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Conclusions

Achievements

- Designed a barrier-free, ergonomic 3D model and validated its structural integrity and safety via SolidWorks simulation.
- Developed a functional web platform featuring a staff dashboard and child interface using HTML/CSS/JS, FastAPI, and SQLite.
- Successfully tested and calibrated the smart system's sensors (BH1750, MQ-135, GY-21) and actuators (scent diffuser, speakers).
- Maintained prototype development costs under the €100 budget constraint while adhering to sustainable, ethical, and clinical hygiene guidelines.

Limitations

- Material Constraints: The current physical prototype is a scaled-down mock-up made of PVC tubes and paper, rather than the intended final premium materials like aluminum, brass, and antimicrobial textiles.
- Hardware-Software Gap: The end-to-end communication between the web backend and the ESP32 hardware controllers is simulated and not yet fully integrated.

Future Development

- Full System Integration: Finalize the full integration between the FastAPI web application and the real hardware for real-time control of the sensory elements.
- Full-Scale Construction: Construct a full-scale, medical-grade prototype using the finalized durable and eco-efficient materials.
- Infrastructure & Clinical Trials: Upgrade the software infrastructure by migrating to a more scalable database like PostgreSQL, and conduct clinical pilot programs to gather empirical feedback from patients.

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