

Enviro Sensing HAT Concept Proposal

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Q1 Enviro sensing HAT Concept

This project's Hardware Attached on Top (HAT) board will consist of two main features, namely: a temperature and pressure sensor. These sensors will be utilized in a multitude of cases by simply connecting it to the STM32 PCB board and to a constant power supply, whether portable or fixed.

The multipurpose functionality of the HAT makes it a practical tool for end-users as it is cost-effective and convenient furthermore it notifies users about environment changes which can prevent mishaps. One use case of this sensor would be a maintaining the pressure and temperature of a wine cellar. It can be mounted to a wall near a socket with a constant power supply in the cellar and alert the user when either temperature or pressure is no longer compatible. Another case would be a tool for hikers to monitor pressure levels whilst hiking in higher altitudes. A sudden change detected in either sensor will alert users as they continue or function as an indicator to opt for a different route. Lastly, it would be in the mining industry; miners can use this device to detect when the conditions become inhospitable, and this can mitigate risk of casualties.

Q2 Requirements

Scenario 1: Individual User Application/Smart Home System

Sensors are needed to automate certain home appliances in a smart home. Temperature and barometer sensors are a valuable measurement device as most appliances involve temperature and pressure fluctuations such as extractor fans and cooling systems. Apart from appliances, clients may use sensors to observe readings for things like plant care, preservation of consumables and even heating.

- R1.1: In a smart home system, users require a pressure sensor to detect when there is excessive steam in the bathroom to alert the user that the extractor fan needs to be turned on.
- R1.2: For wine storage in homes and transportation to homes, the pressure needs to be maintained to prevent the bottles from exploding. Users will require the sensor to measure the pressure in the cellar and during transit and be alerted if the pressure is too high. Consumables like vegetables can also be preserved better when the user is able to observe how much heat the perishables are being subjected to.
- R1.3: During loadshedding, air conditions will stop functioning and spaces will heat up. A temperature sensor that alerts users that the temperature has surpassed a certain point is convenient.
- R1.4: During cooking, the kitchen heats up and there is a presence of steam. Users will require the sensor to detect when conditions exceed bearable amounts.
- R1.5: Users require a temperature sensor for even heating. Readings can be taken all over necessary space to see which areas need attention.

Scenario 2: Outdoor Use

Outdoor physical activities such as hiking, climbing, and camping are all impacted by temperature and pressure. Altitude and temperature determine the conditions for these activities. If users are able to constantly observe any fluctuations, then they may be equipped to deal with any difficulties.

- R2.1: Increase in altitude results in lower pressure levels and lower oxygen levels. Users such as hikers require the sensor to read and record pressure levels and alert the user when oxygen levels are getting dangerously low. This allows users to remain safe and choose a safe path.
- R2.2: Often camping trips last several days and requires campers to cook to drink water using a gas stove. The atmospheric pressure level determines the boiling point therefore users need the sensor to report the pressure level. This will give the user an idea of how long it would take to cook food or boil water for drinking.

- R2.3: Hikers in remote locations don't have signal coverage therefore the temperature sensor is the only way to observe temperature and precisely for that specific location. Users require this insight to avoid dangerously extreme temperatures.

Scenario 3: Medical Practitioners and Treatment

Medical practices require specific temperature control to preserve medicine, cells and prevent bacteria growth. Pharmaceutical production needs to be done in a controlled environment with specified temperature and pressure. Certain medical treatments are based purely of heat and pressure control therefore it is important to be able to monitor temperature closely.

- R3.1: Hyperbaric chamber treatment requires accurate pressure levels therefore users require the sensor to read and store and change in pressure. Thermotherapy requires temperature to be monitored.
- R3.2: Production of medicine and pharmaceuticals requires good ventilations and temperature control; the sensor allows medical professionals to accurately set conditions.
- R3.3: Operating theatres require low temperatures to prevent bacteria growth. A temperature sensor indicates to doctors when that level has been exceeded. Automatic room ventilation may be set to a specific value but factors like light and equipment heat dissipation varies the actual temperature therefore the sensor produces accurate readings.




Scenario 4: Mining Industry

Mines pose a threat to miners when excavating therefore companies need to ensure the safety of their employees. As miners excavate deeper into the ground, the pressure levels increase. Excavation also requires the use of explosives which impacts the temperature and pressure of the environment that miners are subjected to. It would be in the best interest of mining companies to implement sensors to safeguard themselves from lawsuits and protect their employees.

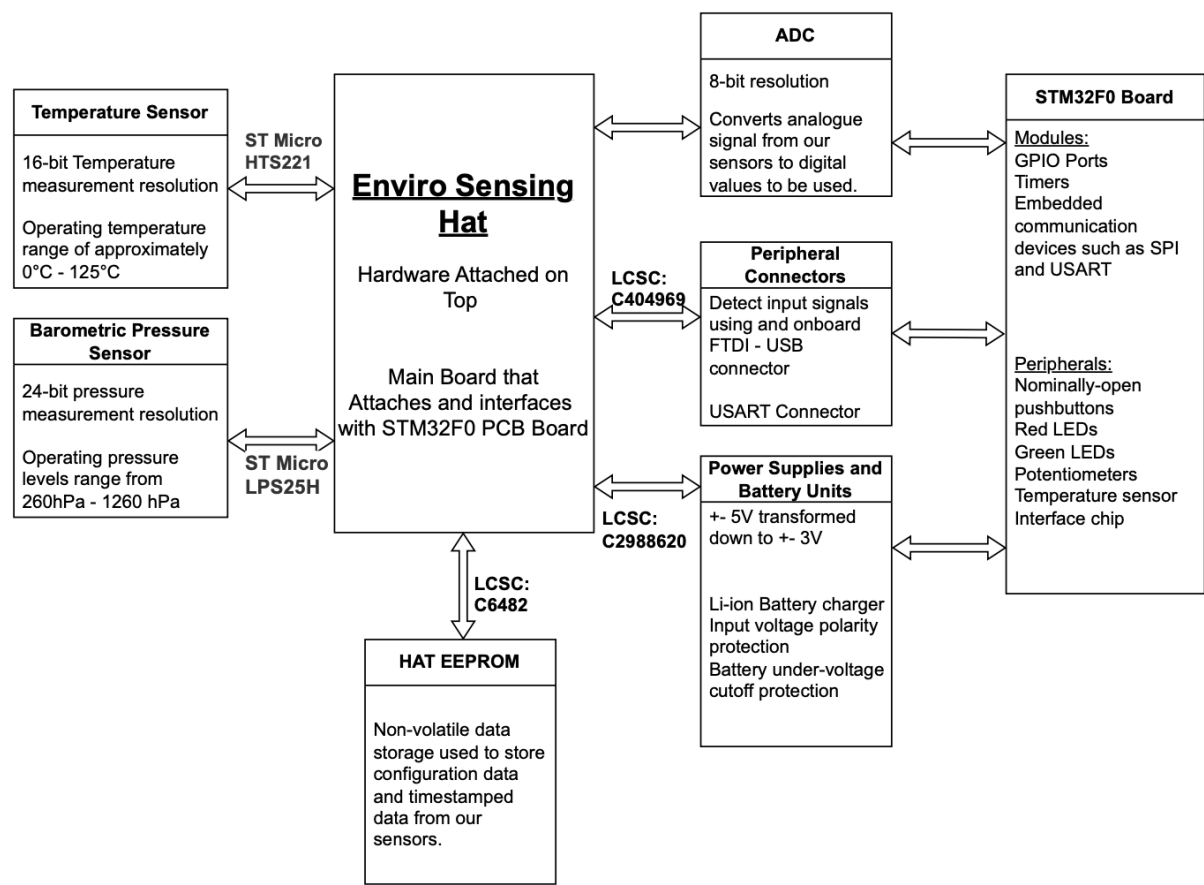
- R4.1: When tunneling deeper into the mines, the pressure increases which has short term dangers and long term impacts on the health of miners. The barometer will alert miners on dangerous pressure levels.
- R4.2: The temperature in mines determines working conditions. As miners get closer to the core of the Earth, the temperature will rise. Higher temperatures may cause expensive machinery to malfunction and be detrimental to miners short term health. A temperature sensor that continuously detects temperature changes is required for efficient operations within the mine.
- R4.3: When controlled explosions are used in mines, reactions are exothermic causing temperature and pressure to spike unpredictably. Temperature and pressure spikes may cause uncontrolled combustion in the mines. Mining companies require the sensor to monitor pressure and temperature levels and alert the user if dangerous levels are reached.

Q4 Link to Team Git Repository

<https://github.com/EEE3088>


| <input type="checkbox"/> Members | | 2FA ▾ | Role ▾ |
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Q3 Project Subsystems Block Diagram



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