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Health Monitoring System for Patients with Autism: with a Focus on Network Protocols

Informed Judgement Report
Group #7

Data Communications and Computer Networks II
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Executive Summary

This report addresses the environmental, societal, and operational considerations inherent in creating a health monitoring system tailored for individuals with autism who experience sensory sensitivities. The system utilizes a NodeMCU ESP32 Development Board, integrating light and audio sensors to detect deviations beyond predefined thresholds, prompting caregivers to intervene as necessary. Moreover, it incorporates a data storage mechanism facilitated by Microsoft Azure IoT Central and includes a feature for generating weekly reports.

Social Impact

The project addresses the pressing demand for affordable and user-friendly solutions tailored to individuals with sensory sensitivities. Furthermore, it offers vital support and peace of mind to caregivers of children facing these challenges. The following sections elaborate on these points.

i. **Affordability**:

Component	Price (in USD)
NodeMCU ESP32	10.71
Sensors	7.14
Other components (cables, breadboard, etc.)	4.12
LCD Display*	7.97

*LCD Display was used mainly for testing purposes but can later be included as an optional feature.

The production cost amounts to approximately $20, excluding the LCD display. This figure stands in stark contrast to the products referenced in our project proposal, which averaged a price of $150. Consequently, our product emerges as a considerably more affordable alternative, even if marketed at *double* its production cost.

ii. **Ease of Use**: Once the device is installed, and the caretaker's email address is successfully entered into the system, no user input is necessary thereafter. The user's primary role shifts to receiving timely alerts and appropriately addressing them in person. This will be discussed in subsequent sections of this report.

iii. **Assistance to Caregivers:** Through its capability to detect potentially harmful levels of light and sound, the device effectively alleviates the necessity for caretakers to be in constant physical proximity to individuals with sensory sensitivities. By autonomously monitoring environmental conditions and promptly alerting caregivers when intervention is warranted, the device significantly reduces the burden of continuous supervision, thereby granting both caregivers and individuals with sensory issues greater freedom and peace of mind.

Environmental Impact

Operating at 3.3V [1] and consuming up to 240 mA [2], the NodeMCU ESP32 uses approximately 0.8 watts of power, significantly less than an LED light bulb, which typically consumes around 10 watts.

Nonetheless, given that the project utilizes cloud computing infrastructure, it is essential to recognize its contribution to greenhouse gas (GHG) emissions, a common consequence associated with cloud computing technologies. However, cloud computing is usually regarded as being energy efficient and thus emitting less GHG than traditional forms of computing [3].

Contribution to economic growth and development

The provision of an accessible and cost-effective product not only meets the immediate needs of caretakers of individuals with autism but also serves as a catalyst for broader market expansion within the realm of assistive technologies. By offering a solution that is both financially viable and user-friendly, the product effectively lowers barriers to adoption, thereby encouraging a wider demographic of caretakers to invest in such technologies. This increased uptake not only benefits individual caregivers and their wards but also contributes to the overall growth and diversification of the market for similar products. Moreover, as awareness of the efficacy and accessibility of these solutions spreads, it fosters a supportive ecosystem wherein innovation and development of assistive technologies are further incentivized, ultimately leading to a more inclusive and accommodating society for individuals with diverse needs.

Ethical considerations

While the production cost of the product remains relatively low, it's acknowledged that certain individuals may still face financial constraints hindering their ability to afford it. In response to this challenge, a viable solution lies in partnering with charity organizations to facilitate the distribution of the product to those in need. By leveraging the resources and networks of these charitable entities, the product can reach marginalized and economically disadvantaged communities, ensuring that it becomes accessible to a broader spectrum of individuals who could benefit from its functionalities. Through such collaborative efforts, the barriers to accessibility can be effectively mitigated, enabling the product to fulfill its intended purpose of providing vital support and assistance to those with sensory sensitivities, regardless of their financial circumstances.

User data

The absence of cameras or voice recorders within the device ensures that it exclusively captures and records data pertaining to light and sound levels. As a result, no sensitive or personally identifiable information is obtained from the user, thereby eliminating any potential threats to their privacy or safety.

Human-Centered Aspects

The device operates autonomously without requiring direct user interaction, focusing solely on detecting values and issuing alerts when potential threats arise. This streamlined functionality enhances ease of use, particularly benefiting elderly individuals or those with limited technological proficiency.

Additionally, when entering the user's email into the system, the user is allowed to customize the desired thresholds for light and sound levels, thereby facilitating a personalized experience. In cases where the user does not specify their preferences, default thresholds are set at 70 dB for sound and 400 LUX for light, based on research conducted on sensory issues in autism [4] [5].

Furthermore, while the device significantly reduces the need for constant human supervision, it does not entirely eliminate it. Caretakers must remain in close proximity to the individual with sensory sensitivities to promptly address alerts as they arise. One potential resolution to this challenge involves communicating with other responsible adults, such as teachers, who can be promptly informed of any alerts and assist in taking appropriate action.

Conclusion

The device successfully fulfills the objectives outlined in the project proposal, including the accurate sensing of light and sound levels, timely alerting in the event of potential threats, and the provision of weekly reports. Nonetheless, as with any project, several challenges and issues must be acknowledged and addressed prior to its market launch.

Sources

[1]

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