

# StepSense

BY naviGAIT



# WHITE PAPER

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Progression in  
Gait Analysis



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## Introduction

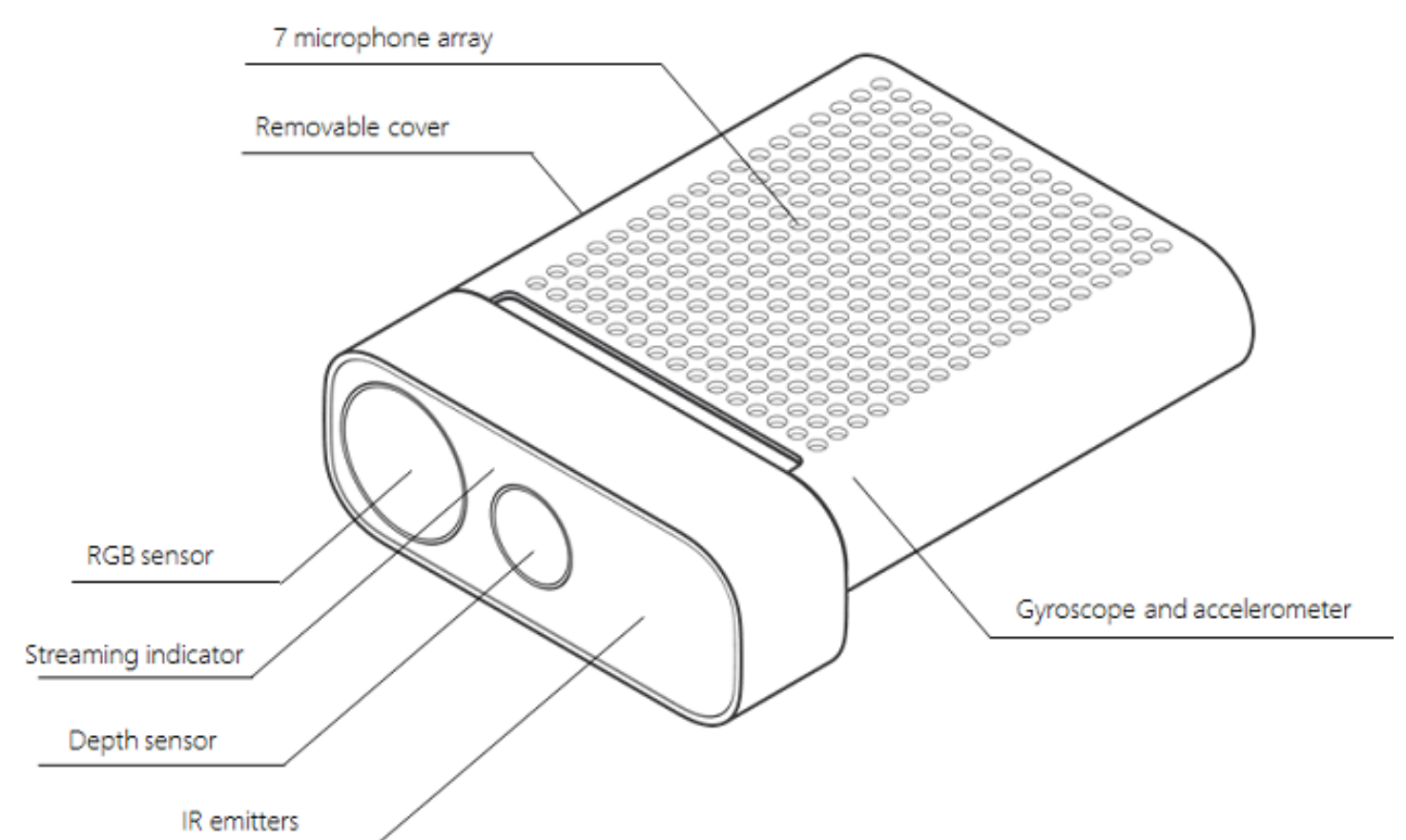
Gait assessment is an essential tool for clinical applications not only to diagnose different neurological conditions but also to monitor disease progression as it contributes to the understanding of underlying deficits. Gait abnormalities due to underlying aetiology are among the most consistent predictors for falls and abnormal gait can cause other severe consequences such as reduced life satisfaction and limited mobility. Impaired gait is present in almost all neurodegenerative diseases (1). More than two-thirds of those admitted to hospital frequently suffer from a neurological condition that leads to a fall, where 85% of those patients were previously undiagnosed (1). Traditionally, patient assessment methods in supervised clinical settings have been widely performed by visual observation from a trained physiotherapist utilising subjective rating scales, which rely on clinician expertise (2). Digital-based technologies (3), Motion analysis systems, instrumented walkway systems and force plates/platforms have been pioneering non-wearable systems that are “gold/reference standard” for capturing kinetic, kinematic and spatiotemporal gait characteristics with reasonable to excellent accuracies (4). However, those technologies conform to a “one size fits all” approach, (4, 5), use of controlled research facilities and trained staff, which provide a snapshot assessment in optimal testing conditions within a predefined capture volume, e.g. length of an instrumented walkway (6).

## Our Gait Analysis System

We offer a state-of-the-art Gait Detection System that empowers health professionals with comprehensive insights into their patients' gait parameters. By harnessing advanced technologies from the latest cutting-edge technologies, we ensure accurate gait analysis and report generation, making it accessible and understandable for participants of all technical backgrounds. The main components enabling the measurement, calculation, and prediction of highly precision gait values:

### Microsoft Azure Kinect depth camera

We use the high performing color and depth camera along with the open source, yet official Microsoft maintained development kit to get a wide-angle colored view along with depth information for our processing. Microsoft Azure Kinect camera is a top-of-the-line off-the-shelf camera well known for providing the highest precision values. The Microsoft Azure Camera is packed with an RGB camera, a Depth sensor, and an Infrared Sensor, all of the data is then fused in together to have get an accurate read on the environment along with the people of interest. "The Azure Kinect DK (Microsoft Inc., Redmond, WA, USA) includes a 12-megapixel color camera (4096 × 3072 px) and a 1-megapixel ToF depth sensor (1024 × 1024 px)." [4]





# Nvidia TRT\_Pose

## Various Gait Parameter predictors

We have trained various predictors and regressors using inhouse use case specific data as long as the standard IEEE open source data sets to predict various complex gait parameters using the basic ones extracted using the depth information and the pose landmarks. These Predictors have undergone various training, validation, and testing loops to ensure a high accuracy in the predicted values.

Avg Gait Speed

Avg Step Speed

Step with Variability

Step Count

Avg Stride Length

Cadence

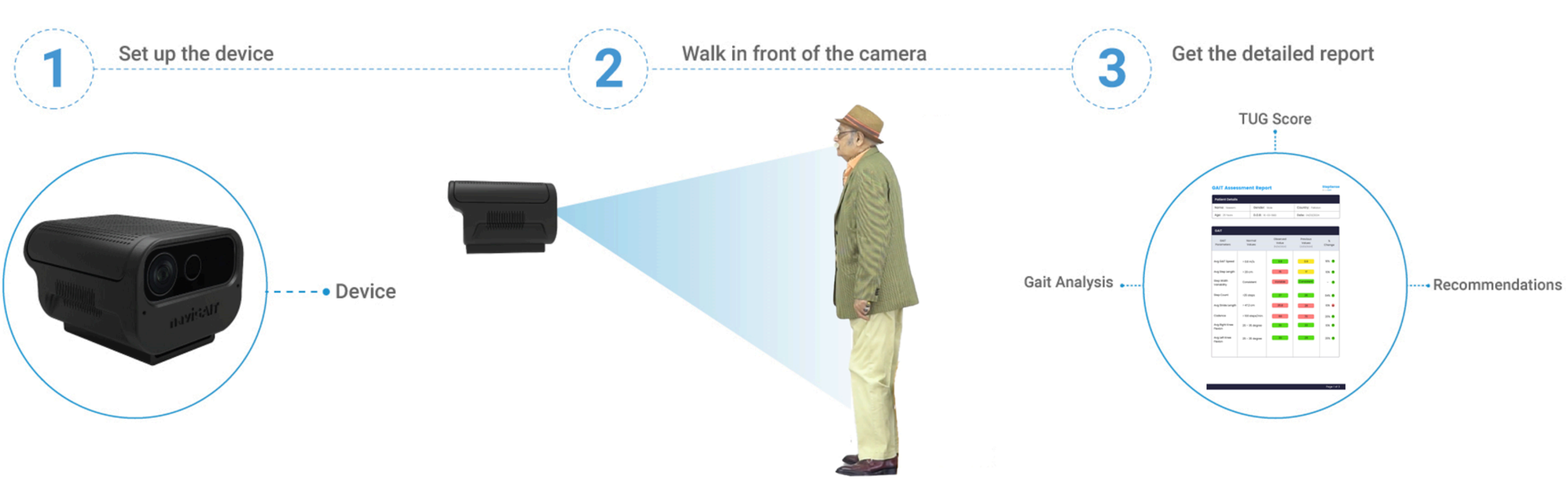
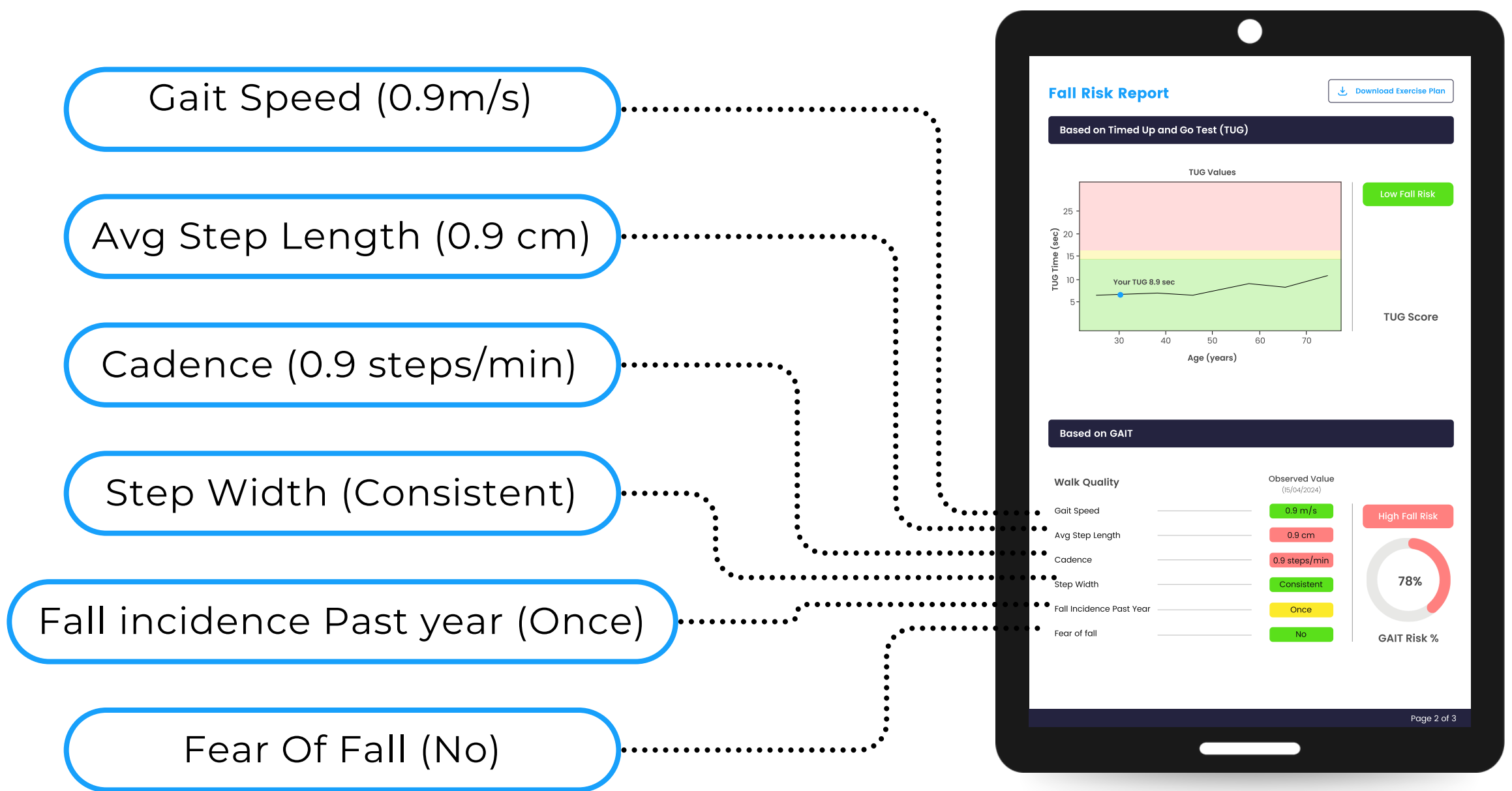
Avg Right Knee Flexion

Avg Left Knee Flexion

GAIT Assessment Report				
Patient Details				
Name: Naseem	Gender: Male	Country: Pakistan		
Age: 25 Years	D.O.B: 16-03-1990	Date: 04/03/2024		
GAIT				
GAIT Parameters	Normal Values	Observed Value (16/04/2024)	Previous Values (22/02/2024)	% Change
Avg GAIT Speed	> 0.8 m/s	0.8	0.9	10% ↑
Avg Step Length	> 20 cm	15	17	10% ↓
Step Width Variability	Consistent	Variable	Consistent	- ↓
Step Count	>25 steps	27	26	04% ↑
Avg Stride Length	> 47.2 cm	25.8	28	10% ↓
Cadence	> 100 steps/min	60	70	20% ↓
Avg Right Knee Flexion	25 - 35 degree	32	33	10% ↓
Avg Left Knee Flexion	25 - 35 degree	30	29	20% ↓

# Prediction of Risk of Fall

This device uses the Microsoft Kinect sensor to generate a report predicting the risk of falls. It measures and analyzes factors such as Time Up and Go, gait speed, step length, step width variability, and cadence based on predefined cut-off values. The program also saves real-time recording frames in a folder for each participant, allowing the user to manually interpret and analyze the data as needed. By comparing these parameters against normative values for age and gender, our system generates a comprehensive report that provides insights into the patient's gait abnormalities. The system also saves real-time recording frames for each participant, allowing for manual interpretation and analysis.



## References

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