Topic: Using Smart Devices to Assess the Health Status of Palliative Care Patients by Monitoring Activities of Daily Living

The primary goal of palliative care is to enhance the overall quality of life of patients facing terminal illnesses, providing support for their families, addressing physical symptoms, and managing psychological and spiritual needs [1]. Activities of Daily Living (ADLs) describe a collection of fundamental skills needed to manage basic physical needs, including personal hygiene, dressing, ambulating, and feeding [2].
Research indicates that a patient's ability to perform ADLs is significantly correlated with their overall quality of life, as, for example, greater independence in daily activities enhances general well-being [3]. Therefore, measuring or assessing a patient's ADLs is an important part of palliative care as it enables the staff to evaluate and track their health. In many instances, ADLs are assessed by methods like self-reporting, questionnaires, or interviews with the patients [4,5].
These methods offer only a subjective snapshot at a single point in time [6], which raises doubts about their true effectiveness and highlights the need for better ways to assess ADLs more accurately over time. One possible way to achieve this is using smart devices or smart sensors capable of continuously monitoring multiple ADLs, providing a more precise and complete picture of a patient's quality of life. Attempts to use popular smart sensors, like smartwatches, to measure activities in elderly people, while often promising great potential [7], have faced challenges stemming from low acceptance rates among participants, with device complexity being a prominent contributor [8], along with limitations in evaluating sensor data, partially caused by the heterogeneity of the technology used [7], as well as the need for technical experts to visit patients' homes to set up complex sensor systems [9]. Furthermore, the data gathered in these studies mostly relate to patients' movement, which would inherently exclude bedridden patients. As palliative patients are often bedridden, measuring additional ADLs, such as drinking from a cup, should prove as beneficial, given that this is an activity universally performed by all patients.

In this thesis, a smart sensor combining the necessary hardware components and software to effectively monitor the ADLs ambulating and drinking - by monitoring door and cup movements - reliably producing data with minimal technical expertise and interaction required, will be designed, developed, and implemented.

Required steps to reach this goal will comprise:

- Literature and related work research, resulting in a comprehensive list of sources highlighting the research gap for this work
- Designing and building at least 5 door/cup sensors, by:
    - Combining a processing unit, sensor(s), power source, and interface modules on a PCB
    - Writing software that enables the recording, processing, and storage of activity data
    - 3D-printing a casing to house the components, protecting them and creating a universally usable form factor
    - Manufacturing the respective units
- Collection of door and cup data gathered with the smart sensor from at least 20 healthy individuals
- Collection of door and cup data gathered with the smart sensor from palliative care patients (if feasible)
- Evaluation and discussion of the data and results, focusing on

- Differences in gathered cup/door data from participant to participant and from healthy group to palliative care group
- Detectability of changes in a patient's health by evaluating cup/door data

The thesis must contain a detailed description of all developed and used algorithms as well as a profound result evaluation and discussion. The implemented code must be documented and provided. Extended research on literature, existing patents and related work in the corresponding areas has to be performed.

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