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# A Review on wearable sensors and experimental design for GAIT analysis

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## INTRODUCTION

All humans have a GAIT or mode of progressive locomotion that is unique to them which involves several subsystems in our bodies, including the skeletal, joint, muscular, neurological, vestibular, and visual systems. It is a natural, repetitive movement that is controlled by muscles when actively contracted under neural control. Information on GAIT characteristics will allow early identification of disorders and their complications, allowing medical staff to find the most appropriate treatment.

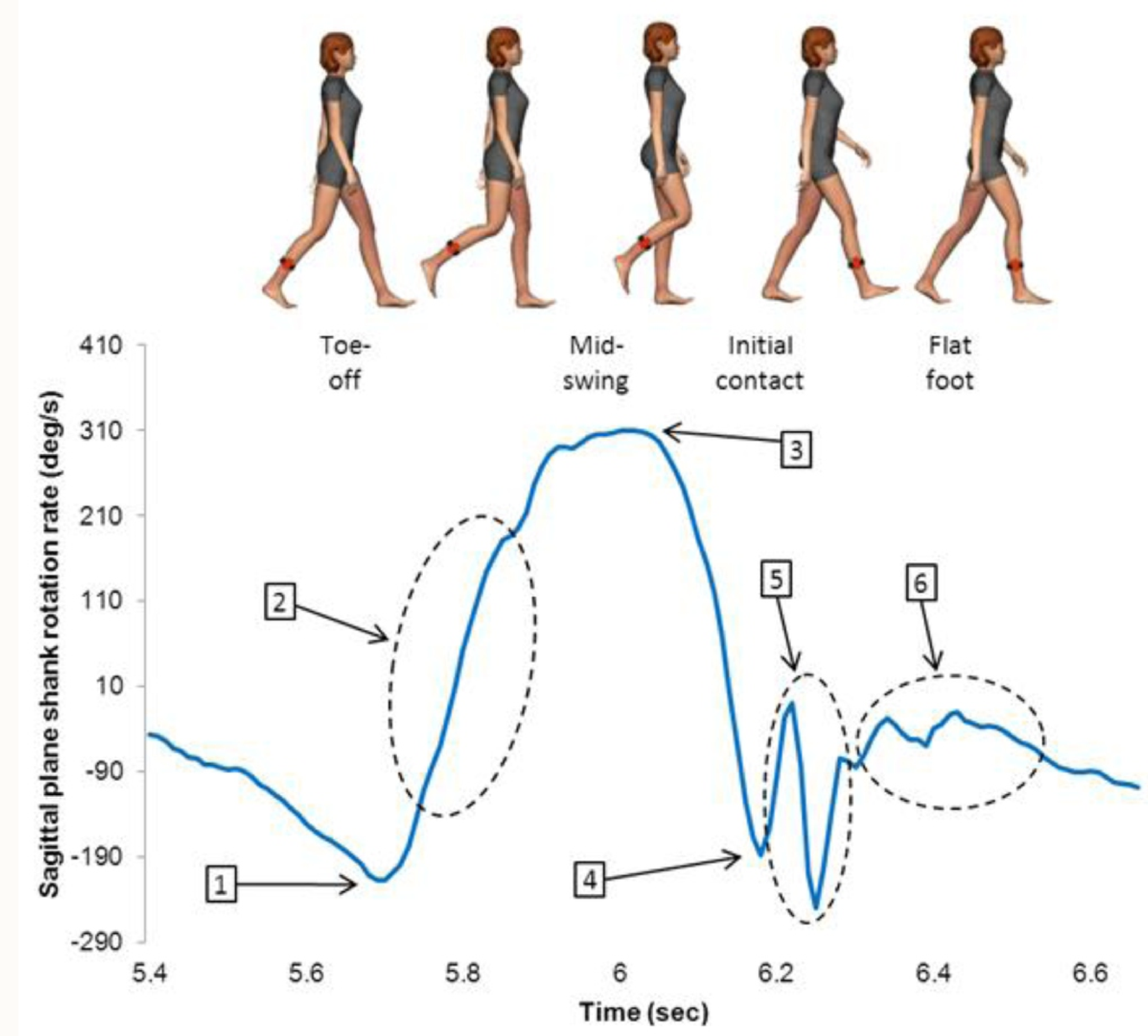



**Figure 1.** The sagittal plane shank gyroscope signal over a single gait cycle. The quantified features from each gait cycle are numbered on the graph. 1—minimum value at TO, 2—rate of change during initial swing, 3—peak shank rotation rate during swing, 4—minimum value at IC, 5—post-HS shank variance and 6—mid-stance variance.

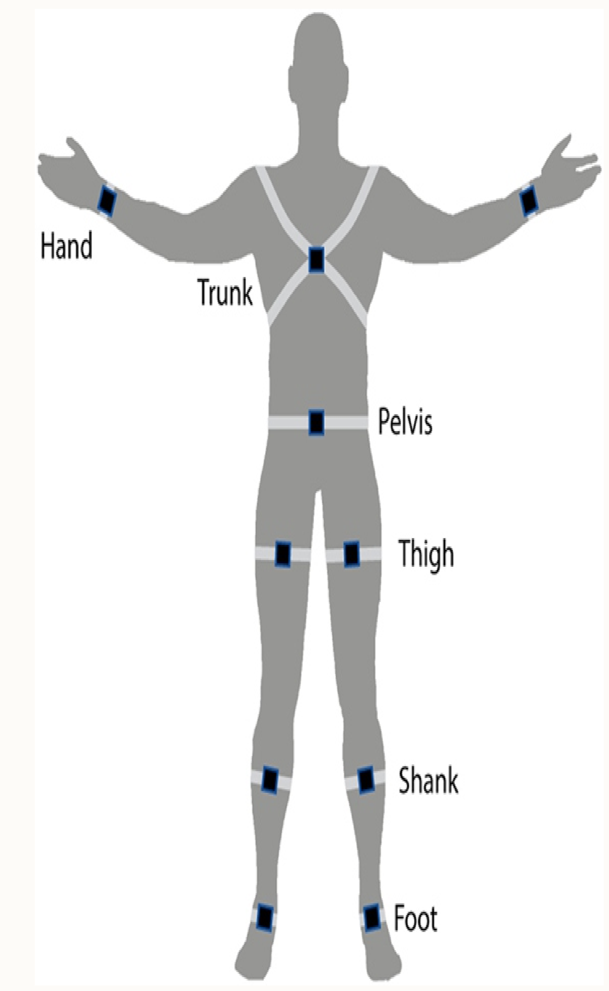



**Figure 2.** Common inertial sensor placements on the body

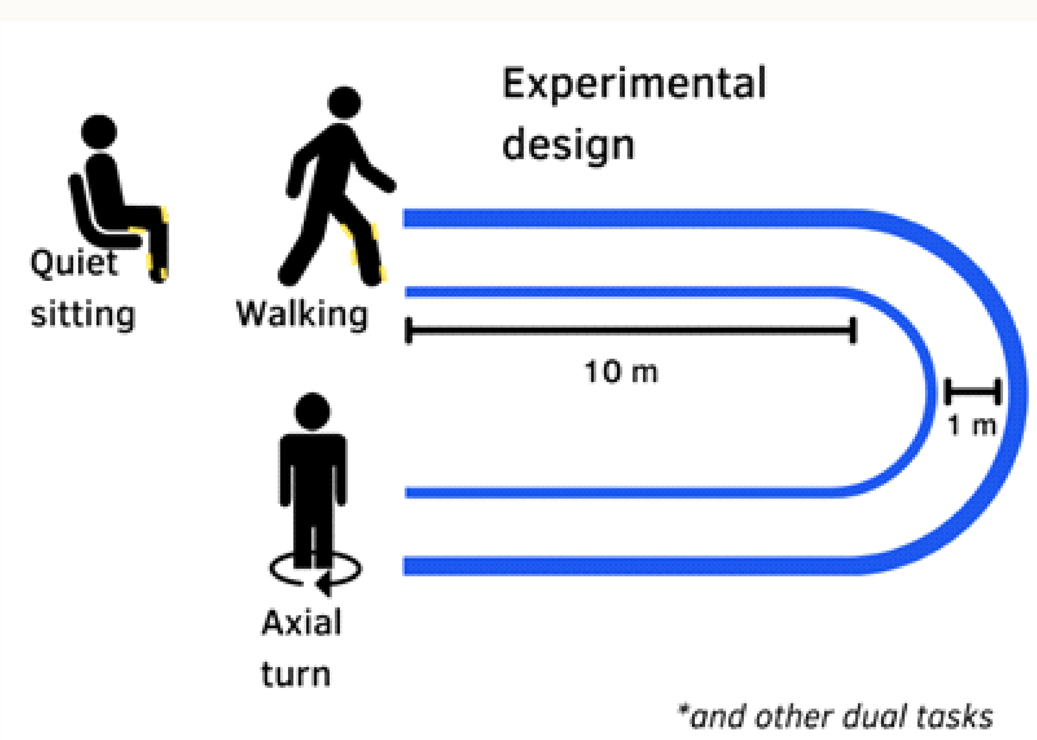
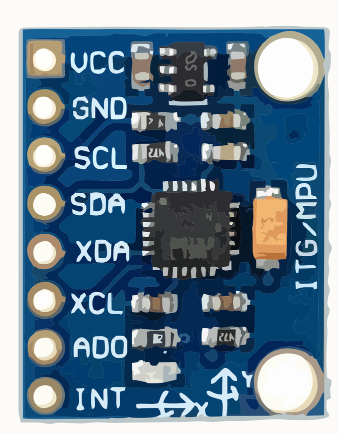
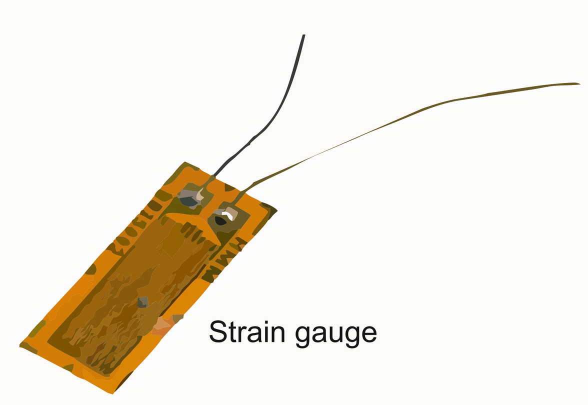


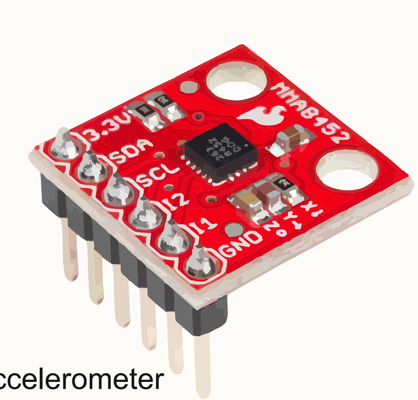

**Figure 3.** Experimental design and tasks to be performed for GAIT analysis



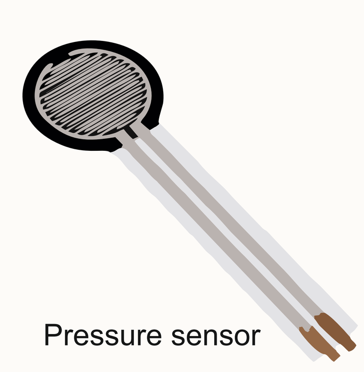
Gyroscope



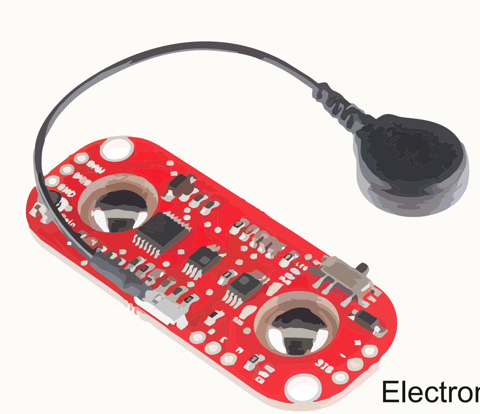
Strain gauge



Accelerometer



Pressure sensor



Electromyography sensor

**Figure 4.** Common wearable sensors used for GAIT analysis

## OBJECTIVES

I. Review literature concerning GAIT abnormalities associated with several GAIT parameters.

II. To study the design parameters of various sensors for GAIT analysis

III. Identify effective experimental design for GAIT assessment.

IV. Discuss and determine feasibility of stretchable sensors for non-contact analysis.

## OUTCOMES

The CNS manages the synchrony of muscles based on a specific task. Understanding this an appropriate model can be devised to conduct an effective GAIT assessment. An overview of existing sensor technology aids to meet the requirements of a user-friendly, non-invasive, simple device that has increased sensitivity, specificity, and stability for healthcare monitoring. The scope of sensor-based GAIT analysis can be further extended to monitor several movement-based abnormalities and other features. Thereby contributing to non-contact analysis in the medical field.

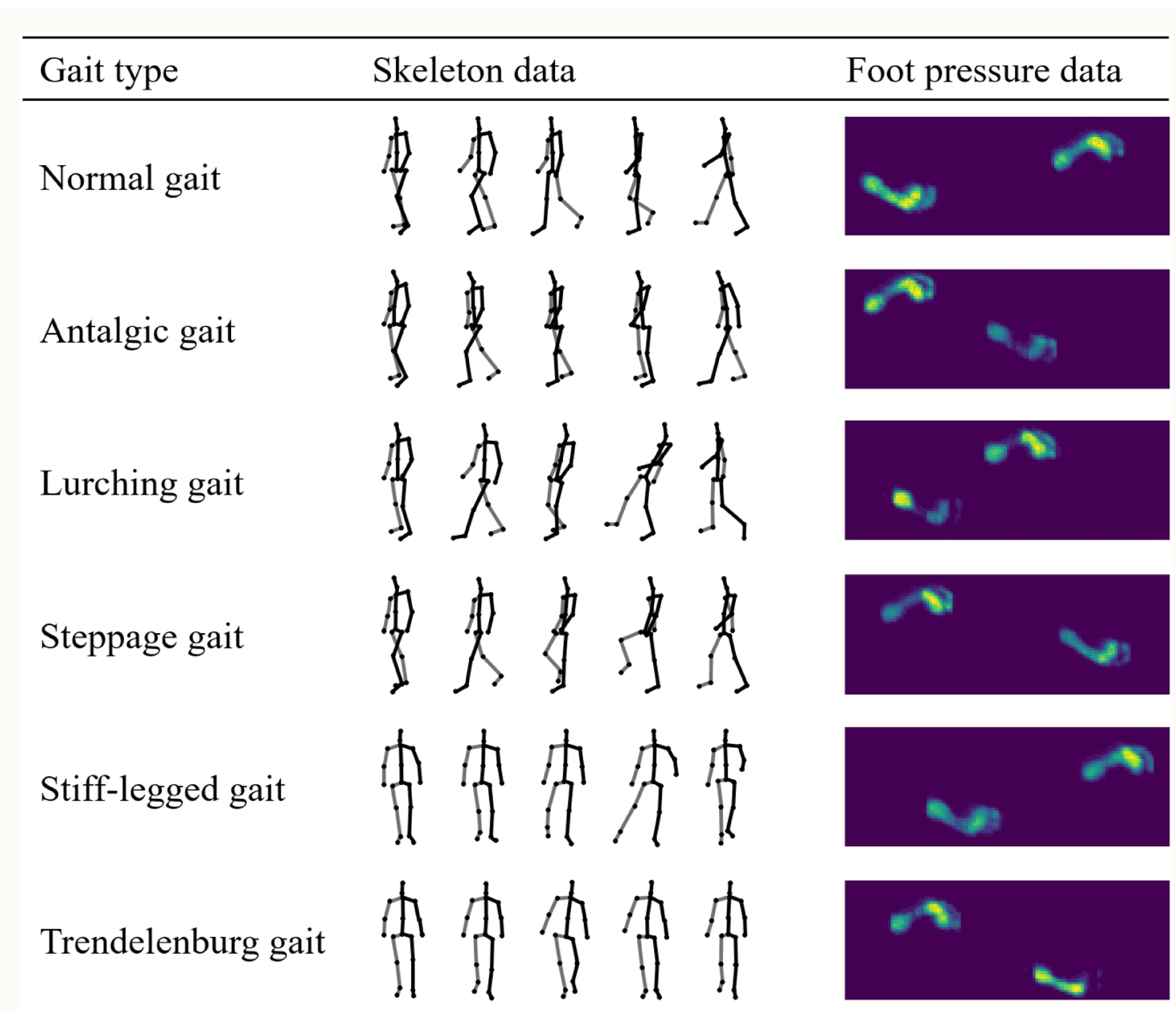



**Figure 5.** GAIT abnormalities and corresponding foot placement

REFERENCES -

[1]Fig.1- Patterson, Matthew R., Eamonn Delahunt, Kevin T. Sweeney, and Brian Caulfield. 2014. "An Ambulatory Method of Identifying Anterior Cruciate Ligament Reconstructed Gait Patterns" Sensors 14, no. 1: 887-899. https://doi.org/10.3390/s140100887

[2]Fig.2- Shanahan Camille J., Boonstra Frederique M. C., Cofré Lizama L. Eduardo, Strik Myrte, Moffat Bradford A., Khan Fary, Kilpatrick Trevor J., van der Walt Anneke, Galea Mary P., Kolbe Scott C,"Technologies for Advanced Gait and Balance Assessments in People with Multiple Sclerosis",https://10.3389/fneur.2017.00708

[3]Fig.5- Kooksung Jun, Sanghyub Lee, Deok-Won Lee, Mun Sang Kim. (2021). Azure Kinect 3D skeleton and foot pressure data for pathological gaits. IEEE Dataport. https://dx.doi.org/10.21227/ev8a-wr16

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