those that have been used before.
- To develop application with reliable connection and control
- Multi-port connections (serial and Bluetooth)
- Learn to manage a project

Background

- What is PDA?
- Human-Computer Interaction
- User Interface on PDA
- The Important of User-Centre Design
- What is GPS
- Bluetooth Communication
- Serial Communication

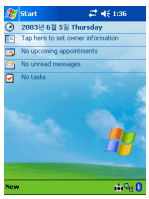
What is PDA?

- Personal Digital Assistant
- Examples are Pocket PC, Palm, Smartphones
- Examples of OS are Windows Mobiles, PalmOS, BlackBerry and Symbian OS
- Becoming very popular espcecially Pocket PC and Smartphones

User Interface & PDA

- User Interface PDA is very different than normal computer User Interface
- Smaller screen
- Less memory
- Different input methods

Examples of User Interface on PDA



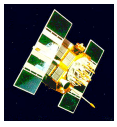
The important of user-centre design

- Users are the people using and not software developers.
- The application must be design for users.
- Always involve user in the development of an application especially one with a lot of interactivity.

Human Computer Interaction

- Study of interaction between people and computers.
- Multi-disciplinary fields
  - Computer Science
  - Psychology
  - Design
  - Ergonomics
  - Etc
- Importance to the design of user interface.

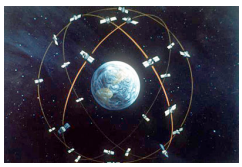
What is GPS?



- Global Positioning System
- Developed by U.S. Military
- A satellite navigation system used to determine one's precise location and providing a highly accurate time reference almost anywhere on Earth or in Earth orbit.
- 27 Earth-orbitting satellites (24 in operation and three extras in case one fails).

GPS Trilateration

- Simple mathematic principle
- GPS actually uses 3D-Trilateration
- Use to calculate the user's exact location.



GPS Applications

- Location - determining a basic position
- Navigation - getting from one location to another
- Tracking - monitoring the movement of people and things
- Mapping - creating maps of the world
- Timing - bringing precise timing to the world
- Geocaching – search for objects hidden in nature

GPS Accuracy

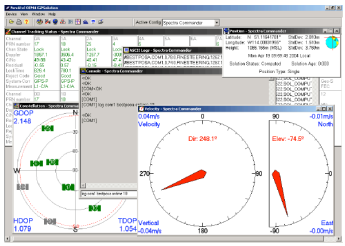
- Prior to 1st May 2000, very inaccurate due **Selected Availability** imposed by U.S. Military on civilian receivers and certain areas.
- After than it was turned off and the accuracy became very accurate especially for industrial level receiver
- Ionosphere
- Signal Dependency
- However, those 2 not really effect industrial level receiver

GPS Receiver

- NovAtel OEM4-GS
- Industrial Level GPS Receiver
- $20,000
- Use both NMEA and various industry-standard messages

Proposal

- To develop a PDA version of the GPS application that comes with the receiver using Bluetooth and Serial Communication

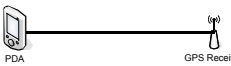


Bluetooth Communication

- An industrial specification for wireless personal area networks (PANs).

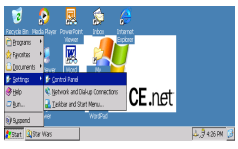
Serial Communication

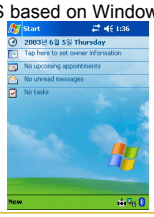
- refers to any data transmission scheme in which data is sent one symbol at one time, sequentially over a communications channel.



Platform

- Windows CE Operating System
- Windows CE ≠ Pocket PC
- Pocket PC is a PDA using Windows Mobile
- Windows Mobile = Windows CE?
- Partly, Windows Mobile is an OS based on Windows CE





Development Environment

- Choices between:
  - Visual Studio .NET 2003
  - eEmbedded Visual C++
  - eEmbedded Visual Basic
- Some of the criteria are:
  - Managed code or Native code?
  - Development time
  - Ease of use
  - Support
  - Performance

Development Environment

- Microsoft Visual Studio .NET 2003
- Support Many Languages
- Large amount of resources
- Use managed code which make development time much faster.
- Use Microsoft .NET Compact Framework

Microsoft .NET Compact Framework

- .NET Framework for mobile applications
- Design to enable the development of secure, downloadable applications on devices such as PDAs, mobile phones and set-top boxes.

Programming Language

- Choices between:
  - Visual Basic .NET
  - Visual C++ .NET
  - Visual J# .NET
  - Visual C# .NET
- Some criteria for choosing the language:
  - Performance
  - Resources available
  - Support for mobile application on Windows CE
  - Various programming language features

Programming Language

- Visual C# .NET was chosen for the development
- Large amount of resources available on mobile development with this language
- Mixed between C++ and Java
- A Language that was developed with .NET Framework in mind.

Software Development Methodology

- Prototyping Approach
- Suit an application that has a lot of interactivity
- Allows for rapid development since prototype system is create early in the development
- Allow for design changes and others

User Interface Design

- Need to follow heuristics (design principles)
  - Visual
  - Consistent
  - Memory
  - Learnability
  - Navigation
  - Workflow
  - Feedback
  - Control

Usability Test

- User walkthrough
- User evaluation
- Various other testing with the users

Key milestone

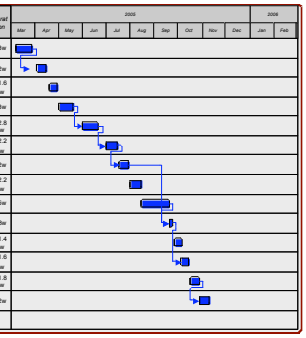
- Background research
- Initial proposal
- PDA to receiver Connection implementation
- GUI functions
- Optional functions
- Final integrating

Deliverable

- A prototype of the application.
- Final Report

Schedule

ID	Task Name	Start	Finish	Duration
1	General background research	8/03/2005	28/03/2005	3w
2	Technology background research	4/04/2005	15/04/2005	2w
3	Version 1.0 GUI design	20/04/2005	29/04/2005	1.6 w
4	Draft report	2/05/2005	20/05/2005	3w
5	System specification	1/06/2005	20/06/2005	2.8 w
6	Produce serial port connection	1/07/2005	15/07/2005	2.2 w
7	Data collection	18/07/2005	29/07/2005	2w
8	Parser functions	1/08/2005	15/08/2005	2.2 w
9	GUI implementaion	16/08/2005	19/09/2005	5w
10	integrating	20/09/2005	23/09/2005	.8w
11	Bluetooth port connection	27/09/2005	5/10/2005	1.4 w
12	Web function	5/10/2005	14/10/2005	1.6 w
13	Usb connection	17/10/2005	27/10/2005	1.8 w
14	PC GUI	28/10/2005	10/11/2005	2w
15				



Possible Optional Functionality

- Develop a client-server application to connect the GPS Receiver.
  - Basically allow users to use the PDA to access the web interface to talk with the GPS receiver that connected to the server.
- USB connection
- More functionality after consultation with various users.

Challenge

- Stride a balance between functionality and usability in the application.
- PDA GUI consistency
- Reliability
- Efficiency
- Bluetooth port
- Working as team
- Share workload

Resources

Websites with various resources on programming with Windows CE

- www.msdn.com Microsoft Developer Network
- www.pocketpcdn.com Pocket PC Developer Network
- www.gotdotnet.com Got Dot Net Workspaces
- www.devbuzz.com Handheld Development
- Various books on .NET Compact Framework and C# Programming

Possible 3rd Party tools and frameworks

- www.franson.com Franson Gps Tools
- www.gpsdotnet.com Global Position SDK
- All cost money to acquire the license to use them
- Will download the trial version first to decide between the two or both

Conclusion

- PDA Interface design is different than normal desktop interface design
- Project is combination of HCI materials in designing GUI and development of application functionality
- Basically learn to stride balance between Usability and Functionality
- Learn to develop application using different platform than previously taught in uni.

References

- Y. Rogers, H. Sharp and J. Preece., 2002, Interaction Design: Beyond Human-Computer Interaction. John Wiley & Sons, Inc
- PFleeger S.L., 2001, Software Engineering Theory and Practice.
- A. Wigley and S. Wheelwright., 2003, Microsoft .NET Compact Framework Core Reference. Microsoft Press.
- J. Hobart. Principle of Good GUI Design. http://axp16.iie.org.mx/Monitor/v01n03/ar_ihc2.htm
- P. Yao and D. Durant., 2004, .NET Compact Framework Programming with C#. Addison-Wesley.

Questions & Answers