Project Proposal

GPS Collection Unit

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Project Abstract

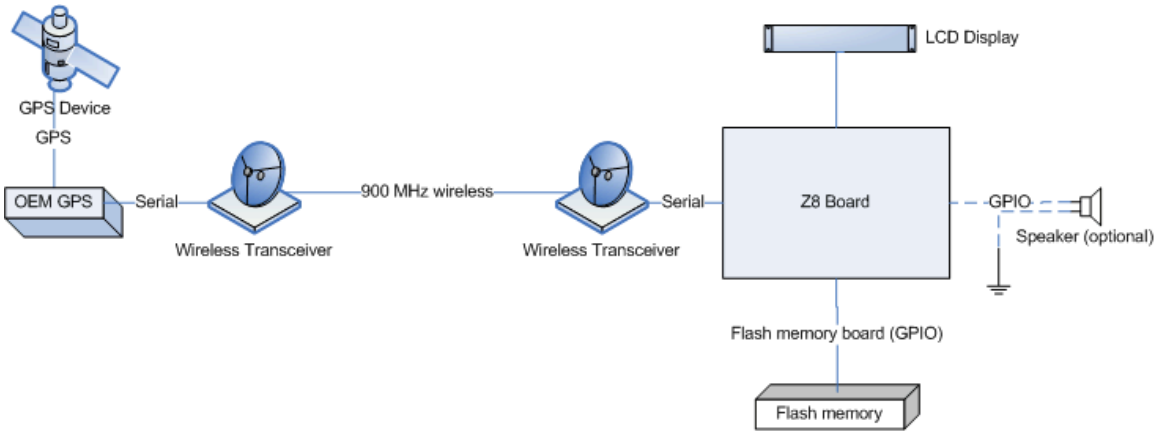
This project is a prototype unit of a small Global Positioning System (GPS) collection and storage device. The device will collect GPS data, display critical information from the GPS receiver on an LCD screen, and store selected GPS data onto a non-volatile compact flash RAM card.

Strategy

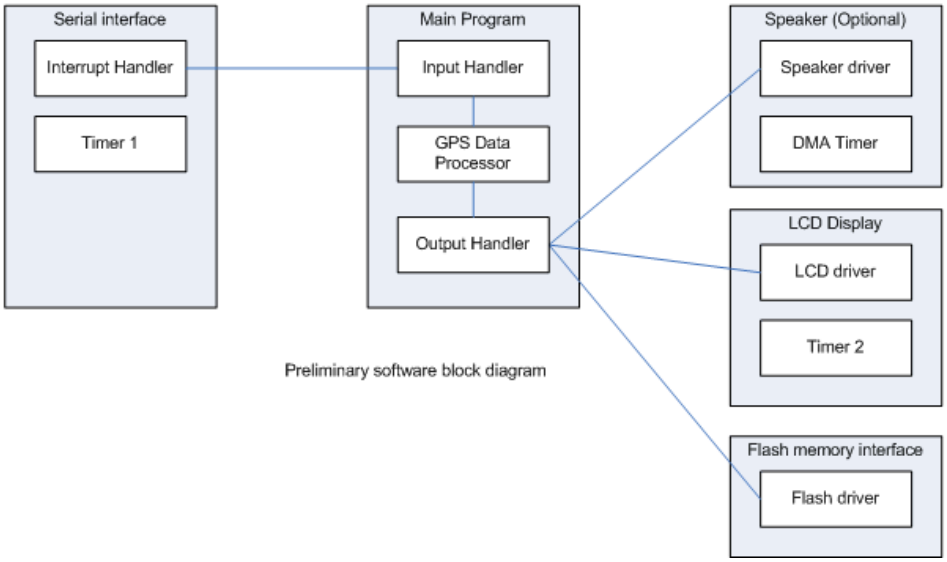
Description of the overall design: The purpose of this project is to build a prototype GPS collection and storage device. We will be using an OEM GPS receiver for accurate GPS position information on a particular object, which may or may not be moving during the time of the class demonstration. The GPS receiver will be connected to the Zilog hardware development kit through a serial interface. We will make use of one or more ASCII LCD display unit(s) to display critical GPS information in real time. The LCD display unit(s) will be interfaced to the Zilog hardware development Kit via a standard I^2C interface. GPS information that will be displayed may include the object's latitude, longitude and altitude, the date, time, number of satellites in view, and an indicator of whether the GPS receiver has determined an accurate location based upon the number of satellites in view and their relative positions to the object on the ground. Finally, we will use a flash card device to store cumulative GPS information onto a flash memory card. The card reader/writer will most likely be interfaced to the Zilog hardware development kit through the general purpose data pins. Time permitting, a speaker may also be used to indicate various types of status. One tone may indicate a lack of GPS data coming into the system. Another tone may indicate the transition from an unknown position to locked position (i.e. a position located within an acceptable error ellipse on the earth's surface).

What platform: based on the Zilog Z8 Encore! chip and development platform.
What capabilities: Serial interface, flash memory interface, GPIO, timers, interrupts, PWM for possible sound.
What external: GPS device, LCD screen, speaker, non-volatile flash memory card.
What sort of evaluations: We already have the GPS device and speaker. We could evaluate different types of non-volatile external memory.

What software modules: GPS data parser, flash memory manipulator, LCD manager, audio manager, main control loop. Design goal to make each module reusable in future projects, or in case the GPS device/non-volatile memory hardware changes.



Preliminary hardware block diagram



Preliminary software block diagram

Unknowns

We have not yet determined the model of external memory card reader board nor the optimal interface between the Zilog board and it. Hopefully we can receive suggestions on boards the professor has available.

Because of the large amount of GPS parameters that are available for display we have not yet determined how many ASCII LCD displays we will interface to the Zilog Hardware Development Kit. We also can't predict the RF environment on the day of the demonstration. In case the RF environment around Tomkins Hall on the day of the demonstration is not optimal we will build a GPS simulator that can transmit previously

recorded serial data directly into the Zilog Hardware Development Kit via a serial interface.

Implementation Plan

The GPS OEM receiver that will be used in this project is manufactured by Garmin and is a model GPS35PC. This particular model GPS receiver has two wire harnesses coming out of the GPS receiver enclosure. One wire harness is the power harness, which has a car lighter power adapter on the end of the cable. Based upon a review of the specifications it's clear that this OEM GPS receiver can either be powered through a car cigarette lighter port or they can be powered by a simple 9 V battery. We have done tests and proved that the GPS receiver is fully functional via both methods of supply power.

The second wire harness coming from the GPS receiver and closure is a DB-9 serial port plug. This serial port will be plugged into a standard serial data transceiver. The GPS receiver will transmit the GPS data through the initial wireless transceiver to a matching wireless transceiver located inside the classroom. The received GPS data will then be connected to a serial port on the Zilog board. The software that we write will receive the GPS data, display its critical components on the LCD, and store the GPS data on a flash memory card.

In addition, the software will use an ASCII LCD display to provider the user with several key GPS parameters from the near real-time data stream coming from the OEM GPS receiver. These critical GPS parameters may include but not be limited to, the latitude, longitude, and altitude of the GPS receiver. In addition, the project may include the displaying of the date, time, the number of satellites in view of the OEM receiver, and an indicator of whether the GPS OEM receiver has achieved an accurate position based upon the number of satellites it in view. The GPS parameters may be displayed either on a single ASCII LCD display or multiple types of display units. The interface to it will be an I^2C communications interface.

We plan on testing the wireless transceivers by bringing our board and GPS unit to class one night. The Zilog board will be placed near the front of the class where the demonstration will be given and the GPS with transceiver will be placed in a personal vehicle. The GPS will be driven around the block in expanding circles until we can establish a reliable transmission distance and map out any dead spots for both the GPS and the transceiver pair. Testing the flash memory card will be with a laptop and attached flash card reader. We will use either the Windows File Explorer or a disk editor such as WinHex to verify our data was written correctly.

[Simple Milestone Chart]
Establish GPS data connection with initial transceiver
Establish wireless interface and data formatting
Connect the two transceivers wirelessly
Test wireless transmission distance, speed, and error correction software

Process GPS data on Zilog board
Create LCD interface library
Create flash memory card interface
Test project so far
Experiment with additional audio cues (if we still have remaining time, timers, IRQs and GPIO pins)

Resources

- Original Z8Encore! Hardware Development Kit (2x)
- ASCII LCD Displays with I^2C interface (borrowed from university)
- Speaker (..not sure if we will use this, recycled from Lab 2)
- Flash card reader/writer board (borrowed from university)
- Flash Memory Card (borrowed from university)
- OEM GPS Receiver (Garmin GPS35PC, already obtained)
- Two Serial Data Transceivers (already obtained):
    - MAXSTREAM 900 MHz
    - 9600 Baud
    - Model: X09-009WNC

Summary

It is clear from an examination of the entire system of components being proposed that error detection and correction will be a big part of the software. The GPS data stream as well as other connections onto the prototype board will be vulnerable to various types of electronic interference, including basic RF interference between the two transceivers. The project as proposed is forecasted to be a considerable software and hardware development effort and require two engineers.

Regarding the division of labor, many of the functions will be developed separately and ultimately integrated together. For example, Aaron will work on the transceiver/serial interface and Jerry will work on the I^2C display side. We'll meet in the middle and tackle the remaining flash memory and optional speaker interface together.