### Hardware in Context Draft 2:

Environmental DNA (eDNA) is DNA derived from mucus, feces, gametes, and carcasses [1]. Many things can be learned once this DNA is put through sequencing. eDNA can be used to determine what species are present in an area, the biodiversity of an area, and if any invasive or endangered species are present [2]. eDNA sampling provides scientists and researchers a non-invasive, rapid, cost-effective and sensitive way to detect and quantify species in many environments.

Traditional sampling of environmental DNA consists of manually filtering water, often requiring one or more researchers to be on location for days or weeks [3]. The filtration process varies depending on the researcher, but it is common to pull a sample of water with a bottle and pour that water into a funnel containing a filter. This can be connected to a vacuum pump to expedite the filtering process. After the sampling process is completed, the filters need to be preserved and the setup cleaned to avoid cross contamination [3]. This process is labor intensive, cost intensive, and can be dangerous, especially for remote locations. While commercialized solutions to this problem exist, they either still require an operator to be on location or are very expensive. Smithroot’s commercial solution offers a simplified process with additional data collection such as GPS location for a fair price, around $8,000[6]. A disadvantage of this solution is that it is not fully autonomous, still requiring an operator to be on location to use the device [4]. An alternative is the DOT Sampler which is a fully autonomous solution that is capable of multiple samples (20+ samples) and is also submersible but comes at a cost of ~$55,000 [5].

The solution designed by the OPEnS Lab is the middle ground of these two solutions. While it is not submersible (limiting its potential sampling environments), it is capable of autonomous, multi-sample operations for extended periods of time (approximately one month) for the cost of $6,000. The two core priorities for our design are its autonomous function and the cross-contamination. The autonomous function of the sampler is important for a handful of reasons. An autonomous system requires less researcher hours spent in the field. This has cost benefits from the reduced hours worked and safety benefits when sampling in hazardous environments.

### References:

[1] - <https://www.usgs.gov/special-topics/water-science-school/science/environmental-dna-edna#overview>

[2] - <https://oceanexplorer.noaa.gov/technology/edna/edna.html>

[3] -

[4] - <https://www.smith-root.com/edna/edna-sampler>

[5] - <https://www.nature.com/articles/s41598-023-32310-3>

Outline:

* More details about eDNA
  + Where it can derive from
  + How long it lasts
  + Etc
* Flaws with current devices/why ours is better
* What our devices is capable of
  + High level overview on how it functions
    - Hardware Section?
    - Software Section?

### 1st Draft:

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Traditional sampling of environmental DNA (eDNA) consists of manually filtering water, often requiring one or more researchers to be on location for days or weeks [3]. The manual filter of water varies depending on the researcher, but it is common to pull a sample of water with a bottle and pour that water into a funnel containing a filter. This can be connected to a vacuum pump to expedite the filtering process. After the sampling process is completed, the filters need to be preserved and the setup cleaned to avoid cross contamination [3]. This process is labor intensive, cost intensive, and can be dangerous, especially for remote locations. While commercialized solutions to this problem exist, they either still require an operator to be on location or are very expensive. Smithroot’s commercial solution offers a simplified process with additional data collection such as GPS location for a fair price, around $8,000[6]. The flaw of this solution is that it is not fully autonomous, still requiring an operator to be on location to use the device [4]. The DOT Sampler is a fully autonomous solution that is capable of multiple samples (20+ samples) and is also submersible but comes at a cost of ~$55,000 [5]. The solution designed by the OPEnS Lab is the middle ground of these two solutions. While it is not submersible (limiting its potential sampling environments), it is capable of autonomous, multi-sample operations for extended periods of time (approximately one month) for the cost of $6,000.

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