# Gait-driven Pose Tracking and Movement Captioning using OpenCV and MediaPipe Machine Learning Framework

**J. Malathi, A. Leela Priya, P. Tarun Teja, M. Kavya Vijay**

**Corresponding Author: J. Malathi Email ID: malathi.j@vrsiddhartha.ac.in**

## 1. Introduction

- Human movement encompasses more than physical actions; it provides insights into individual intentions and motivations. Researchers have developed methods to analyze subtle movements, understanding them as forms of non-verbal expression.
- Advanced video analysis systems that detect movement patterns and classify walking styles have emerged. Recent models leverage hierarchical attention methods to understand the nuances of human movement.
- This work integrates artificial intelligence with Python programming and uses the GHUM 3D model for detailed body reconstruction. By identifying typical and typical movement patterns, the system offers applications in healthcare, sports, surveillance, and behavioral analysis, providing a comprehensive understanding of posture and motion.

## 2. Proposed Approach

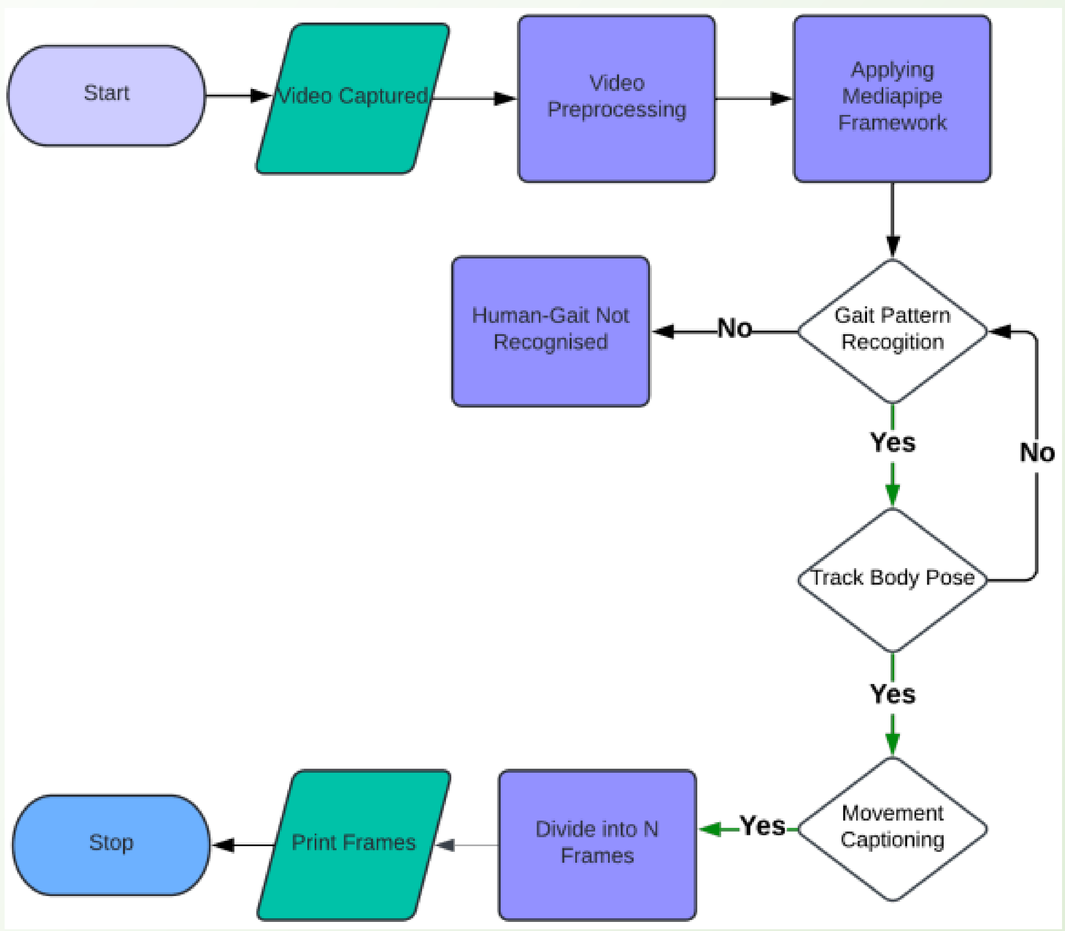


**Fig. 1.** Workflow of the proposed methodology

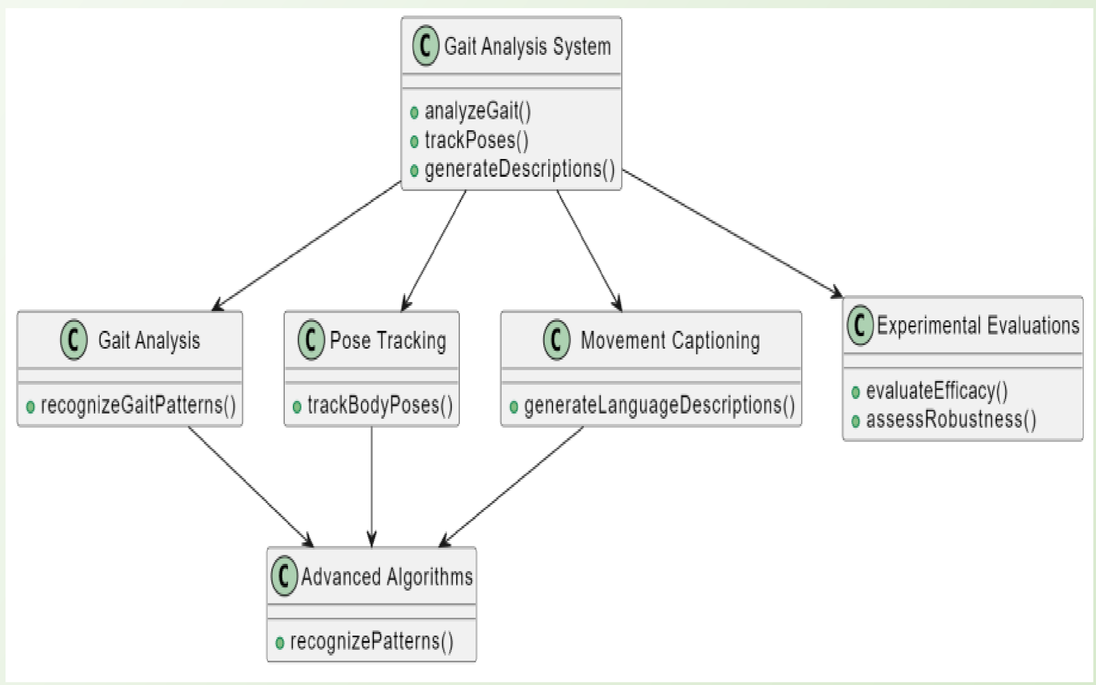


**Fig. 2.** Human activity recognition using Gait

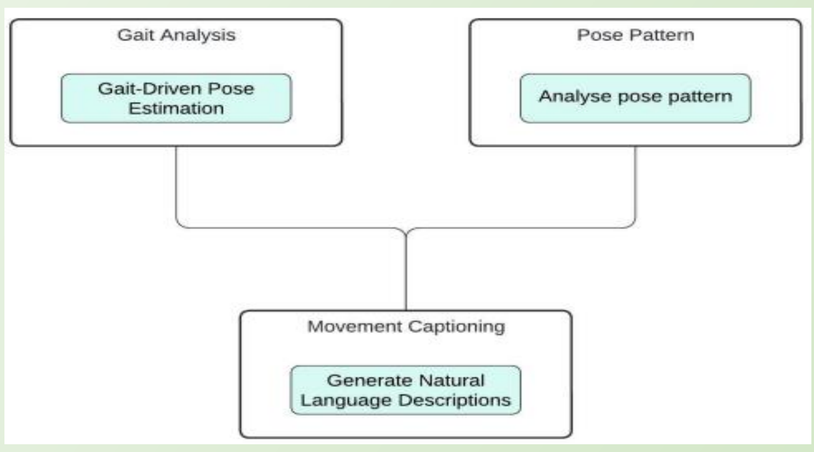


**Fig. 3.** Process of feature extraction

## 3. Results


**Fig. 4.** Crawling recognised


**Fig. 5.** Walking recognised


**Fig. 6.** Real-time activity analysis

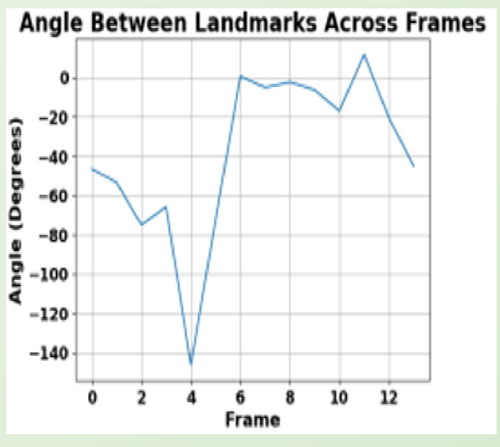


**Fig. 7.** Clapping

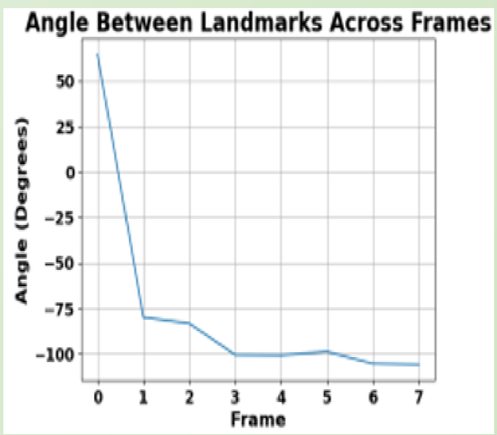


**Fig. 8.** Running

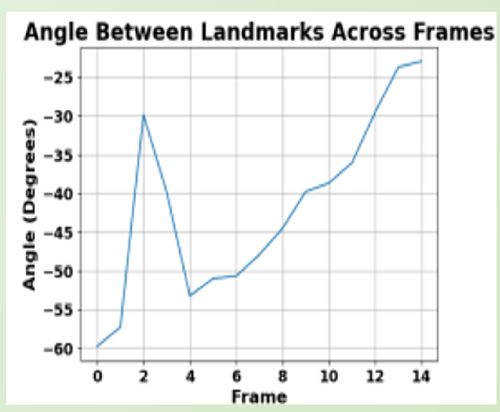


**Fig. 9.** Crawling

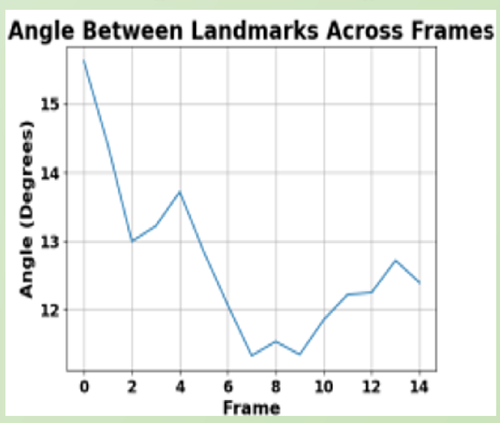


**Fig. 10.** Walking

## 4. Conclusions

- The gait-driven pose tracking and movement captioning system effectively combines GHUM 3D, Python-based machine learning, and HAR algorithms for precise human movement analysis. It enables users to upload videos, view results, and interpret movement captions, providing insights for healthcare, surveillance, and entertainment.
- Future improvements will focus on adding emotion detection through gait analysis, enhancing machine learning models for greater accuracy, and upgrading the user interface with real-time feedback and personalized recommendations.

## 5. Key References

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2. Karg, M.; Kühnlenz, K.; Buss, M. Recognition of affect based on gait patterns. IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics) 2010, 40(4), 1050-1061.
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