BlueSky
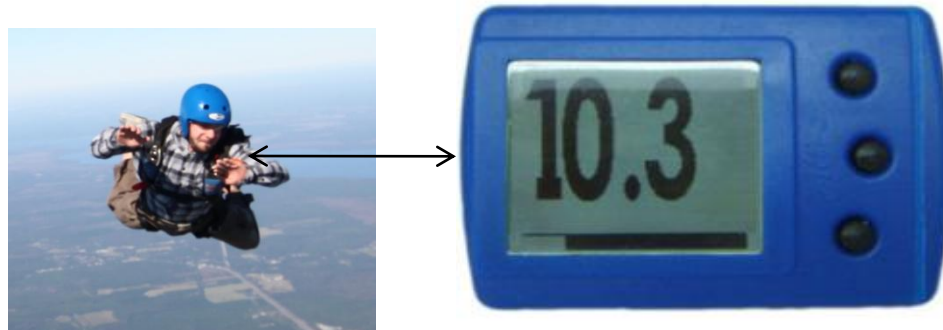
Digital Skydiving altimeter and freefall computer


William McKaba

Project Overview

BlueSky will provide a sound alert, via a small speaker, to a skydiver for when to pull the parachute as well as a display of current altitude and freefall data recorded from a skydive onto an LCD. The data can be analyzed by the skydiver to help improve skydiving performance.

Circuit Constituents

- **MPL115A1 (Miniature SPI Digital Barometer)**
- **Venus638FLPx-L (14 Channel 20Hz GPS Receiver)**
- **ADXL335 (Triple Axis Accelerometer)**
- **Small LCD, Piezo speaker, and PIC microcontroller**
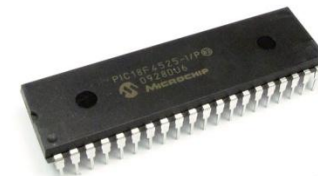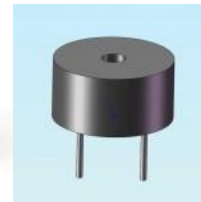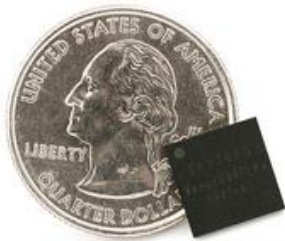
Block Diagram
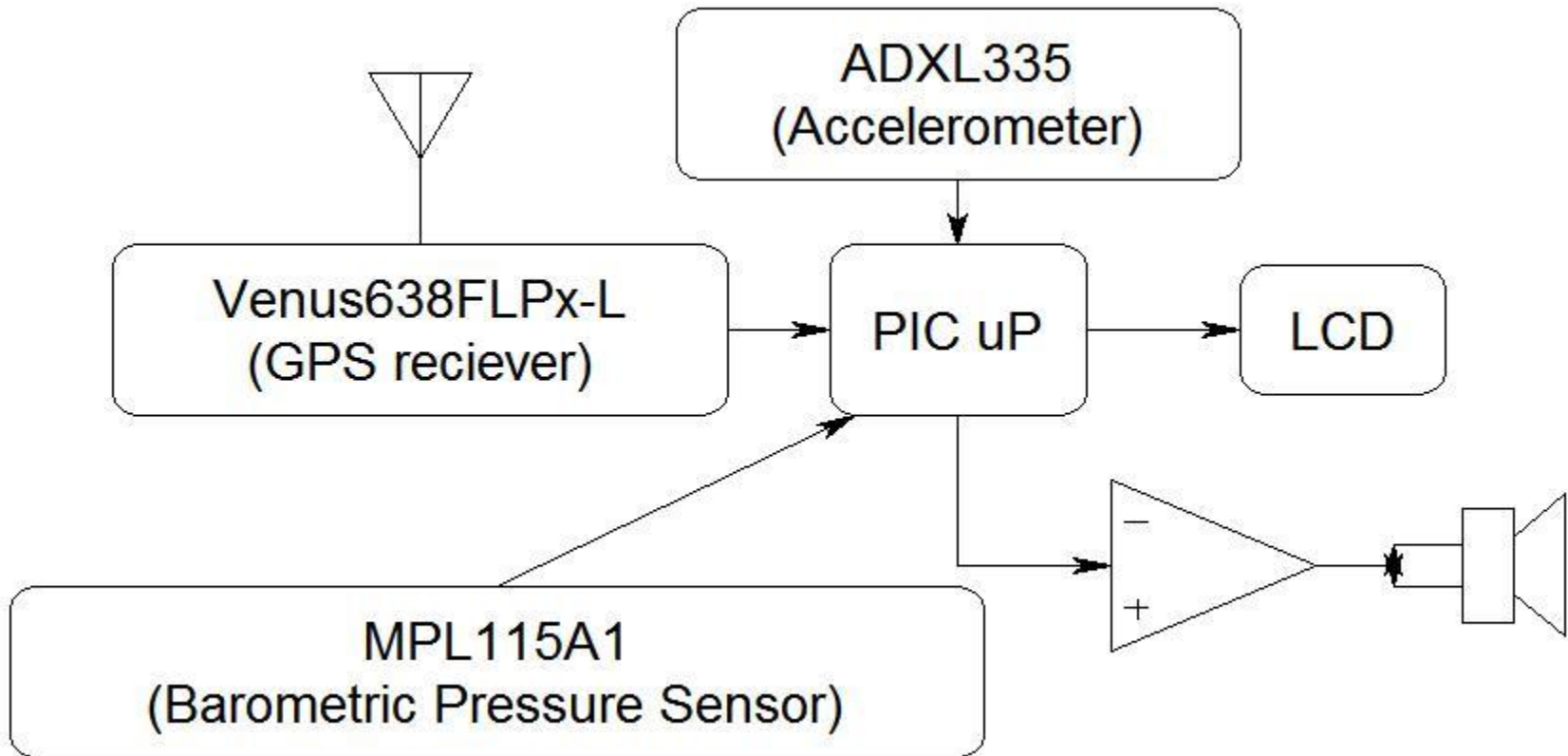
Objectives

- Determine exit altitude:
  - Barometric pressure readings will change dramatically from increasing to decreasing when exiting the plane.
 - Compare samples of readings to determine exit.

Objectives

- Continuously display altitude on LCD:
  - It takes about 5seconds to fall 1000ft, that's about 1 second to fall 200ft. Thus, the altitude should update by 100 ft @ 2Hz to have 100ft accuracy.
  - Constantly sample barometric pressure readings at 5Hz.

$$\text{altitude} = 44330 * \left[1 - \left(\frac{p}{p_0} \right)^{\frac{1}{5.255}} \right]$$

Thus, a pressure change of Δp = 1hPa corresponds to 8.43m at sea level
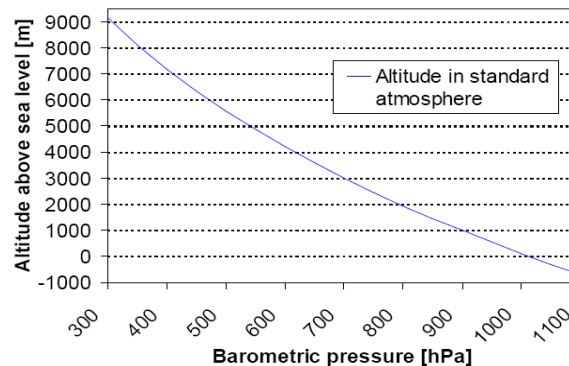
Objectives

- Determine maximum and minimum fall rates:
  - Sample barometric pressure differences over time.
  - Compare differences stored in memory to determine maximum and minimum rates.

Objectives

- Determine maximum glide ratio:
  - Calculate horizontal distance traveled divided by vertical distance fallen every 3 seconds, roughly every 500ft, and compare values in memory to determine the maximum.

Objectives

- Sound an alarm to pull the parachute:
  - The altitude for when to pull the parachute will be selected and stored in memory before the skydive.
  - Compare barometric pressure readings with predetermined value until an equal match occurs then send a square wave to a speaker.
  - Small speaker should fit inside a helmet.
  - Accelerometer should determine when the parachute was pulled to determine total time in freefall.

Problems

- Size:
  - Must be small enough to fit on a person's wrist and not interfere with the skydive.

- Power Consumption:
  - Must be battery powered and be able to last for multiple skydives.

- Cost:
  - Must be cost effective relative to products already on the market.