CMPUT 302 W14

Project Design Milestone

Feb 7th, 2014

Augmented Pen & Paper Interface

Team 4

Group Name: Pen & Paper

Group Members: Ashley Dawn Brown, James Cadek, Gerald Manweiler, Eddie Tai, Yi Zou

Division of Labour:

Division of labour is fluid and determined by each team member’s current academic workload, unique skill sets, interests, and project requirements & deadlines. Workload will be managed by consensus and twice weekly meetings. Workload will be communicated via meetings, email, Trello and our [Github Project Wiki](https://github.com/CMPUT302W14T04/Interface/wiki). Project tasks that lend themselves to one team member being the primary will always be supported by team consensus. All team members have design input, but one team member will be responsible for final prototype copy. Project management will generally be handled by one team member, and documentation by another. There will be one primary programmer, but all team members will contribute to the code base. One team member will lead the experimental testing methodology design, but all members will contribute.

Project Description:

The main objective of this project is to capture and digitize graphical annotation on a paper geographic information system/land use/topographical maps, and be synchronized with relevant audio and video information in a portable fashion.

The project source is Trevor Wiens of [Apropos Information Systems](http://aproposinfosystems.com/). Trevor hopes to use this product with his main product LOUIS Heritage, a tool to help indigenous people in preserving, protecting and promoting their traditional knowledge and values. LOUIS Heritage allows text, maps and media files to be stored and used together.

The project is scientifically interesting because a portable integrated media information data capture system, based on tracking an infrared source, does not currently exist. Many existing programs usually rely on a projector or anoto paper to save written content to a computer. This project aims to remove the need of these requirements for the capture system, which may be beneficial and inspirational to many other scientific developments.

The functionality of the system will be tracking and geo-referencing an infrared dot from a pen on a paper map. First, the map will be calibrated. An audio/video recording will capture the entire session and provide a date/time stamp for cross referencing. When the system picks up IR signal from the pen, the system will record the coordinates from the map and the date/time stamp of the IR signal. Wiimotes will be used as the IR sensors. The physical component of the interface will be infrared tracking hardware, in the form of an infrared pen and wii remote.

The software interface will feature a main screen with menu bar that lets a user enter basic session info on a laptop (map unique identifier, interviewer(s), interviewee(s), date & time), an interface to calibrate the infrared pen to the land use map, an interface to give real time feedback of IR coordinate capture points in relation to location on the land use map, and menu to control video/audio recording of the session.

Evaluation of Interface/Experimental Testing Methodology:

The main forms of evaluation of this project will be:

* Ease of use and start up time for preparing a session
* The motion tracking resolution (our client specified a 1.5 mm accuracy goal)
* The versatility of hardware positioning
* Ease and accuracy of calibration
* Possible Experimental Methodology
  + Trace marking on a paper map with IR pen, digitize annotated map, and compare captured geo-referenced IR coordinates with paper map annotation geographic coordinates. Test annotations will be a point, a line, and a rectangle
  + IR pen coordinate marking on paper map versus Google maps coordinate marking time trial
  + IR resolution of 2 wii remotes versus 4 wii remotes

Client Need Analysis:

* Portability, ease of use and the ability to use paper maps are the utmost priority for the client
* The client wants to reduce manpower costs from a multi-person interview team to a one person interview team.
* The client wants to digitally capture and geo-reference annotations made on a paper map. Resolution of 1.5 mm required on 1:50000 scale maps.
* The client wants digitized map feedback of the IR capture.
* The client wants to verbally anchor map annotation with audio recording of unique feature id of map annotation. This will be used by the Natural Language Processing (NLP) functionality of the client’s product LOUIS Heritage (Land Occupancy and Use Information System) to integrate map annotation. The audio anchoring will be done by timestamp matching to the IR coordinates capture.
* The client needs map/audio/video session data saved in a format compatible with the client’s product LOUIS Heritage.
* The client wants a single video/audio recording of the session.
* The client has specified that the system should work with any operating systems.
* The client specified a maximum map size of 4 feet by 6 feet.
* The client a maximum map bearing surface of a conference room table.

Constraint Analysis:

* All hardware and software setup for an interview session must be done by the interviewer. Therefore, set up time should be minimal.
* Furthermore, the interviewer is not an IT professional. Therefore, some, but not extensive, user training will be required. The training would consist of how to setup, calibrate and use the infrared tracking hardware, and how to record audio/video.
* Further corollary, the physical weight and size of the hardware should be in order of 2 cubic feet and 5 pounds weight.
* Due to time constraints in development, this program will only be supported for Windows initially. If time allows then we will develop support for other operating systems.
* The largest map feasible for use is 24 inches by 36 inches
* The smallest map bearing surface is an average kitchen table.
* We will capture all IR annotations but will not be able to do optical character recognition.

Heuristic Analysis:

<http://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/>

Scenarios:

*Scenario One: Geo-referencing Calibration of Map*

*Scenario Two: Basic Use of System*

Hierarchal Task Analysis:

*Scenario One: Geo-referencing Calibration of Map*

*Scenario Two: Basic Use of System*

Need For Material:

* Hardware
  + Laptop
  + Wii remotes
  + Broadcom 2046 Bluetooth 2.1+EDR USB Dongle with First Connect
  + Infrared pen, 940nm frequency
  + Paper land use map (22” by 34” on average)
  + Video camera on tripod
* Software
  + Wiiusej API (wii remote java interface)
  + Windows 7

Paper Prototypes: