ECE4884 / 4007 Project Summary

Project Title	**Wireless Entertainment and Ordering Pager (WEOP) System**
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Advisor / Section	Whit Smith – Section L03
Semester	Fall 2007
Project Abstract (250-300 words)	The Wireless Entertainment and Ordering Pager (WEOP) is a device which will entertain customers during waiting periods, while also creating advertising revenue and increasing sales for business owners. This device combines current paging and service management functions with games and other customer entertainment options. The device uses a touch-screen LCD interface and simple menus to allow users to navigate intuitively through all of its functions. Although intended to be used in temporary service environments, the prototype was designed for the restaurant industry. The included application modules are typical of what the WEOP pager would normally have, but other various applications can be installed to better suit environment where it will be used. The prototype pager device can perform the basic functions needed by the production level device. It includes three working application modules: the jukebox, ordering menu, and flash game. The prototype device met our initial physical design goals; however, due to monetary and time constraints, the pager device uses a car LCD touch screen for simplicity. The prototype pager device cost approximately $550 in parts, but will also require back-end servers, charging stations, and a wireless network for a complete system. We also predict that a production level device would have a cost of $300, due to volume savings and component re-engineering. These complete systems will replace existing service management options, and create an all-encompassing system for our customers. The back-end server platform also allows for plug-ins supporting existing electronic systems used within restaurants and other environments, thus reducing the learning curve associated with new technology and allowing for interoperability between our platform and existing systems.

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List **codes** and **standards** that significantly affect your project. Briefly describe how they influenced your design.	Codes and standards that affect the project includes the following: (i) **C**E - The CE mark is required for product sale in the European Union and indicates conformity with health and safety requirements set out in European directives. (ii) GS - The GS mark is required for product sale in Germany. It requires that the electrical safety of a device be independently verified and minimizes the risks of claims or recalls. (iii) IEEE 802.11b/g - This is a standard for wireless local area connection communication. It will be used with the device and a router supporting the 802.11b/g standard will be required to form the wireless network. (iv) LCD Interface - Several interfaces exist to connect monitors to computers including the prominent LVDS, and VGA connectors. Additionally, touch screen sensors require a controller which typically interfaces with the computer through a Serial/COM or USB port. Even though different controllers are required for the different touch sensors, the computer connections are standardized. (v) .Net Framework - Programming inside Windows XP Embedded becomes an easy task when the .NET Compact architecture is employed. .NET ensures that all languages used within its framework are compatible with devices that can run the framework. .NET also makes programming Direct-X for graphical applications a simple task. Microsoft Visual Studio 2008 can also be used to simulate all .NET applications during software creation, rather than loading software onto the device for testing. (vi) Power - Powering the system will initially use Lithium-Ion batteries. These provide a 2200 mAH output, and will be recharged with a linear charger. (vii) SBC Form Factor - A Single Board Computer will be the backbone of the portable unit. The dimensions of a "pico-ITX" motherboard are 10 cm x 7.2 cm. Standard I/O ports on the embedded systems will include LVDS/DVI, VGA, USB, Serial RS-232, and SATA. These ports can provide Display, Battery Recharging Capability, Touch Screen Interface, and HDD storage respectively. (viii) Module Connections - SBCs usually contain PCI, mini-PCI, SD, or USB connections, or more than one of these. If the board does not contain an integrated IEEE 802.11b/g wireless controller, one of these interfaces will have to be utilized to provide wireless functionality via a daughterboard.
List at least two significant **realistic design constraints** that applied to your project. Briefly describe how they affected your design.	(i) Development Cost and Sale Price – Must be kept to a minimum in order to maximize profits. Board functions may be compromised in order to adhere to cost guideline. (ii) Needs to be waterproof and shock resistant due to the environment. (iii) Must make it as small and light as possible. Touch screen is used to minimize footprint and SBC is the Pico-ITX form factor.

Briefly explain two **significant trade-offs** considered in your design, including options considered and the solution chosen.	(i) Screen: Car LCD touchscreen vs touchscreen kit – The touchscreen kit offered a more compact solution, but the Car LCD touchscreen offers simplicity and cost advantages. Ultimately, the integrated (USB/VGA) LCD option was chosen. (ii) Windows vs Linux platform - Linux software is widely available and free of charge; however, many of our end users will not be familiar with Linux systems and their maintenance. Additionally, our developers have a great deal more experience programming in a Windows environment, making it a natural choice for our application.
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.*	There are various application modules that can be installed on the device quickly and the inclusion of any module depends on the environment in which the device is being used. Useful WEOP application modules include the following: • Paging (Implemented) - Advanced waiting and paging to provide a customer with additional knowledge of when, for example, a table at a restaurant will be ready. This could include the number of parties currently waiting who are in front of a customer in the queue and an estimated time remaining until a spot is available. • Ordering (Implemented) - A basic menu, perhaps a subset of the traditional menu, of items or services available at the current location will be available via the device. For example, if the device were used at a restaurant it could allow for the ordering of beverages, appetizers, beverage refills, or deserts. In a hotel situation it could be used for room service orders. • Gaming (Implemented) - A basic gaming module can be implemented in our overall platform for the entertainment of kids (or adults) during the waiting period and while in the restaurant. This would keep kids occupied who might otherwise become impatient or even distracting towards other customers. • Trivia (Supported) - A trivia module for the device we be available to allow all customers at a restaurant to compete in a trivia game with other guests. This alleviates the need for customers to manually deliver their question answers to the trivia host. The device could also display the question and time remaining until the next question so that there is no confusion. The top team scores and each customer's score would be displayed clearly. • Bill Payment (Requires additional hardware) - The current total cost of items and services ordered would be available and a tip can be selected when a customer is ready to check out. An optional card reader could be within the device to allow for direct payment and reduce the risk of skimming, which is the unauthorized gathering of credit card numbers using personal card scanning devices. This module will decrease check out time substantially. • Jukebox (Implemented) - A music selection interface will be available to queue a song from a list of available songs at the current location. This allows customers to change the background music played at most restaurants today without having to go to a jukebox machine, if one even exists. A sound card within the server would be used to output the music to the location's speakers if no existing system is present. • Advertising (Supported) - Advertising is a key ingredient for this platform. Services and items available at the current location would be displayed as a screensaver when the device is idle. A simple tap on one of the on-screen advertisements would place the item in the order queue. Alternatively, external advertising could be provided via the device for an additional source of revenue. These advertisements could replace the paper and

	plastic cards usually displayed in various hotels and restaurants. The device relies upon a software framework, wireless network, server, and in some cases, remote display terminals. The software framework was designed using the Microsoft .Net framework for Windows embedded computers. The wireless network is a basic array of IEEE 802.11b/g routers, which connects all of the entertainment device nodes, server, and remote terminals to the same network. The server is a basic Windows computer running a server version of our platform software. It displays critical information about the device network, such as pending orders, number of open tables, order information, etc. These blocks of important information are called module information panels, and are installed with their corresponding application modules. For example, the ordering application module provides the display of menu items on the device and handles the order queue of items. The module information panel is the employer interface to managing and processing orders and displays currently pending orders, tables where the orders were made, fulfilled orders, etc. The server also manages communications between devices and handles transactions, such as delivering orders to kitchen displays and processing payments. In general, the server has the following functions: • Module Information Display (Module Information Panels) (Implemented) - This always-on display shows critical WEOP information such as the number of devices distributed, the number of free slots (tables) available, currently pending orders and personnel requests, trivia results, the jukebox music queue list, and more, depending on the device functions. The display is divided up into panels, called module information panels, and will exist only if the corresponding module application for a panel is installed on the platform and the panel is enabled. • WEOP Terminal Administration (Supported) - Allows the administering of WEOP terminals and the panels each terminal will display. • WEOP Administration (Supported) - Allows the registration of new pagers. • Application Module Administration (Supported) - Allows for the adding and removing of pager applications and the changing of application module parameters. • General Administration (Supported) - This interface will allow general settings to be modified, such as the restaurant name, time synchronization settings, etc. Additionally, WEOP terminals, which would essentially be inexpensive computers with displays, can be used to disseminate critical information to other areas. For example, if this system were to be used in a restaurant, the remote terminals might be placed in the kitchen to provide order information. These terminals would display a full-screen individual module information panel with minor GUI modifications.