

## **ECE 411 Industry Design Processes: Assignment #2**

Due on Thursday, October 24, 2019

Team: T09

W. Cheng, Blaine R. Jemmett, X. Jia, J. Liu

# **Project Design Specification (PDS)**

**for**

**GPS enabled clock**

**Version 1.0**

**October 24, 2019**

# Table of Contents

Introduction

Purpose of the Product Design Specification Document

Project Overview

System Architecture

Requirements

Functional Requirements

Performance Requirements

Economic and Marketing Requirements

Power Requirements

Health and Safety

Maintainability

Operational Environment

Usability

REFERENCES

## **Introduction:**

A GPS clock having high precision positioning timing prevents people from manually adjusting the local time when they go to different places. The GPS clock is not affected by various electromagnetic interferences, and the time is accurate and is not limited by geography. Although such products are already on the market, the expensive price cannot meet the requirements of ordinary families. The purpose of the project is to create this clock having more accurate time at a lower price so that a lot of people can buy it.

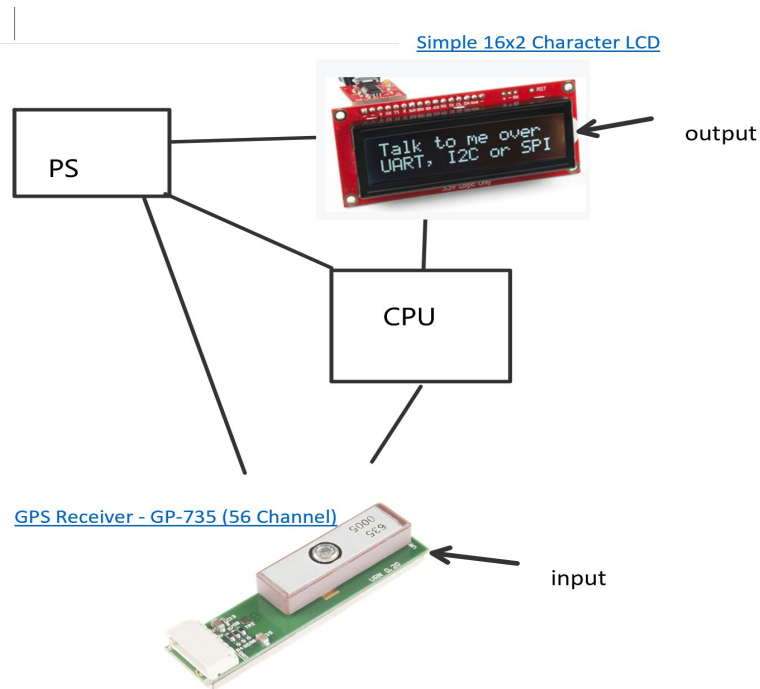
## **Purpose of the Product Design Specification Document:**

The purpose of the product design specification is to confirm that the subsequent design and development of the product can meet the needs of the users. The project must meet all the requirements that “Must” be completed in the specification document. “Should” and “May” are additionally but not necessary, they will show below.

## **Project Overview**

This project solves the problem of excessive cost of traditional GPS clocks. The GPS clock has a GPS receiver - GP-735 (56 channels) that receives GPS satellite signals. The receiver is very small and convenient, and it can turn on/off the power through the GPIO control pin. This can achieve the purpose of saving power loss when the GPS function is not used. Therefore, the project achieves small size, low cost, energy saving, etc.

## System Architecture



## User Characteristic

The following sections list the main user types to better describe the expected target market.

- Students

Students often get late for school because the alarm clock is not on time. With this cheap GPS clock, students can know the time accurately and no longer worry about being late for school. Students who regularly manage their own learning can use the clock to accurately manage their learning time.

- People waiting at the station

People who like to fly or bus are always very time-conscious, and they are always worried about missing flights or trains. The GPS clock accurately provided them with time and guaranteed their time.

### **Assumptions**

- Users are familiar with the ECE 411 practicum design guidelines.
- The system works in different regions.
- The system is at the temperature at which it can work.

### **Constraints**

- Must be completed within a limited time (8 to 10 weeks).
- Use a two or more layer PCB.
- Have one or more sensors (inputs).
- Have one or more actuators (outputs).
- Have one or more processing modules which control actuators based on sensors.
- Use 25% or more surface mount components that can be hand or reflow soldered.

## Requirements:

### 1. Functional Requirements:

Req#	Requirement	Priority	Station
1.1	Have one or more inputs or sensors	Must	GPS module
1.2	Ability to connect to PC via USB	Must	GPS module
1.3	Transmitting satellite data	Must	GPS module
1.4	Communicate with alphanumeric displays by a simple SPI interface	Must	LCD/GPS module
1.5	Heat resistant and cold resistant	Should	LCD/GPS module
1.6	Require significantly more amplification and filtering	Must	GPS module
1.7	Reduce the size for carrying	Should	LCD/GPS module

**Table 1: Functional Requirements**

### 2. Performance Requirements:

Req#	Requirement	Priority	Station
2.1	GPS module update frequency range is 5Hz -10Hz	Must	GPS module
2.2	These tiny GPS units can use a lot of power around 30mA at 3.3V On average	Must	GPS module

**Table 2: Performance Requirements**

### 3. Economic and Marketing Requirements:

Req#	Requirement	Priority	Station
3.1	Should not use non-standard components	Should	GPS module
3.2	Buying 20 or more will cost \$5/each	Must	LCD/GPS module

**Table 3: Economic and Marketing Requirements**

### 4. Power Requirements:

Req#	Requirement	Priority	Station
4.1	A 5V Wall Adapter Power Supply provides all the power for the displays and to power the Arduino	Must	LCD/GPS module
4.2	Peak current shall not exceed 2000mA	Must	LCD/GPS module
4.3	The GPS module can be controlled directly through the GPIO pin when it is not in use	Must	GPS module

**Table 4: Power Requirements**

### 5. Health and Safety:

Req#	Requirement	Priority	Station
5.1	The system shall not expose humans to unhealthy levels of electromagnetic radiation as deemed by FCC guidelines	Must	LCD/GPS module

**Table 5: Health and Safety**



## 6. Maintainability:

Req#	Requirement	Priority
6.1	Record the progress of the project every week	Must
6.2	Progress reports may be submitted by email	May
6.3	Record experimental data and results via Github	May

**Table 6: Maintainability**

## 7. Operational Environment:

Req#	Requirement	Priority	Station
7.1	Can work in high temperature and cold environment	Should	LCD/GPS module

**Table 7: Operational Environment**

## 8. Usability:

Req#	Requirement	Priority	Station
8.1	Users should be able to use the system without training	Must	LCD/GPS module

**Table 8: Usability**

## 9. Manufacturability:

Req#	Requirement	Priority	Station
9.1	Must be possible to assemble by hand	Must	LCD/GPS module
9.2	Use 25% or more surface mount components that can be hand or reflow soldered	Must	LCD/GPS module

**Table 9: Manufacturability**

## REFERENCES

[https://en.wikipedia.org/wiki/Product\\_design\\_specification](https://en.wikipedia.org/wiki/Product_design_specification)

<https://learn.sparkfun.com/tutorials/gps-basics>

[https://en.wikipedia.org/wiki/Global\\_Positioning\\_System](https://en.wikipedia.org/wiki/Global_Positioning_System)

