ECE4007 Project Summary

Project Title	WaitLess Bus Tracking System
Team Members (names and majors)	Matthew Brooks (Computer Engineering) Chris Chidi (Electrical Engineering) Josh Mauldin (Electrical Engineering) Daniel Nadeau (Electrical Engineering)
Advisor / Section	Dr. Keezer / L04
Semester	2009 Spring
Project Abstract (250-300 words)	The WaitLess bus tracking device is a standalone system designed to display the real-time location(s) of the buses on Georgia Tech's campus. The system will consist of a solar panel and backup battery, wireless module, microprocessor, and a LED embedded map of the Georgia Tech bus transportation routes. Assembly of these components will enable the tracking device to connect to the internet to obtain GPS data of the bus locations, which it will depict by activating LEDs in the approximate geographic positions of the buses on the route map. In addition, the device will be portable and sustainable; it will not require an external power source, which will eliminate long-term energy costs. NextBus, the company that tracks Georgia Tech buses, uses the GPS location of the campus buses to provide a website that shows what buses are where. Currently, the only solution to give information to potential bus riders cost $3600, and is just a scrolling LED panel installed at the bus stop; currently only three of the bus stops on campus have this LED panel. The display panel provides a rough text-based time estimate of the next arrival of a bus at the particular stop. The WaitLess bus tracking device will instead use LEDs to show the location of buses on a map; then, a better decision can be made whether to wait for the bus or just walk. The WaitLess bus tracking device will serve as a viable alternative notification system that will be more effective than the LED scrolling panel but for a quarter of the cost. A system prototype can be designed and assembled for approximately $6,724.10, when accounting for labor and component costs. The parts cost would be less than $400. If, subsequently, 40 of these systems were produced to be installed at each of the bus stops on the Georgia Tech campus; each device could be individually sold for $933 dollars, resulting in a 33% profit margin.

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List **codes** and **standards** that significantly affect your project. Briefly describe how they influenced your design.	Serial – RS-232: The link between the Wi-Fi module and Arduino microcontroller is a UART serial link. 802.11b/g: The Wi-Fi module connects to the internet under the specifications of this standard. This is the standard needed for GTwireless. I^2C: The Arduino microcontroller interacts with the LED drivers by means of this protocol.

List at least two significant **realistic design constraints** that applied to your project. Briefly describe how they affected your design.	• Can only poll the NextBus server every 10 seconds:
	  o LED indication on decal map will refresh only every 10 seconds.
	• Total device power consumption must be under 1.1A (optimal supply from solar panel) at 5V in order for the device to sustain power:
	  o Blink LEDs to conserver power, use low-power microcontroller versus single-board computer. Turns out we were able to make it only draw 160mA, well under our design constraint.
	• Could not purchase evaluation board for the Wi-Fi module due to budget limit:
	  o Had to solder wires to the pins of the Wi-Fi module.
	• Arduino microprocessor board available RAM was only 1 KB.
	  o Because the data structures we had to work with were so large, we needed more RAM. So we bought a new chip ATmega328 and used it in the Arduino. This chip had 2KB RAM, and this was sufficient.

Briefly explain two **significant trade-offs** considered in your design, including options considered and the solution chosen.	• To minimize the total power consumption of the device, the design implemented a microcontroller instead of a single-board computer. The single-board computer has more capabilities than a microcontroller and would make design implementation a lot easier. • Could have used an LCD display which would allow for more aesthetic display options; however, the LCD consumes a lot of power likely requiring hardwired power. Also requires a VGA connection which would demand the use of a single-board computer. These tradeoffs would defy the sustainable low power design goal of the project.
Briefly describe the **computing aspects** of your projects, specifically identifying **hardware-software** tradeoffs, interfaces, and/or interactions. *Complete if applicable; required if team includes CmpE majors.*	The computing aspects of the project include writing code in C for a microcontroller to communicate with a wireless internet adapter over a serial-UART interface. Also, code is to be written for the GPS data attained to be parsed and saved to appropriate variables. The final code that is to be written is to use the GPS data saved and through logic and the I^2C protocol, send commands from the microprocessor to the LED Drivers, which control each LED.