Artificial intelligence model for continuous, in-home, posture and health monitoring including user feedback and predictions of clinical assessment.

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## Introduction

According to (Gill et al., 2023) in 2020 alone, musculoskeletal disorders (MSDs) had been ranked 2nd as the leading non-fatal disability which has been affecting more than a billion people worldwide. In Finland, MSD had taken the spotlight as being the leading cause of temporal disability within the nation, through which a lot of resources allocated towards the health services (Martimo, 2010). It might be misconceived that only the elderly are the only ones that suffer from this condition. However, a report by (European Agency for Safety and Health at Work., 2021) has concluded that quite a number of individuals across different age groups are currently suffering from it. It was reported that MSDs can often originate during the childhood stage mainly due to adoption of abnormal postures and low physical activities, which subsequently lead to long-term chronic pain, discomfort, and physical limitations. Traditional examination and treatment procedures most often consist of regular clinical visits and are currently viewed as being inconvenient and costly. According to (Bevan, 2015), MSDs have said to have cost the EU over 2% of its gross domestic product (GDP), which is estimated to be over €240bn each year. There is no doubt that this is a steadily growing concern that needs to be properly addressed.

Currently, a majority of office work requires one to be in a seated position for an extended period of time, which is said to have adverse effects to one’s health. According to (Arora and Khatri, 2022) and (Putsa et al., 2022), prolong sitting is one of the leading causes of . It is therefore recommended that the users should go for small walk breaks after every few hours.

Furthermore, with the rapid advancement in data sensor technology and Artificial Intelligence in this present age, there should be new and commercialized solutions out there in the market for continuous posture and health monitoring. There is no doubt that these types of systems have the potential of contributing towards the idea of personalized healthcare and improving the quality of life, especially for individuals that are suffering from MSDs.

With that in mind, various research studies have investigated on the development of posture monitoring systems which are aimed at detecting bad sitting postures to help the end user in maintaining the right sitting posture at every given time. These types of systems are named as “smart sensing chairs” which goes all the way back to a research study done by (Tan et al., 2001) which fitted a chair with a pressure distribution sensor in order to classify a user’s sitting postures which was just first of many. Furthermore, with a lot of research papers being published in this field, this literature review aims to evaluate related studies and identify research gaps that can pave the way for further investigation into this study. By exploring existing studies, it is possible to gain a better understanding of the current state on the implementation of a smart sensing chair for posture classification and health monitoring.

## Literature Review

### Existing Sitting Posture Monitoring Systems

The development of a sitting posture monitoring system is not an entirely new concept, rather it is an area that has been explored in the past. Currently, over 30 related papers have been published focusing on the of the use of unobtrusive means for the classification of different sitting positions. These papers have shed light on the common methods and techniques being used to be able to classify various sitting postures.

### Sensor Technology

### Smart Wheelchair Systems

### User Feedback System

### Machine Learning Algorithm

### Machine Learning

### Commercialization

### Research Gaps

### Future/Proposed Plans

### Conclusions

## References

Arora, S.N. and Khatri, S. (2022) ‘Prevalence of work-related musculoskeletal disorder in sitting professionals’. *International Journal Of Community Medicine And Public Health* 9(2), p. 892. doi: 10.18203/2394-6040.ijcmph20220259.

Bevan, S. (2015) ‘Economic impact of musculoskeletal disorders (MSDs) on work in Europe’. *Best Practice & Research Clinical Rheumatology* 29(3), pp. 356–373. doi: 10.1016/j.berh.2015.08.002.

European Agency for Safety and Health at Work. (2021) *Musculoskeletal disorders among children and young people: prevalence, risk factors and preventive measures : a scoping review.* LU: Publications Office. Available at: https://data.europa.eu/doi/10.2802/511243 (Accessed: 21 November 2023).

Gill, T.K. et al. (2023) ‘Global, regional, and national burden of other musculoskeletal disorders, 1990–2020, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021’. *The Lancet Rheumatology* 5(11), pp. e670–e682. doi: 10.1016/S2665-9913(23)00232-1.

Martimo, K.-P. (2010) *Musculoskeletal disorders, disability, and work*. Helsinki, Finland: Finnish Institute of Occupational Health.

Putsa, B., Jalayondeja, W., Mekhora, K., Bhuanantanondh, P. and Jalayondeja, C. (2022) ‘Factors associated with reduced risk of musculoskeletal disorders among office workers: a cross-sectional study 2017 to 2020’. *BMC Public Health* 22(1), p. 1503. doi: 10.1186/s12889-022-13940-0.

Tan, H.Z., Slivovsky, L.A. and Pentland, A. (2001) ‘A sensing chair using pressure distribution sensors’. *IEEE/ASME Transactions on Mechatronics* 6(3), pp. 261–268. doi: 10.1109/3516.951364.