# Design Review

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# Overview

Building a "smart" ski helmet that will let you communicate (hands-free) with your friends while skiing.

# Features

- GPS tracking of the helmet
- Pre-loaded ski slope GPS maps to identify which slope a user's helmet is on
- Radio transmission and receiving for connecting multiple helmets together (up to four helmets in a "family" of helmets)
- Find out where your friends are ("*Friend number one is on slope x*")
- CO sensor
- Bluetooth audio playback*
- Walkie-talkie communication*

* indicates extra 20% which will be difficult to implement but included in product
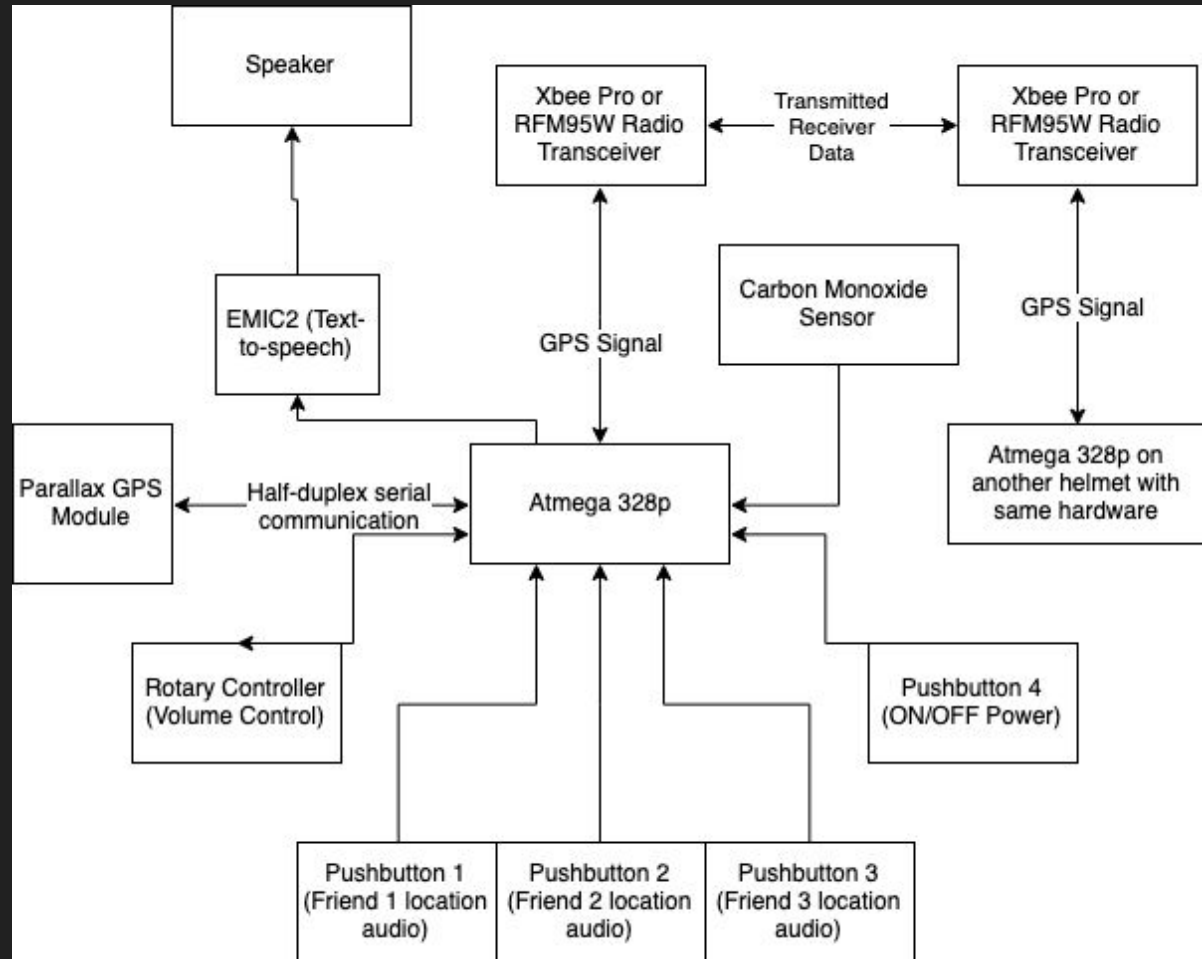
# Inputs

1. Buttons for friend alerts (helmets in the same family)
2. GPS data
3. Radio receiver
4. CO sensor
5. Volume control
6. Microphone for speech transmit/receive
7. Button for slope alerts (general news and information)

* indicates input necessary for extra 20% feature
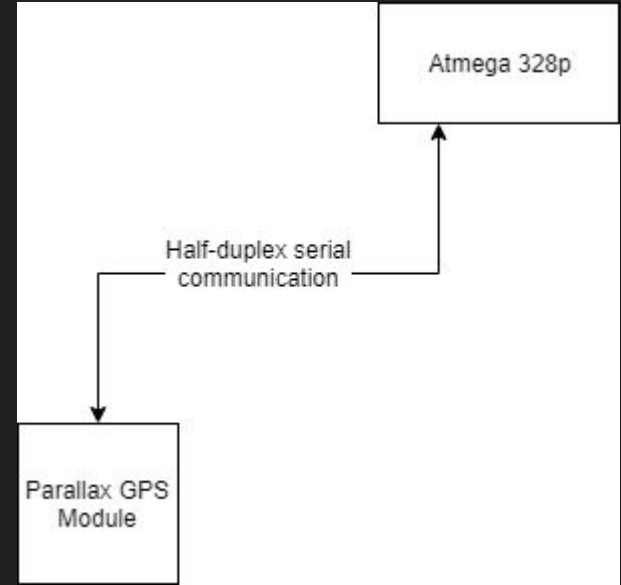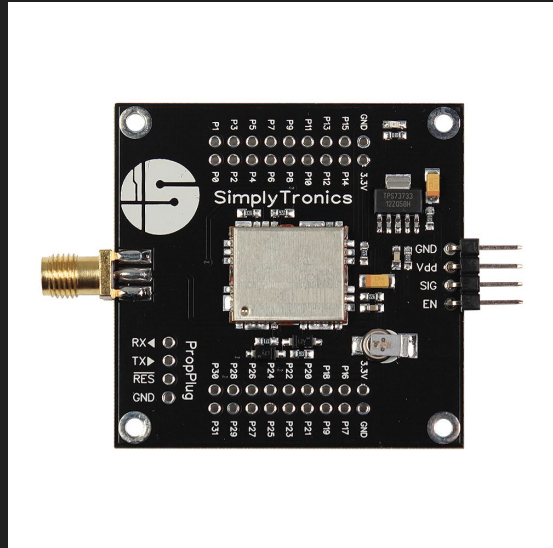
# Outputs

1. Speaker
2. Radio transmission

# Overall Block Diagram Design

# GPS Block Diagram

- We will use a Parallax GPS Module
- Half-duplex serial communication

# GPS Software

- Microcontroller will issue commands for data it needs (latitude, longitude)
- GPS module will send back specific data
- General Approach:
  - Disable interrupts
  - Send command from a pin (for instance, pin 12 on Atmega328p)
  - Block and wait for response
  - Enable interrupts
- Only ask for coordinates every few seconds

# Carbon Monoxide Sensor Block Diagram

- Connect to power and ground
- Connect to an ADC pin of Atmega328p
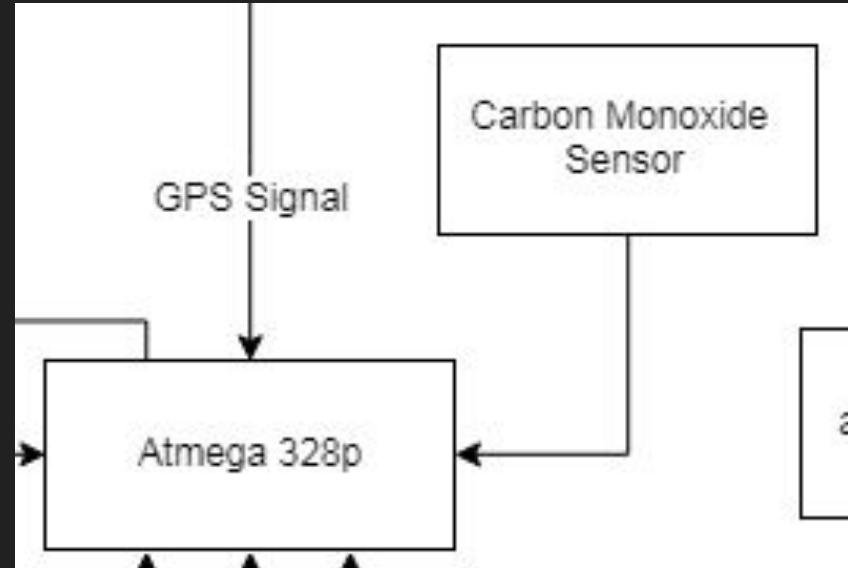
# Carbon Monoxide Sensor Software

- Microcontroller will perform analog to digital conversion of value from sensor every few seconds
- If value is above a threshold, we will issue a text-to-speech alert

# Radio Communication Block Diagram

- Radio communication has one job:
  - 1.) Send GPS information from helmet to helmet when requested to figure out other helmet's locations.
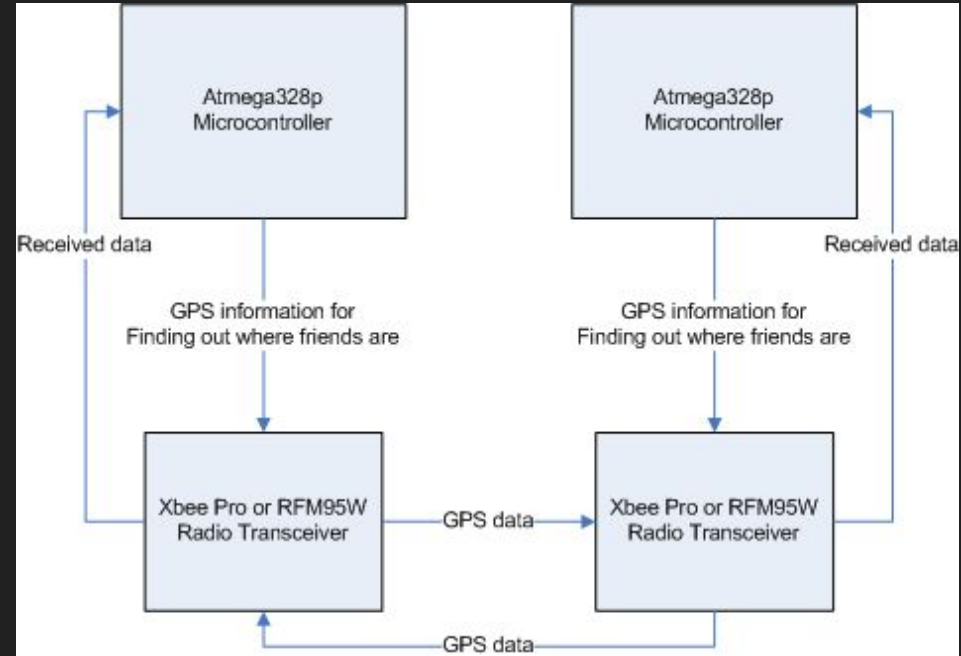
# Radio Communication Details and Software

- When the User presses the button to see where friends are, the microcontroller will initiate a request from other GPS units on other helmets.
- Synchronized Handshaking from other radio transceivers on helmets
- Interrupts enabled for when a new transmission comes in to the microcontroller to be processed
- Addressing of the packets within the network
- Time window for allowed communication and max number of attempts
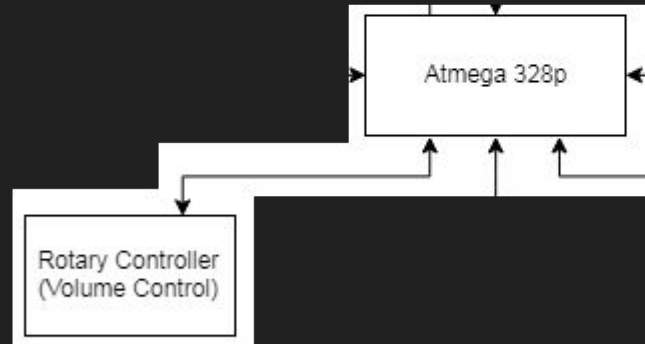
# Digikey 401 Push Buttons

- 3 buttons to dictate which slope your friends are on
- 1 On/Off Button
- SW
- Enable Interrupt
- 
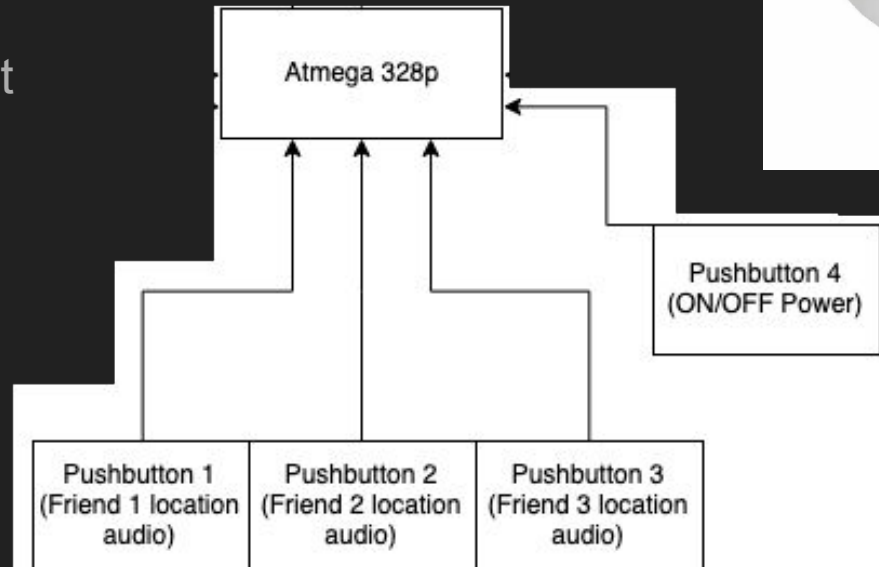
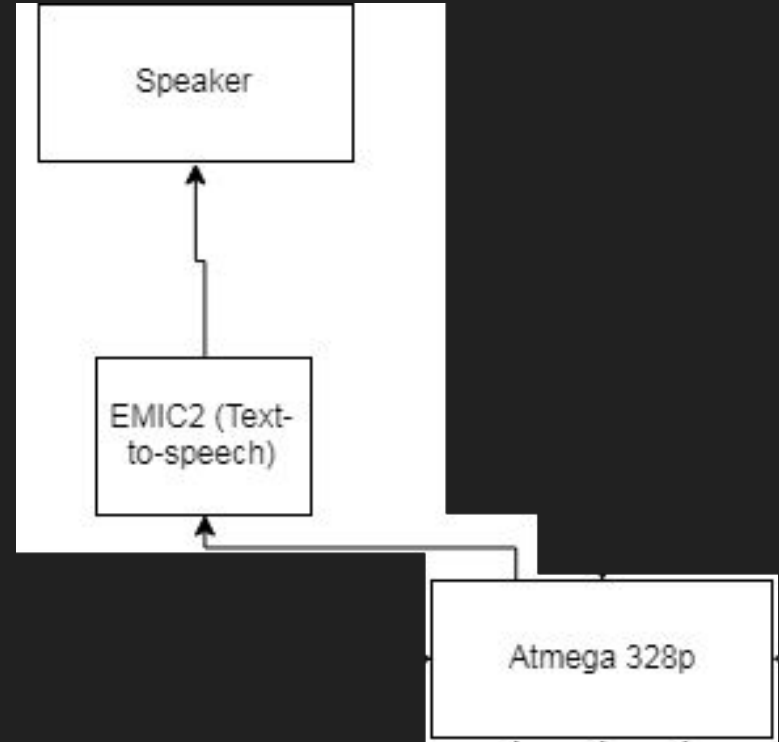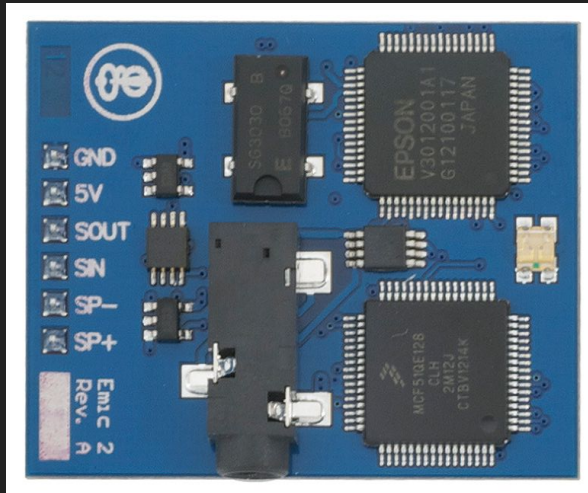# Rotary Encoder - Digikey 3315Y-001-006L
# Knob for Rotary Encoder - Jameco 290125

- Used to set volume of speaker
- Using interrupts





Atmega 328p

Rotary Controller
(Volume Control)

# Emic 2 Text-to-Speech Module

- Voice GPS location of other helmets
- Serial Interface
- Call a function to write to the serial interface when button is pressed

# Costs

| Part | Quantity | Unit Price | Total Cost |
|------|----------|------------|------------|
| Parallax GPS Module | 1 | 34.99 | 34.99 |
| Xbee Pro | 2 | 34.00 | 68.00 |
| Jameco Speaker | 1 | 2.49 | 2.49 |
| Rotary Encoder | 1 | 3.92 | 3.92 |
| Emic2 Text-to-Speech | 1 | 59.95 | 59.95 |
| CO Sensor | 1 | 5.95 | 5.95 |
| Microcontroller | 1 | 2.00 | 2.00 |
| TOTAL | | | 177.30 |

# Timeline

Deadline: 4/18/19

Total time frame: 3.5 weeks

Week 1: Order parts, consider design

Week 2: Parts arrive.  Split into separate components. Get everything to work individually (Xbee, GPS, Speech-to-text, CO Sensor)

Week 3: Buffer room to get everything working.

Week 4: Put it all together.

# Questions?