

Cave Climate Monitor

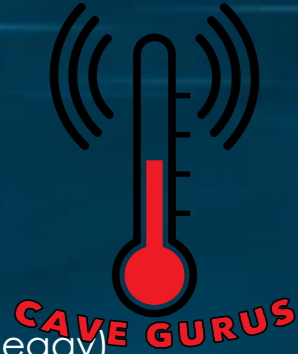
Presented by the Cave Gurus
(Yang Du, Cheng Wang, Jason Damp, Taylor Begay)

Who?

Cave Climate Monitor:

- Client: Tim Titus - USGS
- GTA Mentor: Dina Ghanai
- Group: Cave Gurus

(Yang Du, Cheng Wang, Jason Damp, Taylor Begay)



Why?

- Access to caves is often limited or difficult/dangerous
- Minimizing danger is #1
- Data Collection is often tedious and strung out
- Exert minimal effort to receive maximal results
- Prove that a concept can be brought to life

Our Solution... Overview

- Multi-node weather collection net for subterranean environments
- Relay data from node to node for collection at surface
- Collect temperature, pressure, and humidity
- Operate unmanaged for extended periods of time
- Achieve peak performance in sub-par environments

Our Solution... Subsystems

1. Durable, Weatherproof enclosure
2. Climate Collection
3. Data Storage
4. Time Keeping
5. Wireless transmitting/receiving
6. Microcontroller
7. Battery system

Subsystems... Enclosure

- Water tight
- Durable construction
- Dark color for camouflage
- Ability for weather module to record accurate data
(Access port or some small sectioned opening to allow for adjustment to ambient conditions)

Subsystems... Climate Collection

- BME/BMP280 I2C temperature, pressure, humidity module
- Records all necessary weather data
- Driven by I2C for ease of integration with other modules

Subsystems... Data Storage

- MicroSD SPI Module
- Ability to record and store data
- Hard copy of recorded weather data for retrieval by used
- Can insert varying size of SD cards for varied amounts of data storage

Subsystems... Time Keeping

- DS3231 Real-time clock module
- Allows for a time-stamp on recorded data
- Can control power mode of microcontroller for decreased power consumption

Subsystems... Wireless Communications

- HC-12 Wireless Communication Module
- Easy to use I2C bus for integration with other modules
- Send/pass data from node to node
- Receive data before preparing to send it outc

Subsystems... Microcontroller

- Arduino Nano
- More than enough useable pins for our application
- Low power consumption
- Easy to use IDE and programming interface
- Ability to implement both I2C and SPI communication protocols

Subsystems... Battery

- Back burned
- Need to prove all other subsystems work together
- Focus on optimizing modules for best efficiency as a complete system
- Then find a power system (battery) that matches the requirement of our optimized system

Combining Subsystems

1. Time module signals for BME/BMP280 to record weather
2. SD Card module stores time and collected weather data
3. Data is passed to HC-12 for wireless transmission to next node
4. HC-12 checks for incoming data from previous node
5. Cycle repeats until all nodes data is stored on root device at entrance to cave

Current Prototypes

1. Climate Collection from BME/BMP280
2. Timekeeping with DS3231
3. Basic data storage with SD card module
4. Sturdy, weather resistant enclosure

Recap

- Easily deployable, modular climate collection network
- Discreetly and accurately record data in non-ideal environments
- Record temperature, pressure and humidity
- Keep time of weather data recording
- Store all data to a local SD card in the event the wireless communication system fails
- Open source construction for ability to continue and advance concept