

Problem Statement and Goals

Mechatronics Engineering

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Table 1: Revision History

Date	Developer(s)	Change
September 25th	N/A	Initial documentation

1 Problem Statement

1.1 Motivation Problem

Dr. Luciana Macedo investigates treatment strategies for elders with lumbar spinal disorders (LSS), particularly focused on Ecological Momentary Assessment (EMA). EMA aims to study the thoughts, experiences, and behaviours of patients' daily lives by repeatedly collecting data in their day-to-day environment, at or close to the time they carry out that particular behaviour.

Since Dr. Macedo's EMA work is focused on analyzing the daily activities and symptoms of mostly-elderly people with mobility issues, her solution needs to capture their slow and subtle movements. In order to accomplish this, she and her students have attempted to use various smart-watch-esque activity tracking devices along with various software applications to prompt their patients with questions. However, they have been frustrated with very limited success.

Their current system works on a time-based prompt-system, asking questions at regular intervals throughout the day. This isn't as useful, as they are rather interested in the experiences of their patients when certain events or triggers happen. In addition, all of her data collection methods are heavily segregated and inefficient. In order to report their symptoms, a patient must input their answers into a smart watch, a mobile app, a website, etc. According to Dr. Macedo, this is not quite user-friendly especially when it comes to a group of elderly patients, and incredibly annoying and difficult for a researcher to analyze the gathered data. Importantly, the existing commercial products are designed to capture the activities of healthy and active people, which contrasts with what she is trying to capture: shuffling, limping, slower walking, etc.

This solution device would have to capture the subtle and slow movement of elderly patients with lumbar spinal stenosis (LSS) and prompt them with pre-determined questions when they stop or make certain type of movements. It will then have to collect and send those data back to Dr. Macedo for her analysis.

1.2 Inputs and Outputs

[Inputs]

- Sensor data will be used as a trigger to start the EMA
- User responses to the survey for data collection
- Geolocation data of the user

[Outputs]

The output will be something that's useful for research and conclusion. This includes:

- Graphically represented data that can be easily interpreted.
- Specific numerical data of interest.

1.3 Stakeholders

- Dr. Luciana Macedo of School of Rehabilitation Science at McMaster University.

1.4 Environment

[\[Hardware and software —SS\]](#)

1.5 Constraints

Constraints include:

- Safety
- Fail-safe
- Offline useability
- Portability
- Strict data privacy (security)
- Accurate timing; system is very sensitive to timing inaccuracies

2 Base Goals

3 Stretch Goals