

# ENS

The Electronic Nervous System (ENS) represents a fully integrated, modular platform designed to monitor, analyze, and respond to environmental conditions in real time. At its core, the ENS combines the HUD's real-time sensory feedback, the BlackBox's robust data logging, and the Control Center's intelligent signal management into a unified network that operates with precision and reliability. The HUD provides immediate, actionable insights—such as temperature, humidity, and gas detection—directly to the user, while the Control Center acts as the system's brain, coordinating inputs from the RTC and GPS to ensure accurate timing and geospatial context. Meanwhile, the BlackBox serves as the system's memory, preserving a detailed, time-stamped record of all sensor data for post-mission review or forensic analysis. Together, these modules create a closed-loop system where every component communicates seamlessly, enabling users to navigate hazardous environments with confidence. Whether for early hazard detection, environmental tracking, or post-incident analysis, the ENS transforms raw data into situational awareness, making it an indispensable tool for safety, accountability, and operational efficiency in demanding conditions.

# Part 1

module 1, the HUD

The HUD (Heads-Up Display) module serves as the user's real-time interface to the RainBox system, providing critical environmental data in a compact, accessible format. Powered by an ATmega328 microcontroller, the HUD integrates a DHT-11 sensor for accurate humidity and temperature readings, alongside a gas/smoke sensor to detect hazardous airborne substances. Information is presented on a 0.96-inch OLED display, mounted in the bottom-left corner of the gas mask for easy visibility without obstructing the user's field of view. The display is organized for clarity, showing temperature, humidity, time, and date in a vertical layout from top to bottom. In the event of gas or smoke detection, the HUD triggers an immediate visual alert—a flashing screen—and an audible warning via a piezo buzzer, signaling the user to halt and avoid the contaminated area. Beyond its role as a real-time monitoring tool, the HUD acts as a vital early warning system, ensuring user safety in potentially dangerous environments. All sensor data is simultaneously logged to the BlackBox module, enabling offline analysis and record-keeping for post-mission review. This combination of real-time feedback and data storage makes the HUD indispensable for both situational awareness and long-term environmental tracking.

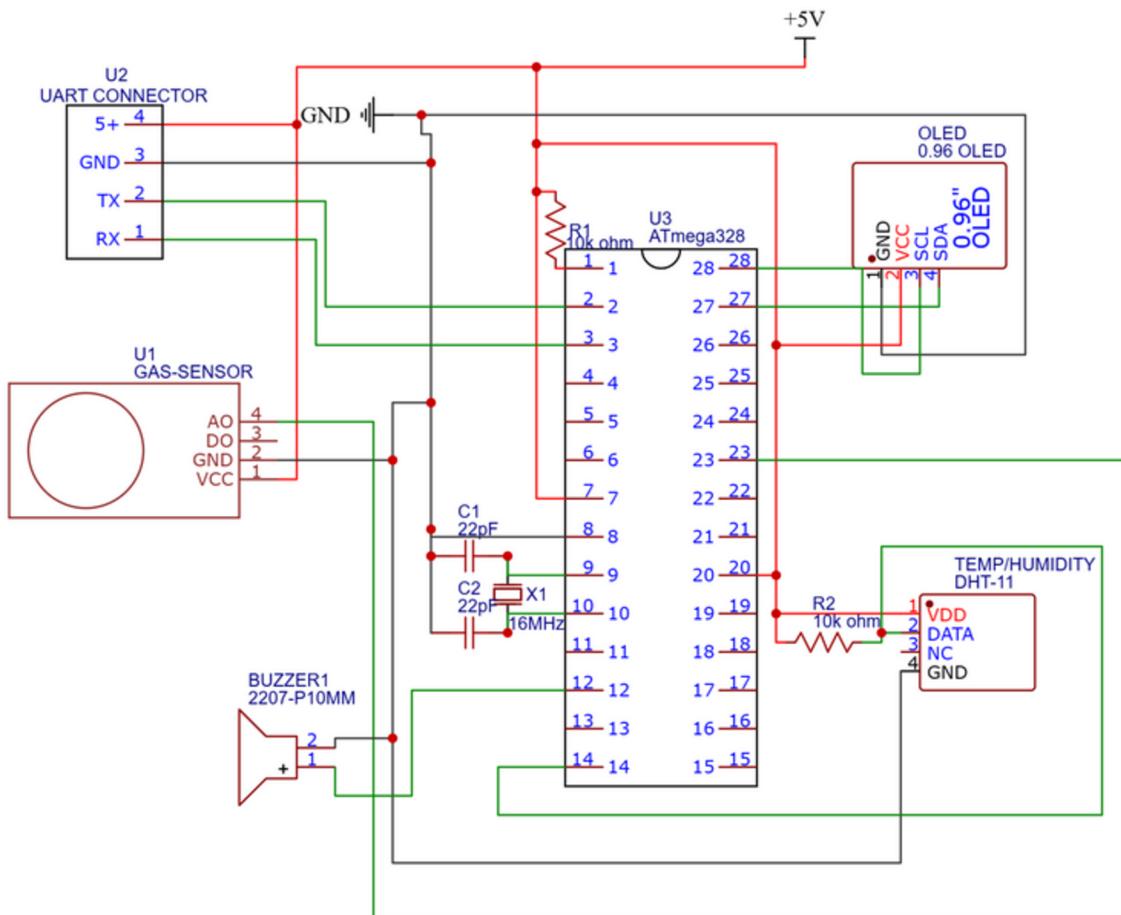
# ABOUT

A the HUD is the only way the user can see information gathered from the enviromental sensors the RainBox has to offer. The 0.96 inch OLED screen sits in the bottom left corner of the mask and displays all of the information it can. the HUD is what makes the rainbox able to do an "Early Warning" for dangerous gasses. the hud offers many sensors like the DHT-11 for humidity and temprature. all the information is stored in BlackBox for offline storage.

# BOM

1	22 picofarad capacitor
2	10k OHM RESISTOR
3	GAS SENSOR
4	0.96 OLED
5	DHT-11
6	16mhz crystal oscillator
7	ATmega328

B <https://github.com/PAN-DA-BOI/civil-disobedience.git>



TITLE: HUD	REV: 1.0
Company: Your Company	Sheet: 1/1
Date: 2025-09-01	Drawn By: pan-da-boi

# Part 2

## module 2, the BlackBox

The BlackBox module acts as the RainBox system's central data archive, systematically recording date, time, temperature, humidity, gas sensor readings, and GPS coordinates from the HUD and control center. This continuous logging creates a detailed, time-stamped record of environmental conditions and user activity, which can be invaluable for post-mission debriefing or analysis. For instance, in scenarios where users need to track exposure to environmental hazards over time—such as monitoring prolonged exposure to high humidity or fluctuating gas levels—the BlackBox provides a reliable dataset to identify patterns, assess risks, and refine safety protocols. Additionally, its role as a redundant data repository ensures that critical information remains accessible even if other system components are compromised. Whether for reviewing operational efficiency, investigating anomalies, or supporting compliance reporting, the BlackBox transforms raw sensor data into actionable insights, making it a cornerstone of the RainBox's functionality.

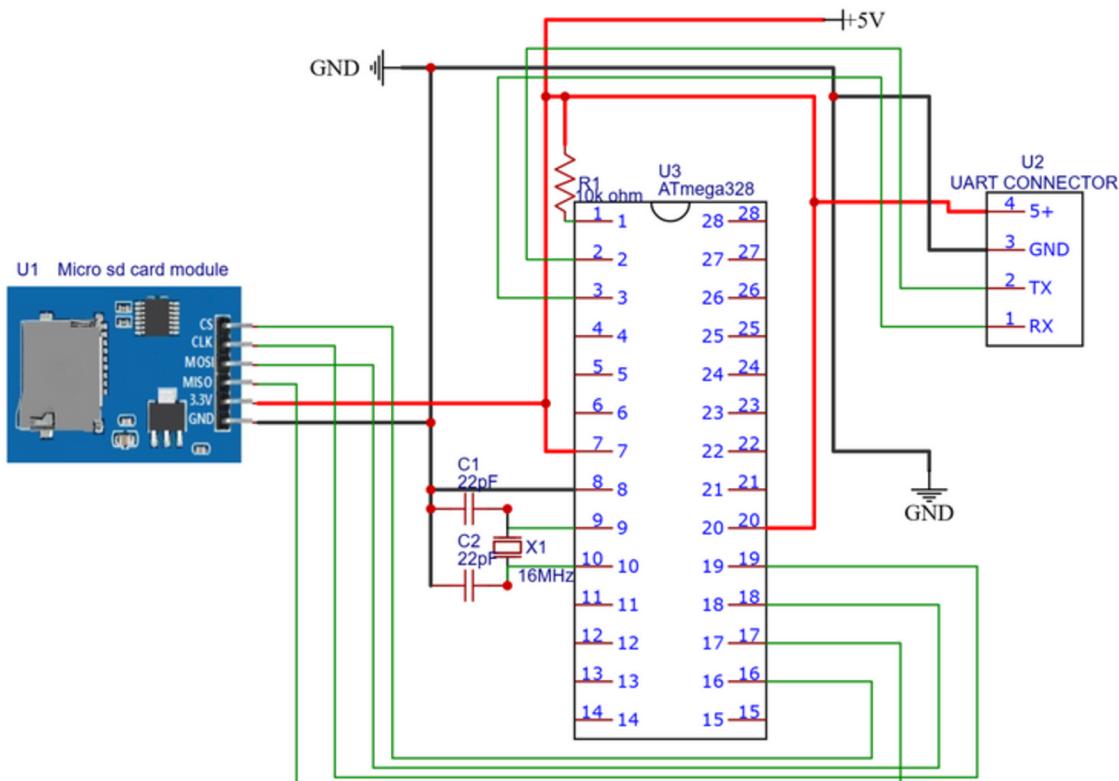
# ABOUT

The "Black Box" is used to keep all the sensor data formatted in a way that it can be looked for in the future. For example, the user can go back and see what happened and at what time. This makes it so the footage can be easily searched after the fact. In this example, the gas sensor goes off and the temperature rises. The user can then go into the footage to check when the gas sensor went off and the corresponding time of the event. The user can then open the footage to that time and see what happened. BlackBox is also a last chance to get data off of broken equipment.

<https://github.com/PAN-DA-BOI/civil-disobedience.git>

## BOM

1	22 picofarad capacitor
2	10k OHM RESISTOR
3	Micro sd card
4	ATmega328
5	16mhz crystal oscillator



TITLE:

Black Box

REV: 1.0

Company: Your Company

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Date: 2025-09-01 Drawn By: pan-da-boi

# Part 3

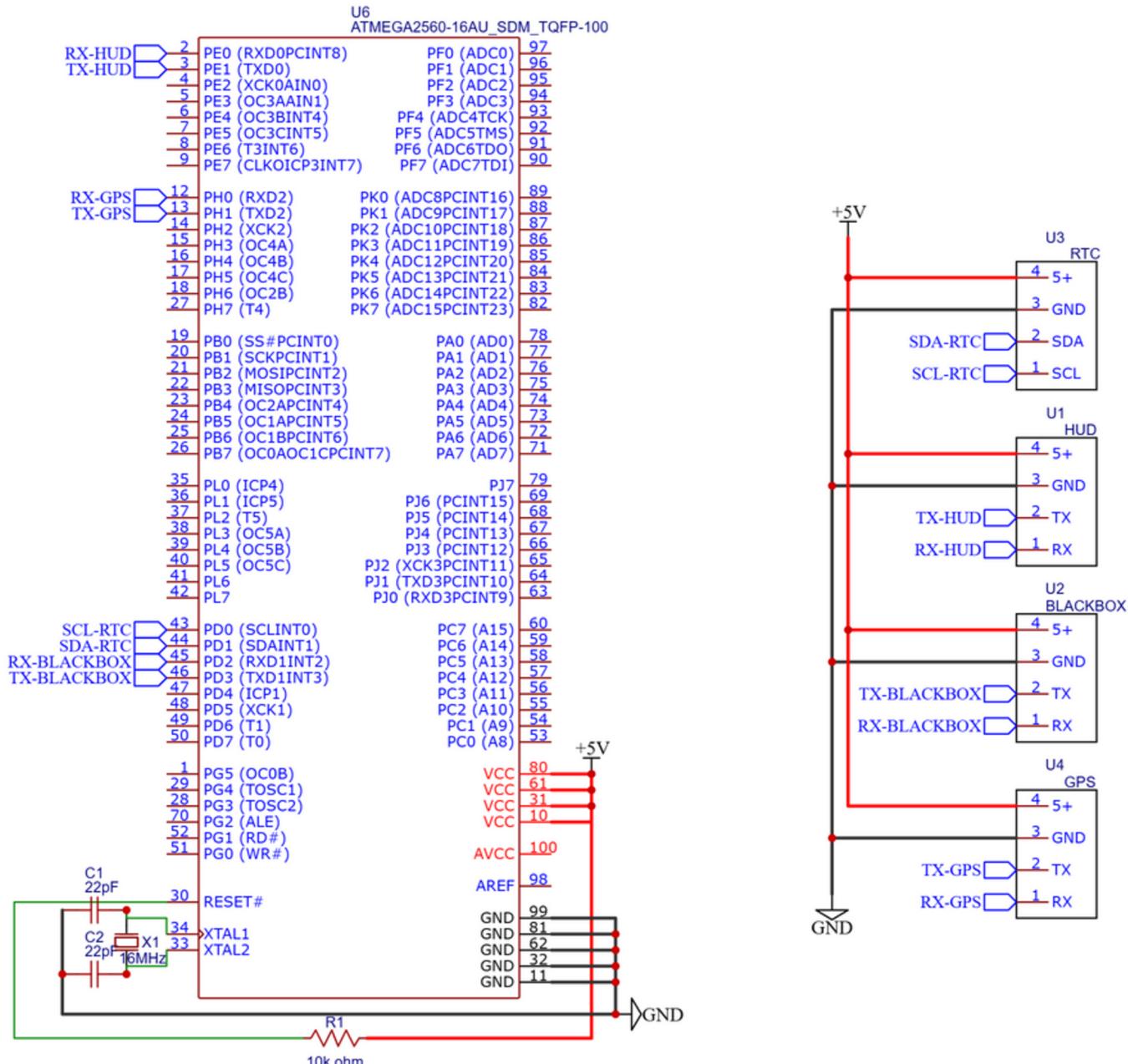
module 3, the control center

The Control Center module serves as the neural hub of the RainBox system, overseeing the communication between all components. Acting as the system's central processor, it receives, routes, and manages signals from the HUD, Real-Time Clock (RTC), and GPS module, integrating these inputs into a cohesive operational framework. By consolidating data streams—such as environmental readings, temporal stamps, and geospatial coordinates—the Control Center not only facilitates instant decision-making but also preprocesses information before forwarding it to the BlackBox for secure storage. Its role extends beyond mere signal distribution; it synchronizes the system's functions, enabling precise timing, accurate location tracking, and reliable data integrity. As the operational core of the RainBox, this module guarantees that every sensor, alert, and log entry is efficiently directed and recorded, making it indispensable for maintaining the system's responsiveness and overall effectiveness in dynamic environments.

# ABOUT

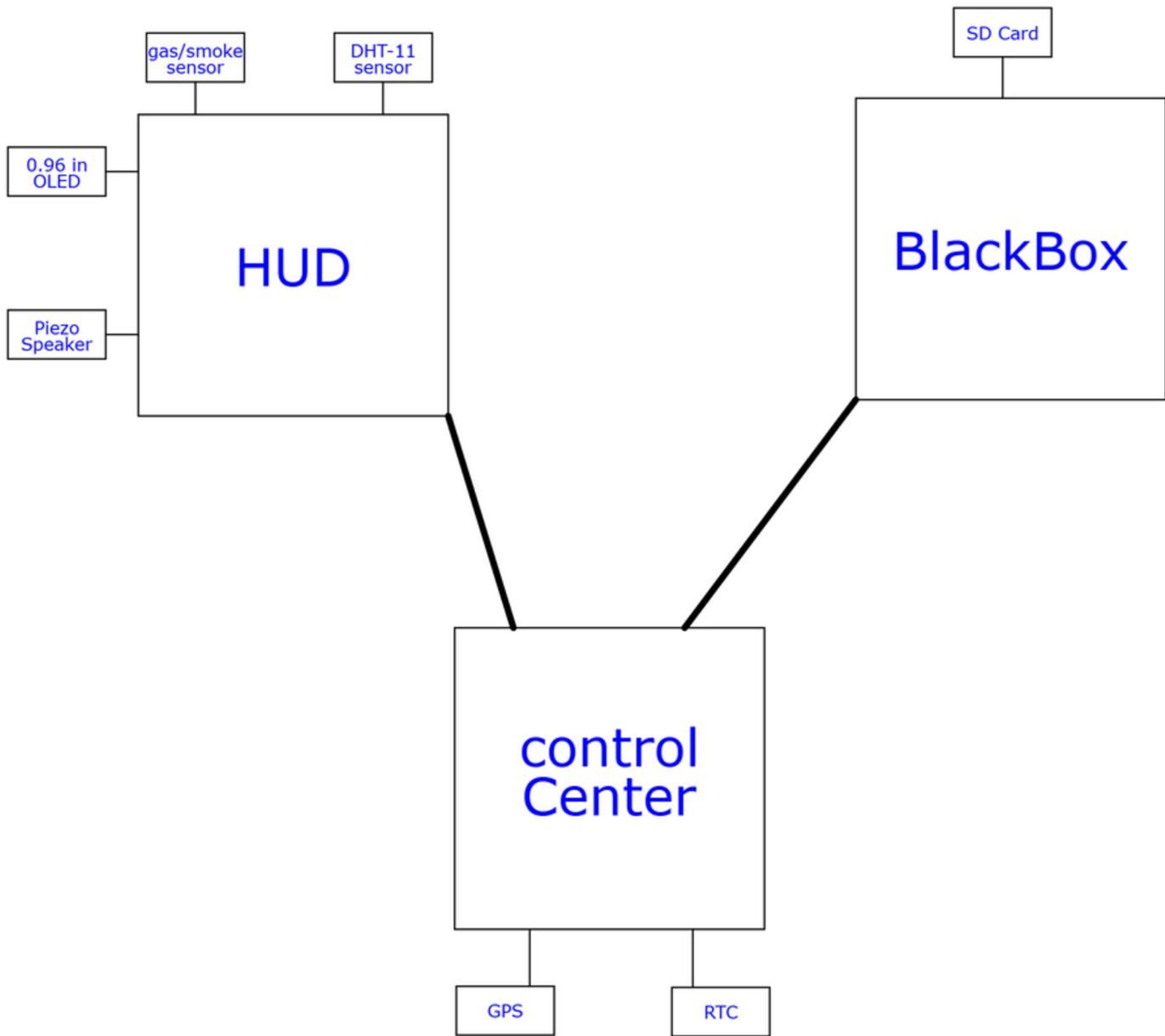
The control center is the "switchboard" of the RainBox. it sends and directs signals around the system to make sure everything can communicate effectively. also connects the Real Time Clock and GPS for additional information. This is the beating heart of the ENS. Information comes in from the HUD board, the RTC, or the GPS. That information is then sorted and sent to the BlackBox board to be stored securely.

<https://github.com/PAN-DA-BOI/civil-disobedience.git>



TITLE: Control Center		REV: 1.0
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# Final Assembly



TITLE: Full Assembly		REV: 1.0
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