Software Tools for Environmental Field Studies (STEPS)

Mobile Computing Technology
Vision

- Environmental and Civil Engineering Require the Collection of Field Data.
- Advances in Mobile Computing allow the development of Tools to Aid Data Collection.
- Platform is expandable to include Advanced Data Collection Technologies: GIS, GPS, RS and Telemetry.
Feedback from Your Applications

- What technology would you use to assess the river water quality?
  - “I would want to check the water for bacteria and toxic chemicals, such as arsenic.”
  - “I would look over the entire site and check for possible upstream tributaries…”
  - “While the most thorough way would be to conduct chemical tests, a good and effective way is to test the life in the water.”
Feedback from Your Applications

How would you communicate this information to others?

- “I think that colorful graphs and charts will do the best job, because the general public will understand visual information better.”
- “If communication were possible in the field, then the data could be shared immediately.”
- “A possible idea is to set up an Internet database where the public has access to the water sampling results.”
Feedback from Your Applications

- How would you know this information is correct?
  - “To ensure that my data analysis is correct, I would repeat the data collection daily.”
  - “A reliable and highly tested unit would allow you the greatest confidence in the results.”
  - “I would use a GPS instrument to chart the location of each sample and correlate these data.”
Feedback from Your Applications – My answers

- Sampling of pertinent water quality parameters in specified locations of the water body.
- Time series data analysis followed by visual presentation of results in a spatial reference frame.
- Periodical calibration, multiple sampling and independent verification through laboratory analysis.
Hydrologic & Geospatial Field Data Collection

Field Hydrology Data Collection:
- Stream Geometry & Velocity
- Discharge Computations
- Water Quality Sampling
Technology
COMPUTING

- Compaq IPAQ
- Windows CE
- eMbedded VB, VC++
- Microsoft Access

SENSING

- HydroLab Probe
- Teletype GPS
- Chemistry Kits
- Flow Meters
Essentials of Mobile Computing

- The Big Match: PocketPC versus Palm OS
  - Who will win the hearts of mobile users?
  - Advantages and Disadvantages of each?
  - Is there a real need for all this technology?
  - What performance measures are important?
    - Ease of use? Computing power? Expandibility?
  - Market share of each type of product?
  - Who are the software/hardware providers?
  - Is one platform better or worse for development?
The PocketPC platform

- Microsoft began developing Windows CE for all embedded devices (phones, handhelds).
- Development for various processors and various hardware types.
- Windows CE provided desktop-like functionality and software as well as increased computing power.
- New launch of PocketPC 2002 in October.
- http://www.microsoft.com/mobile/
Essentials of Mobile Computing

- Preloaded Software with our PocketPC
  - Pocket Word (word processor)
  - Pocket Excel (spreadsheets)
  - Pocket Outlook (email)
  - Pocket Access (database)
  - Internet Explorer (browser)
  - Reader (e-book)
  - Windows Media Player (video player)
  - Microsoft Active Sync (desktop file transfer)
Essentials of Mobile Computing

- Third Party Software, Shareware, Freeware available for PocketPC
  - How many can you identify?
  - Conduit Technologies (www.conduit.com)
    - Pocket Slides (powerpoint)
    - Pocket Artists (images)
  - Ruksun Software (www.ruksun.com)
    - Messenger Force (instant messaging)
    - Scotty FTP (ftp client)
IAP Field Trip

Australia 2002

Water Quantity and Quality Sampling in Australian Watersheds
Review of STEFS application

Mobile Field Notebook Specifications

- Launch of Application and Project Setup
- Main Control Screen
- Automated Probe Control Frame
- Manual Input Frames
- Saving, Syncing, Accessing Database
- Engineering Calculations
- Mapping and Displaying Data

http://www.learningwebservices.com/icampus.stefs
Review of STEFS application

Software Framework

**Instruments**
- GPS Teletype
- Serial Comm Handler C++
- Serial Read/Write Protocols
- Instruments/Computer (HydroLab)

**Windows CE**
- Active Sync (Client part)
- Field Notebook Main Application
- GUI VB MFC
- Customized ArcPad Handler
- ArcPad for CE
- Micro Database File (.cdb)

**Desktop/Laptop PC**
- Active Sync Software (Desktop part)
- ENVI Desktop AppI VB
- ADO
- Access Database
Review of STEFS application

- Competing technologies
  - PocketTroll (www.in-situ.com)
  - Fieldworker (www.fieldworker.com)
  - Condor PenMap (www.condorearth.com)
  - PenMetrics (www.penmetrics.com)
  - Pocket EQUis (www.earthsoft.com)
- Others in web.mit.edu/envit/www
IAP Field Trip

Hawkesbury-Nepean Watersheds near Sydney, Australia

Examples of Maps and GIS data available for the area
Hawkesbury-Nepean Watersheds
WorkingGroups

- The goal of each WorkingGroup project is to deliver a portion of the STEFS prototype.
- Teams of 2-3 people with advisor
- Examples:
  - Development of the GUI for manual measurements.
  - Development of scripts for GPS geopositional data.
  - Development of query system for water probe.
  - Development of database components.
  - Development of hardware for field deployment.
Project Status

- Conceptual design and Planning completed.
- Core Team and UROP researchers have created initial parts of prototype.
- Two mockups have been created:
  - Power Point GUI design
  - GPS/ArcPad Demo
- Further tasks to be assigned.
- Important deadlines established.