Engineering Clinic Group

Project:

A Mote and GPS Based System for Real-time Driving Directions Optimized for Traffic Avoidance

Group Members:

Ben Meakin
Calvin Yan
Dan Rolfe
Eric Hsu
Revised Schedule of Completion

Obtain Parts and Assemble (All)  
Jun. 1st – Aug. 20th

Develop Mote to GPS Interface  
(Eric and Ben)  
Aug. 20th – Sep. 13th

Develop Mote to I/O Interface  
(Calvin and Dan)  
Aug. 20th – Sep. 13th

Mote Networking  
(Eric and Calvin)  
Sep. 15th – Oct. 6th

Software Development  
(Ben and Dan)  
Sep. 15th – Oct. 6th

Integration  
(All)  
Aug. 20th – Nov. 31st

Optimization  
(Ben and Dan)  
Oct. 6th – Nov. 31st

UI Development  
(Eric and Calvin)  
Oct. 6th – Nov. 31st

Integration  
(All)  
Jun. 1st – Nov. 31st

Debugging  
(All)  
Jun. 1st – Nov. 31st
Bill of Materials

Crossbow Imote2 .NET Edition (IPR2410CA)
  - Price: $299
  - Source: www.xbow.com
  - Contact: sales@xbow.com

Garmin GPS 15H (010-00240-06)
  - Price: $55
  - Source: www.garmin.com
  - Contact: 1-800-800-1020

Cylab Inc. RS-232 to VGA Converter
  - Price: $62
  - Source: www.rs-big-print.com
  - Contact: sales@rs-big-print.com
Bill of Materials – Cont.

Lilliput 7" EBY701 Touch screen LCD VGA MONITOR
- Price: $163
- Source: www.ebay.com

Digilent PmodENC Rotary Encoder Module
- Price: $10
- Source: www.digilentinc.com
- Contact: sales@digilentinc.com
The Map Problem

Issue: Need data about city streets and a data structure to represent them

Problems:
- Map files are either encrypted or too large to store locally
- Interface with Google Maps could be too complicated in embedded software development
- Bluetooth interface to handheld GPS device possible, but defeats the purpose of developing our own system
The Map Solution

Overview: Install a graph based representation of streets local to each city mote and transmit to car motes upon request

Limitations: Bandwidth and Memory
- For long trips it may be impossible to download street information covering the whole path. If it can download the whole path, it may not fit in memory.

Workaround: Only Download What you NEED
- Graph Pruning Algorithms

- Provide data limited optimized routes
  - If not possible then just tell user where known traffic is.
Information Display
And
Destination Input
Information Display

Parts 1:

Rs232 to vga converter

- Display 12 large characters in a line and 6 lines in total or
- Display 20 small characters in a line and 8 lines in total
- Characters supported: 0-9, A-Z, a space, plus & negative signs and a period.
Information Display

Parts 2:

Lilliput 7" EBY701 CAR PC Touch screen LCD VGA MONITOR

- VGA input
- Touch Screen Function with USB interface
- W 7 3/4" X H 4 1/2" X D 1 3/8"
- 30Ms Responsive Time
Destination Input

Parts 1:

PmodENC Rotary Encoder Peripheral Module

- Rotary push-button shaft encoder
- Slide switch

Parts 2:

Lilliput 7" EBY701 CAR PC Touch screen LCD VGA MONITOR
**Destination Input**

PmodENC Rotary Encoder Peripheral Module

- Slide Switch: On/Off Output at pin SWT
- Press Button: High on pin BTN when being pressed
- Rotate: Receive rising edge of pin A and B in different sequence

![Diagram of Rotary Encoder and Push Button](image-url)
Destination Input

PmodENC Rotary Encoder Peripheral Module

- Rotate Right: Receive rising edge of pin A before pin B
- Rotate Right: Receive rising edge of pin B before pin A
- The last two pins are GND and VCC
GOOD DAY
SWITCH ON
TO INPUT THE
DESTINATION

DIRECTING
TURN RIGHT
IN THE NEXT
INTERSECTION

Switch On

Switch Off

Data
Input
Sequence
Input Style 1

INPUT · E ·
DESTINATION
425S 1000E

Rotate Left

Rotate Right

INPUT · D ·
DESTINATION
425S 1000D

Button Pressed

INPUT · F ·
DESTINATION
425S 1000F

INPUT · E ·
DESTINATION
425S 1000EE
Input Style 2

INPUT 6 7 8 9 0
DESTINATION 425S 1

INPUT 1 2 3 4 5
DESTINATION 425S 1

INPUT A B C D E
DESTINATION 425S 1

Rotate Left

Screen

Touch

Rotate Right

INPUT 6 7 8 9 0
DESTINATION 425S 1

INPUT 6 7 8 9 0
DESTINATION 425S 16
Input Style

- Two kinds of input style
- Determine by the following
  1. Sensitive of the touch screen
  2. Graphic quality
  3. The ease of rotating the button
Wireless

• 802.15.4

• Since we are working with the other team
  – What they expect from us.
  – What we expect from them.
  – How we plan on doing it.
Talking

• Things we will be sending them
  – Current position, and velocity of each vehicle.

• City motes send us
  – Map data.

• We can request from them
  – gas station locations.
The Idea

- Some information will be sent on regular intervals.
- Other information will be available upon request.
- Between the two groups we will come up with an expected message format.
Mote Power

- To power the mote we will interface with the car battery
  - The interface will supply the proper amount of power for the mote.
THE BIG PICTURE
Updated RISKS

• GPS module from Garmin - Interface via serial instead of Bluetooth (eliminating wireless problem)

• No complicated GUI - Display text directions and information.

• No proprietary map scheme – Acquire map data from STATIONARY motes.
Conclusion

• FINAL Original HARDWARE components.

• FINAL Original SOFTWARE design.

• Same timeline for the schedules.
Q&A

• Questions?

• Comments…