ECE 411 Industry Design Processes: Assignment #2

Due on Thursday, October 24, 2019

Team: T09

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Project Design Specification (PDS)

for

GPS enabled clock

Version 1.0

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Introduction:

A GPS clock having high precision positioning timing prevents people from having to manually adjust to 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 budgetary requirements of ordinary families. The purpose of the project is to create this clock having more accurate time at a lower price so that more people can afford it.

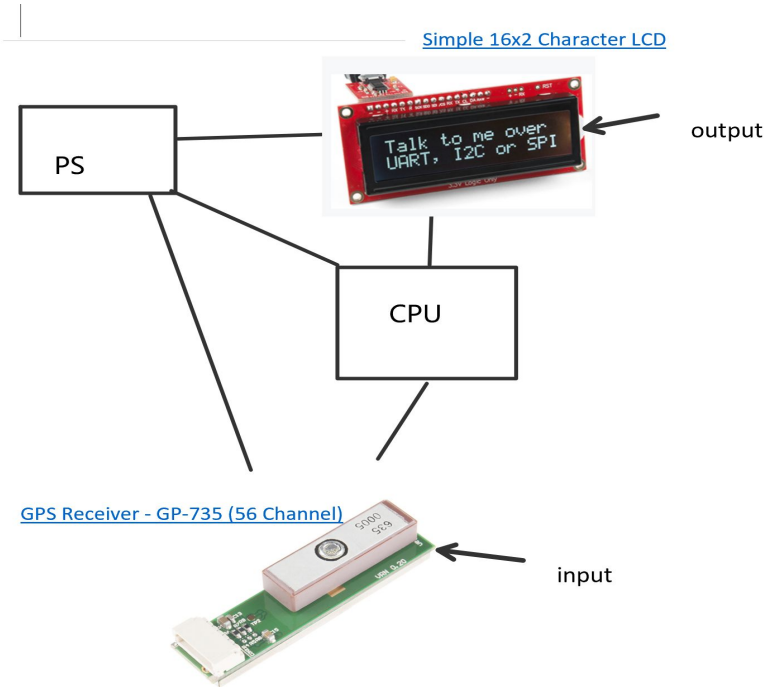
Purpose of the Product Design Specification Document:

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 additional but not necessary.

Project Overview

This project solves the problem of the prohibitive 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 a 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

The people who live and study in different places or different time zone is more likely to buy this product. They can know the time even they go back home or go to school without setting a clock. It is very convenient for these people to know the time.

- Commuters and Travelers

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 provides them with the correct time for appropriate arrival times.

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	receive GPS signal	Must	GPS module
1.3	Communicate with an alphanumeric display by a simple SPI interface	Must	LCD/GPS module
1.4	Hot and cold resistant	Should	LCD/GPS module
1.5	Detect ambient light levels and adjust LCD accordingly	Should	LCD Module
1.6	Alarm setting	Should	CPU
1.7	Automatically adjust for DST	Should	CPU

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 25 or more will save $3.76/each	Should	LCD/GPS module
3.3	The whole product can be sold as $60	Should	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 to be powered down when not in use	Must	GPS module

Table 4: Power Requirements

5. **Health and Safety:**

Req#	Requirement	Priority	Station
5.1	Make sure the product will not injure people.	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 hot and cold environments	Should	LCD/GPS module

Table 7: Operational Environment

8. **Usability:**

Req#	Requirement	Priority	Station
8.1	Users are 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://learn.sparkfun.com/tutorials/gps-basics

https://en.wikipedia.org/wiki/Global_Positioning_System