Environmental Monitoring System - Clarifications

Purposes of This Document

This document is intended to outline additional hardware and system architecture consideration not included in Environmental-Monitoring-System.pdf. Furthermore this document aims to outline advantages and disadvantages between two system configurations in comparison, to help find the optimal option for the project.

Master/Bridge Node Hardware Considerations

Considering the choice between a Raspberry Pi 5-based master nodes and Arduino Arduino Portenta-based bridge nodes, it's important to consider their suitability for a production-ready environment and whether the finished assembly would be at all functional. It is important to consider that stacking multiple HATs (Hardware Attached on Top) is generally not recommended due to space, power delivery and heat management concerns. Multiple HATs will make the overall device larger (taller). Additionally compatibility between HATs is not guaranteed and significant pi assignment conflicts will impact the functionality of the system. Power delivery is another concern, since the Raspberry Pi may struggle to efficiently power more than one HAT. It's also worth considering that the Raspberry Pi, even with a dedicated cooling system, will likely struggle with dissipating heat, especially if it also performs data aggregation on-board. These considerations are especially important to consider since it would require both an SSD HAT and a LoRa transceiver HAT. On the other hand, a bridge node based on the Arduino Portenta H7 is an arguably simpler and less obtrusive option that also comes with the benefit of more infrequent maintenance needs (it is in fact a set it and forget it system that requires virtually no maintenance unless something serious does happen). Here, using a vision shield Ethernet and an external LoRa transceiver would be more straight forward, while the Portenta H7 (and other models in the Portenta family for that matter) offers a somewhat lower number of dedicated pins without the breakout shield, there would still be sufficient unused pins for both the Vision Shield - Ethernet and the RFM95W since the Camera, SD Card and microphone (though that microphone could be used for loudness sensing) are unused, which eliminates pin conflicts (in this case, all on-board pins would remain available since the vision shield Ethernet, especially with the planned programming, would not use most of the pins routed to the other features of the Vision Shield). Additionally the concern of connection integrity needs to be addressed, since friction-fit connections (like on the raspberry pi) are prone to coming loose unless the HATs are screwed down with stand offs, which not every HAT is compatible with. On the Portenta H7, the connections are primarily soldered and, for the Vision Shield -

Ethernet, much tighter due to the two more industry standard-aligned high density 80-pin connectors. For greater modularity without sacrificing reliability, screw terminals can be added to the Arduino Portenta H7. Another interesting, but in this case, less desirable option would be a server-setup based on the Arduino Portenta X8 with the Portenta Max Carrier, which already integrates both LoRa and Ethernet connectivity, and M.2 mass storage media compatibility, but would be significantly larger and more expensive. The use of screw terminal blocks, like the Degson RM 2,54 mm would contribute to modularity. The use of the Portenta Breakout board was considered, but would significantly increase the physical size of the bridge note.

Conclusion

It is generally recommended to use choose the Arduino Portenta H7-based bridge node over the Raspberry Pi 5, due to a more straightforward setup for its components while keeping the size rather small and unobtrusive, which is crucial in an office environment. The reliability of the Arduino Portenta H7 and its means of connection are unmatched by the Raspberry Pi 5. Important for overall system reliability. Additionally, the Arduino Portenta H7 setup would consume considerably less power than the raspberry Pi 5 setup and would need virtually no maintenance. While such a bridge node would be more expensive than the Raspberry pi 5-based system in terms of BOM (Bill of Materials), the reliability would be worth the additional investment, considering that its cost of ownership would be very minimal due to the significantly low (virtually nonexistent) maintenance needs.