

## 1. Introduction:

### **Statement of Need:**

As information becomes more readily available, the need to access it quickly becomes a problem. This is becoming more and more apparent with the explosion of devices such as Internet-capable PDAs and smart phones which can aggregate large amounts of data with little user interaction. However, this concept has not yet made much of an impact on large-scale dissemination of information. Programmable billboards and non-interactive electronic kiosks currently exist, but these are expensive and usually not dynamic. A web-programmable LED marquee would be inexpensive, easy to operate and able to integrate new information as quickly as its information sources are updated, without requiring user interaction.

### **Problem Definition:**

#### Goal:

The goal of this project is to design a marquee that can, once configured, automatically update its display from any number of network sources, such as news feeds to show current events and calendar files to show dates and times of upcoming events. This information will be displayed on an High Brightness LED array.

#### Objective:

The objective of this project it to design a power optimized device that will pull http data from the Internet, at set intervals, and display it on a LED matrix.

#### Constraints:

The constraints for this project involve power optimization so the required amount of runtime is achieved.

#### Objectives:

- Device will be able to resume from unexpected power losses.
- Web interface can be secured through use of user name and password.
- Device must run from an embedded computing device.
- Network interface will consist of wired and wireless interfaces, which can be configured via the web interface.

*Constraints:*

- LED marquee must be able to operate without a full sized attached PC.
- Marquee must be able to provide the most recent data if no network connection is available, otherwise dump information will be displayed.
- May be configured to display last known information, or display a static set of information (possibly a warning message, to be decided by the user).
- Device must be able to detect movement.
- Marquee must update information when a networking connection is established.
- Marquee configuration must be user friendly, requiring no training.
- Marquee must be completely autonomous, after the initial setup, and able to control system properties, such as automatically selecting the correct power source and configuring network interface.

## 2. High Level Requirements:

- [R-100] LED output must be high enough to see outside and from a distance
- [R-101] Device must provide a constant stream of information on the display
- [R-102] Device must support wireless encryption
- [R-103] Device must be able to detect ambient lighting conditions and motion and adjust brightness/power settings accordingly
- [R-104] Device must support different power saving modes
- [R-105] Device must be able to detect and monitor battery charge level
- [R-106] Device must parse and write XML files correctly
- [R-107] Cache must be large enough to hold many feeds and stories
- [R-108] Device must support remote web administration
- [R-109] Web administration must be secured by an authentication technique
- [R-110] Web administration must display current configuration data
- [R-111] Web administration must guard against invalid inputs

- [R-112] Web administration interface must be fully featured and easy to use
- [R-113] Serial Communication to the display must be done at a high enough rate to sustain smooth movement
- [R-114] Web Camera must be high enough resolution to detect movement at a distance for power saving
- [R-115] Device must have non-volatile memory for saving device settings
- [R-116] Device must be able to display character data on the LED display
- [R-117] Device must be able to retrieve HTTP data from the Internet
- [R-118] Device must be able to utilize wired or wireless networking capability
- [R-119] Device must support 802.11g wireless connection
- [R-120] Device must be able to select the appropriate network interface
- [R-121] Device must provide a failsafe mode in case the network settings render the device unreachable
- [R-122] Device must be able to be powered and charged from a single power source
- [R-123] Device must charge batteries when extra power is available
- [R-124] Device must shutdown gracefully when available power is insufficient
- [R-125] Device must keep display off until battery contains enough charge to power the device for a guaranteed amount of runtime
- [R-126] Device must provide some functionality without a network connection, displays a static message
- [R-127] Device must support horizontal scrolling text

These high level requirements are requirements that we have decided to not implement into our project. The purpose for including them is to demonstrate the exact scope of our project.

- [R-500] Will not specify a minimum time to operate on solar/battery alone

- [R-501] Will not guarantee operating levels on solar/battery alone
- [R-502] Will not guarantee battery life properties
- [R-503] Will not be able to discriminate between animals, humans, or other moving objects
- [R-504] Will not guarantee motion detection will work in very low light levels
- [R-505] Will not guarantee device will operate in all temperature conditions
- [R-506] Will not guarantee and dynamic or static physical stress properties on the device
- [R-507] Will not guarantee any other wireless connection protocol
- [R-508] Will not guarantee graphics of any type
- [R-509] Will not guarantee support for other types of Internet data feeds
- [R-510] Will not encode or perform CRC on data when sent across UART links
- [R-511] Will not guarantee minimum network bandwidth so the device can operate properly

### 3. Design Requirements Specification:

#### *Computing:*

- Must have enough memory to display 500 information feeds from on board memory.
- Will support WEP encryption over wireless link.
- Will support remote administration

#### *Radiation:*

- LEDs must be able to output greater than 3000mcd per LED

#### *Power:*

- Must operate under 100 watts of power under all lighting conditions.
- Power sources will include batteries, which will provide at least 50 Watts of power.
- Device will be able to operate continually without solar energy for a maximum of 2 days, with a full battery.