# Digital Transformation Strategy Framework for Gait Analysis

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## Motivation

Gait analysis (GA) is an important objective in medical & rehabilitation clinics to diagnose & treat patients with various gait disorders. GA is not widely available due to scarcity of expensive equipment, need to attend a lab, complicated time consuming procedures needing technical or clinical staff and overall expense. Improving opportunities for GA to increase accessibility requires a major transformation strategy framework of GA that includes the development & use of new & affordable technologies for diagnosis and monitoring of gait. Therefore, we design a novel digital transformation strategy framework for GA based on the development & use of new technology, changes to value creation, structural change & affordability.

## Proposed Digital Transformation Strategy Framework for GA

The proposed GA digital transformation strategy (Fig 1) should be aligned to developing technology and the needs of companies and user requirements

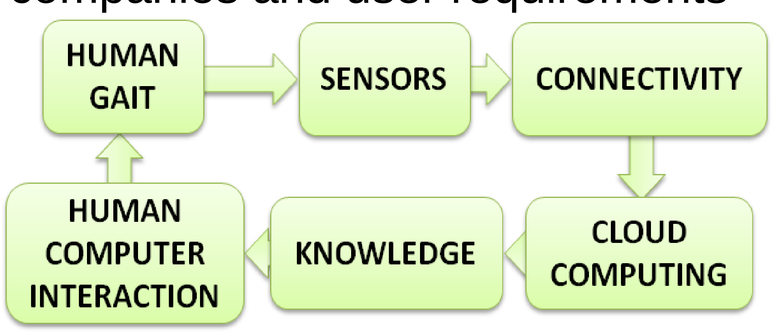


Figure 1: Proposed digital transformation framework

**HUMAN GAIT** measurements are Spatiotemporal, Kinematic, Kinetic & Dynamic Electromyography (EMG) based parameters from subjects. These are affected by (health, age, size, weight, speed) shown in Fig 2.

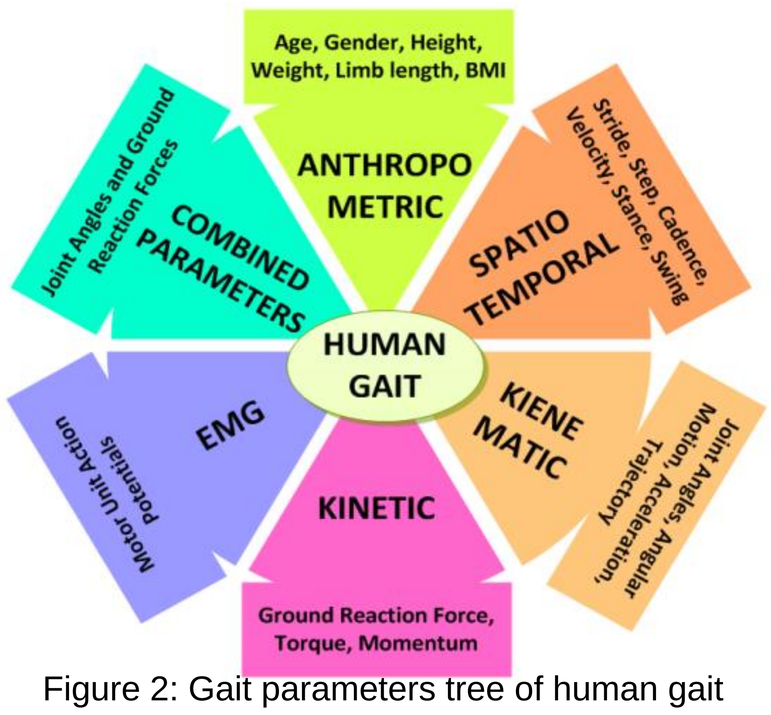


Figure 2: Gait parameters tree of human gait

**SENSORS**, for measuring oxygen saturation, electrocardiogram, heart rate, blood glucose, respiratory rate, blood pressure, body temperature which are human vital signs, can be broadly classified into 3 groups shown in Fig 3.

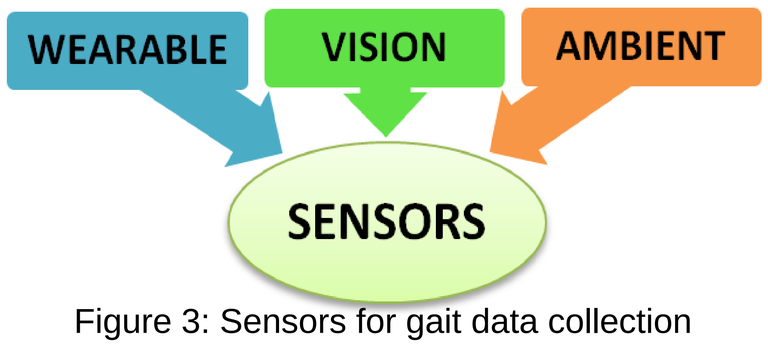


Figure 3: Sensors for gait data collection

**CONNECTIVITY** allows collected sensor data to be transferred through a network shown in Fig 4.

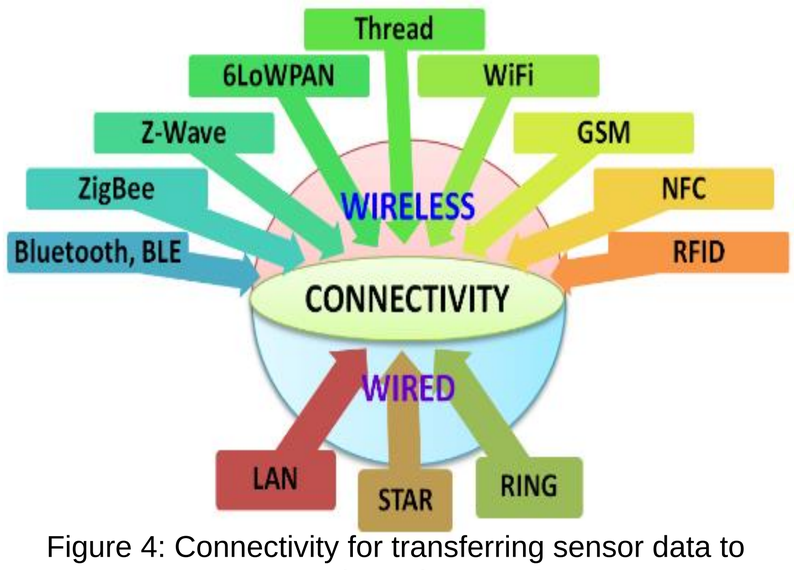


Figure 4: Connectivity for transferring sensor data to server through network

**CLOUD COMPUTING** the Internet cloud stores, manages, and processes data, providing security and safe communication (Fig 5).

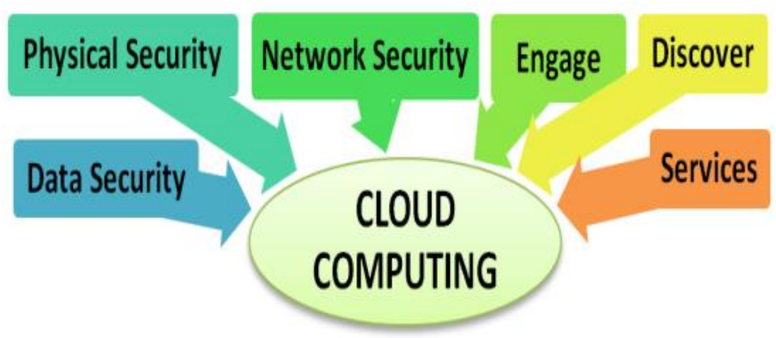


Figure 5: Cloud computing for servers hosted on the Internet to store, manage, and process data, provide security and safe communication

**KNOWLEDGE** created from stored gait information will be extracted by applying AI to understand & monitor gait. (Fig 6)

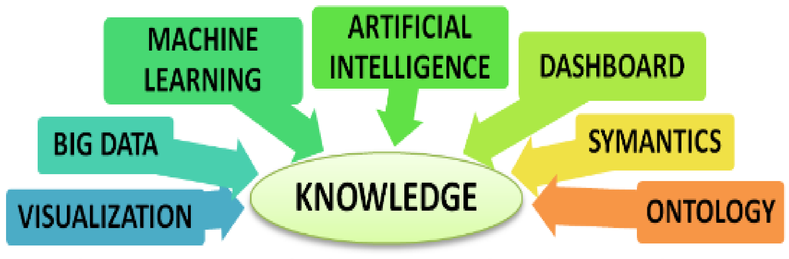


Figure 6: Knowledge extraction from gait information

**HUMAN COMPUTER INTERACTION** will allow patients, physician, social carer, biomechanics to make decisions shown in Fig 7.

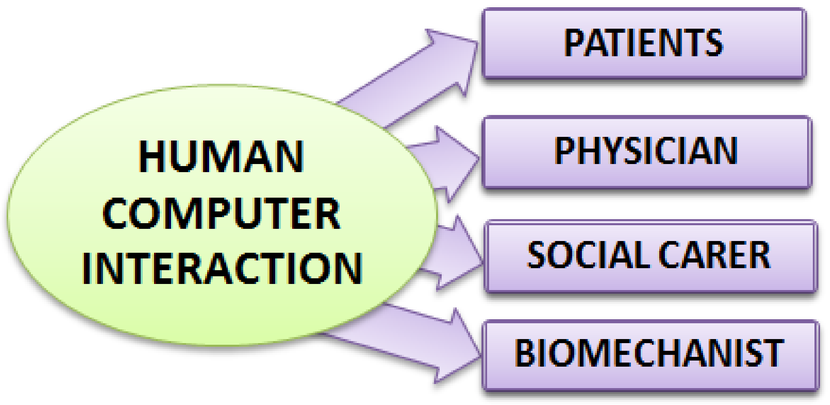


Figure 7: Human computer interaction

**PILOT STUDY** is conducted based on the proposed framework. Locomotion data is collected using synchronous Inertial Measurement Unit (IMU) sensors. Our results are shown in Fig 8.

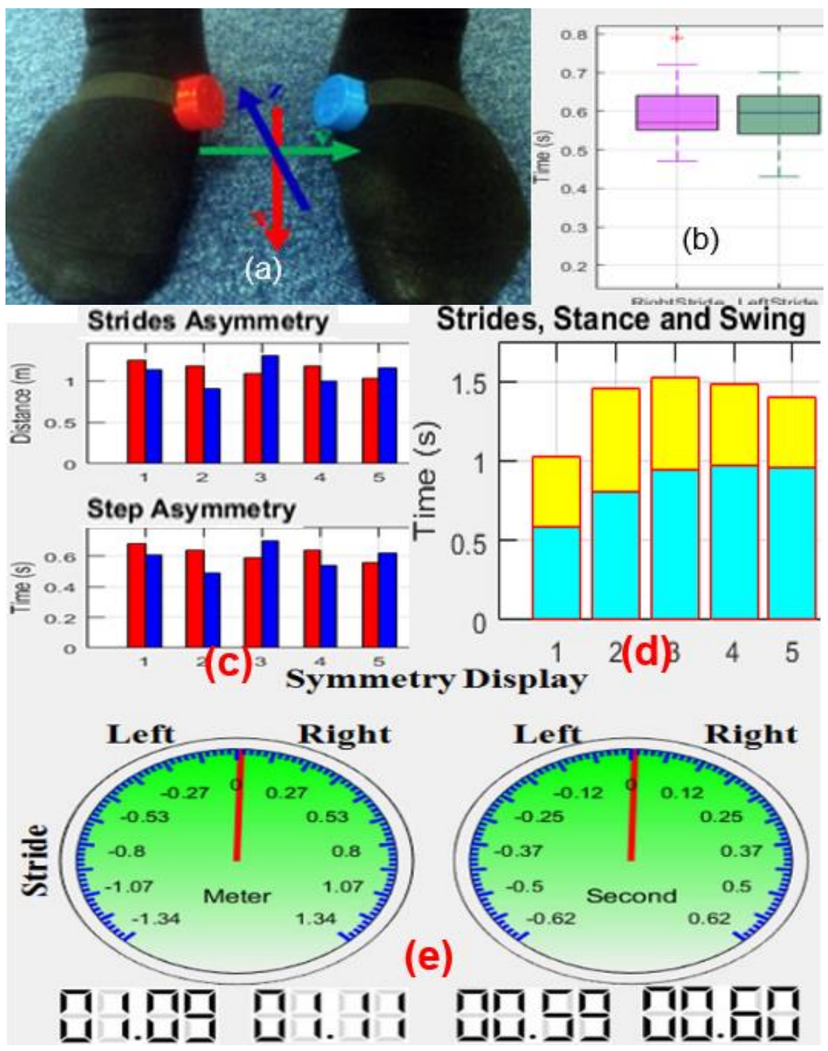


Figure 8: a) IMUs b) BoxPlot c) Asymmetry of legs d) Stride, Stance, Swing; d) Spatiotemporal gait visualization

**IMPACT** changes in value creation, reduces cost and increases portability of healthcare, reduces health inequalities, reduces burden of sickness, increases patient QoL and GP involvement, creates money for new business, opens jobs (Fig 9).

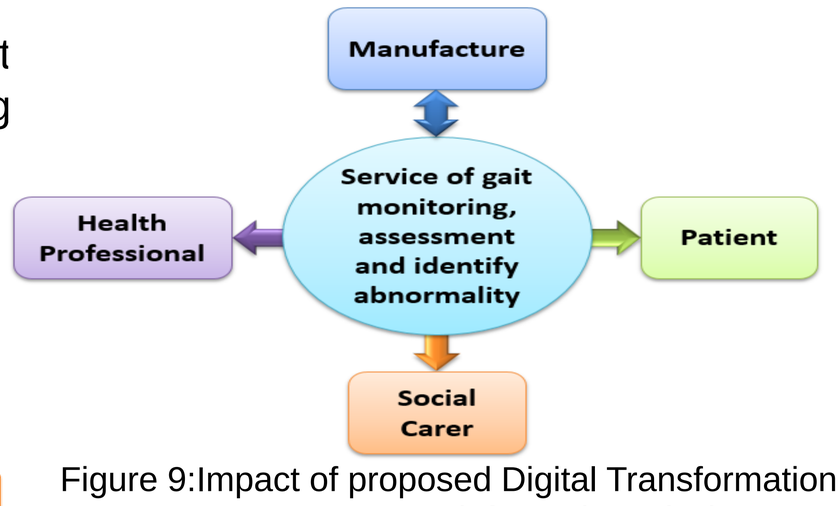


Figure 9:Impact of proposed Digital Transformation Strategy Framework for Gait analysis

## References

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