SIT723 Research Training & Project

Pass Task 2.1: Summary of Existing Works

Title: Summary of Existing Works on Early Detection of Gait Disorders for IOT-based Framework.

1. Introduction:

This research project aims to develop an IoT framework and prototype for unobtrusive gait measurement in outdoor landscapes. The sensor-equipped landscape, placed in frequented areas, will collect data for machine learning/AI analysis, creating individual gait profiles and estimating fall risk.

2. Search Queries:

"LIDAR Based Gait Detection & Analysis"

"Sensor-Based Sitting Device to Measure Physical Strength"

"Machine Learning and AI Algorithms for Gait Analysis"

"Gait Analysis and Clinical Correlations"

"Gait Analysis Done in Outdoor Environment"

3. Academic References:

3.1 Paper 1:

Title: Development and Validation of 2D-LiDAR-Based Gait Analysis Instrument and Algorithm

Author(s): Seongjun Yoon et al.

Published in: Elsevier, 2018

Summary: This paper presents an innovative gait analysis tool utilizing a compact and unobtrusive design, employing 2D light detection, and ranging (2D-LiDAR) technology. The paper includes a validation study and a comparative analysis between the LIDAR technology and a stereo camera.

3.2 Paper 2:

Title: Developing and Evaluating a Mixed Sensor Smart Chair System for Real-Time Posture Classification

Author(s): Jeong, H., Park, W.

Published in: IEEE Journal of Biomedical and Health Informatics, 2020

Summary: This research introduces a smart chair system that integrates pressure and distance-based sensors to actively monitor and categorize an individual's sitting positions in real-time. The primary objective of the study is to assess the performance of posture classification by contrasting the mixed sensor system with a single-sensor type.

3.3 Paper 3:

Title: Computer Vision and Machine Learning-Based Gait Pattern Recognition for Flat Fall Prediction

Author(s): Biao Chen et al.

Published in: MDPI, Biomedical Sensors, 2022

Summary: This study uses computer vision to assess lower limb variables and identifies the most effective machine learning algorithm for classifying gait patterns in people without mobility issues. In a validation experiment, KNN, SVM, CNN, and LSTM were tested, with SVM achieving the highest accuracy in categorizing three distinct gait patterns.

3.4 Paper 4:

Title: Gait analysis and clinical correlations in early Parkinson's disease

Author(s): Michele Pistacchi et al.

Published in: Journal of PubMed Central, 2017

Summary: This study examines spatiotemporal and kinematic gait parameters through 3D gait analysis in individuals with Parkinson's disease. The research established a clear correlation between various gait parameters such as Cadence, Stride Duration, Step Width, Stride Length, and Swing Velocity with the early stages of Parkinson's disorder.

3.5 Paper 5:

Title: Gait Phase Estimation of Unsupervised Outdoors Walking Using IMUs and a Linear Regression Model

Author(s): Ahmed Soliman et al.

Published in: IEEE Access, 2022

Summary: The paper investigates the gait phase of individuals in an unsupervised outdoor setting, removing the necessity for predetermined thresholds and the use of insoles with embedded sensors. Gait patterns are established through the integration of a force plate and a motion capture system.

4. Conclusion:

In summary, the analysis of around 15 research papers using the specified search queries reveals a notable absence of any established IoT-based framework for gait measurement and its correlation with clinical issues. Prior investigations predominantly centre around conventional wearable technology, neglecting the integration of an IoT framework in outdoor environments which underscores the significance of pioneering a novel approach. Additionally, the collective insights from past studies contribute to a comprehensive understanding of the various aspects relevant to the project, setting the stage for innovative advancements in the early detection of gait-based disorders.