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CLOUD DATABASES FOR GAIT NETWORKING

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Abstract: Cloud databases provide a scalable and reliable platform for storing and processing large-scale gait data, enabling real-time insights through machine learning. Cloud computing has become a promising paradigm for storing and processing large-scale data, including gait data. This review explores the use of cloud databases for gait networking, highlighting its potential benefits and challenges. Gait networking is a novel application of cloud computing where gait data is collected from distributed sources and processed in the cloud to extract insights into human movement patterns. Cloud databases offer advantages such as scalability, elasticity, and reliability. The review covers different types of cloud databases suitable for gait networking, challenges, and state-of-the-art research in this area.

Keywords: Cloud Computing, Gait Networking, Databases, Gait Data

Introduction

Gait networking is a cloud-based technology that collects and processes gait data from distributed sources to analyse human movement patterns. This innovative application of cloud computing offers scalability, elasticity, and reliability, making it a potential technology in various medical industries. Cloud databases provide a reliable platform for storing and processing large amounts of data, while gait networking enables real-time analysis of human movement patterns. These technologies have the potential to revolutionise various industries by providing a scalable and reliable platform for storing and processing large amounts of data.

Cloud databases for gait networking are a promising technology that could revolutionise medicine by enabling the collection and analysis of gait data from various sources, such as wearable sensors, cameras, and smart floors. This data can be used to track human movement patterns over time, identify gait anomalies, and assess the risk of falls and injuries. Cloud databases offer a scalable and reliable platform for storing and processing large volumes of gait data, making it easier to diagnose and treat gait disorders. This innovative approach to gait networking has the potential to revolutionise the way it diagnose and treat gait disorders, making it a critical application in the field of medicine.

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Origins of Gait Network Analysis in Medical

Cloud databases for gait networking offer several medical uses for ages 5 to 60. Some examples are:

- Gait analysis has the potential to facilitate the timely identification and correction of developmental problems such as autism and cerebral palsy, as well as gait abnormalities associated with Parkinson's disease and multiple sclerosis in figure 1. The aforementioned data may be used in the formulation of intervention initiatives, the enhancement of long-term results, and the facilitation of prompt identification and therapy, thereby enhancing the overall well-being of the patient [1-2].

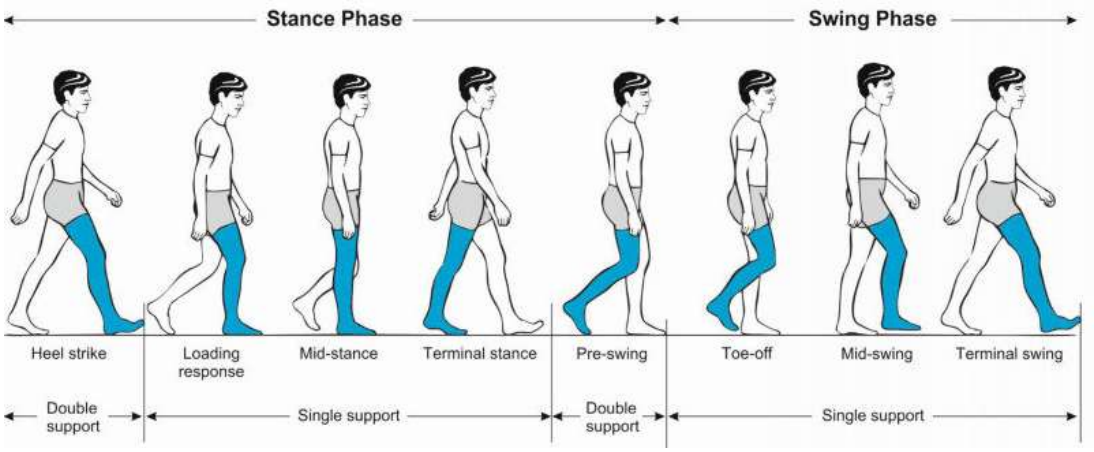

Figure 1. Representation of Gait cycle

- Gait networking can be utilised to monitor the progression of neurological disorders like Parkinson's and Alzheimer's, enabling the adjustment of treatment plans and improving the quality of life for patients. It can also be used to monitor the progression of gait disorders and the effectiveness of treatment, allowing for necessary adjustments to treatment plans [3-4].
- Gait networking aids in identifying individuals at risk of falls and fractures, enabling the development of preventive interventions like exercise programmes and home modifications [5-6].
- Gait networking can be utilized for rehabilitation after injuries and surgeries, tracking progress and adjusting programs to help patients achieve functional goals. It can also be used for gait disorders rehabilitation, providing feedback during exercises to improve gait and reduce fall risk, thus enhancing patient outcomes [7-8].

Medical cloud database applications for gait networking in 5–60-year-olds:

- Gait networking technology can find children with movement problems like cerebral palsy and muscular dystrophy as early as age 5 children with autism use monitors that they wear, and children with cerebral palsy use smart braces. To find autism early, a machine learning tool looks at data in a cloud library. The child's doctor is told, and help is given right away. Wearable sensor data on walking is stored and analysed in the cloud, which helps physical therapists change how they treat patients [9-10].
- Children over 10 years old can use cameras and smart floors in schools to collect and store data about their steps. This data can then be processed in the cloud. This information can be used to test how well students can walk and find possible walking issues that might be hurting their schoolwork. Gait networking can also be used to track the steps of kids who have juvenile idiopathic arthritis (JIA), a long-term autoimmune disease that can hurt and swell joints [11-12].
- Wearable sensors are placed on a 20-year-old adult with Parkinson's disease to track their walking patterns. These patterns are then sent to a cloud database so that a machine learning programme can analyse them. This information helps the doctor change the patient's medications and help them deal with their problems. Gait networking can also be used to watch how players walk, figure out which ones are most likely to get hurt, and make training plans for them. Cloud systems store and process movement data from athletes and other fitness-minded people. Keep track of their progress and spot changes that could be caused by injuries [13-14].
- Cloud databases can be utilised to store and process gait data from pregnant women aged 30-years, enabling monitoring of gait changes during pregnancy and identifying potential falls or complications. Gait networking can also be employed to identify women at risk of falls and develop interventions to reduce their risk [15-16].
- Middle-aged adults in the 40+ age group have smart shoes fitted to track their gait patterns, which a machine learning algorithm then analyses to spot falls and fractures. The data is sent to a cloud database, where it is used to prevent falls and fractures. The programme includes exercise classes and home modifications. Gait networking can also be used to monitor the gait of diabetic patients, who can develop foot ulcers and other complications due to damage to nerves and blood vessels. Cloud databases can store and process gait data to assess their function and treatment effectiveness [17-18].
- A smart shoe is fitted to an older adult who recently underwent knee surgery, allowing them to track their gait patterns. The data is sent to a cloud database, where it is analyzed by a machine learning algorithm to track their rehabilitation progress. The physical therapist then makes adjustments to their rehabilitation program using the data. Cloud databases can also be used to

store and process gait data from people with neurodegenerative diseases, such as Parkinson's and Alzheimer's, to track their progression and treatment effectiveness. Gait networking can also help identify older adults at risk of falls and develop interventions to reduce their risk [19-25].

Methodologies

Smart shoes and wearable sensors are increasingly being used to collect gait data, which can be connected to cloud databases for gait networking and analysed using machine learning to extract insights into human movement patterns. Different sensors can collect different types of gait data, such as foot pressure and joint angles, to create a comprehensive picture of the wearer's gait. The data can be sent to a cloud-based server via Bluetooth or Wi-Fi or stored on the smart shoe itself. Once stored in a cloud database, machine learning algorithms can be used to analyse the data, identify individuals by their gait, track human movement patterns over time, and detect anomalies in gait data in figure 2.

Wearable sensors collect various data about human movements, including acceleration, gyroscope, and magnetometer readings. Accelerometers measure acceleration in three dimensions, while gyroscopes measure rotational velocity in three dimensions. Force sensors measure foot pressure and force applied to different body parts during movement. These data can extract insights into gait patterns, such as stride length, cadence, and foot contact time. The wearable sensors should be designed to collect relevant data about the wearer's gait, such as foot pressure, joint angles, and walking speed. They should be comfortable and easy to wear. A scalable and reliable database should be developed to store and manage the collected data. The sensors should be connected to the IoT Cloud using a secure and reliable communication protocol. Machine learning algorithms can analyze the gait data, extracting insights such as identifying patterns, detecting anomalies, and predicting future gait patterns. Applications can be developed to improve health, safety, and performance, such as providing personalized fitness programs, tracking athlete progress, or identifying hazardous work environments.

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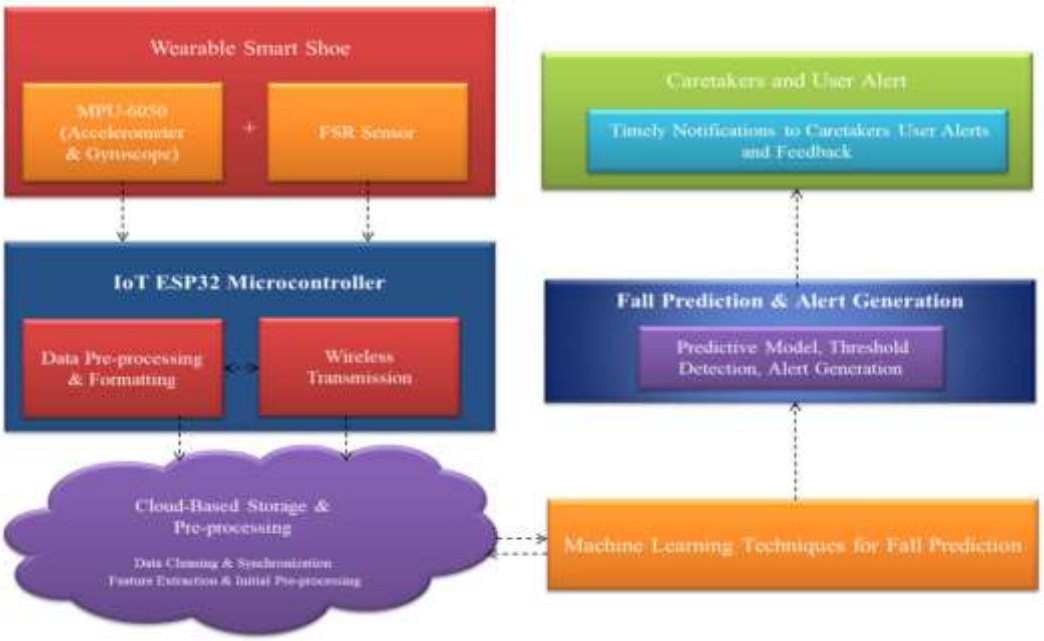

Figure 2 Representation of flow diagram process

Wearable sensors can collect data on foot pressure, joint angles, and walking speed, embedded in shoe soles and connected to a microcontroller. A cloud-based database can be developed to store the sensor data in a scalable and reliable manner. The sensors can be connected to the IoT cloud using secure communication protocols like HTTPS, either directly or through a gateway device. Machine learning algorithms can be developed to analyse gait data, identifying patterns that could lead to accidents or injuries. For instance, a machine learning algorithm could be trained to identify the gait patterns of workers at risk of tripping or falling. This technology could significantly improve safety and efficiency in the workplace.

The application can analyse workers' gait data to identify patterns that could lead to accidents or injuries. It can then identify hazardous work environments using the insights. Employers can then generate reports recommending safety interventions. This is just one example of how wearable sensors and IoT-connected databases can improve workplace safety. Other applications could also enhance health, fitness, and sports performance.

Develop and deploy wearable sensors and databases linked to the IoT Cloud for Gait Networking using these methods:

- Wearable sensors can be used in various methodologies to improve health, safety, and performance. Centralised methodology involves sending data to a central cloud database, where

it is processed and analysed using machine learning algorithms. This data is then used to develop applications that improve health, safety, and performance.

- Decentralised methodology involves processing and analysing data on the edge, reducing latency, and improving privacy and security.
- A hybrid methodology combines elements of both centralised and decentralised methodologies, allowing data to be processed and analysed on the edge for real-time applications and sent to a central cloud database for long-term storage and analysis.
- Real-time gait monitoring uses wearable sensors to collect data about the wearer's gait in real time. Then, machine learning algorithms analyze this data in a cloud database to derive insights into the wearer's movement patterns. This information can be used to provide real-time feedback to the wearer or alert carers or medical professionals to potential problems.
- Gait analysis uses wearable sensors to collect data about the wearer's gait over time, identifying trends and patterns. This information can be used to diagnose medical conditions, assess fall risk, or track rehabilitation progress.
- Gait-based authentication uses wearable sensors to authenticate the wearer's identity, making it more secure than traditional methods like passwords or PINs.

Different methodologies can be employed to develop and deploy wearable sensors and databases connected to the IoT cloud for gait networking, with the best approach varying based on the specific application requirements.

- A centralised methodology could be employed to track worker movement in a factory using wearable sensors. The data collected from these sensors is sent to a central cloud server for analysis using machine learning algorithms. The server identifies patterns in workers' movements that could indicate injury risks, generating alerts for caretakers to take the necessary steps to mitigate the risk of injuries. This system would significantly improve safety in the workplace.
- An edge computing methodology could be employed to develop a system for monitoring the gait of patients with neurological disorders. Wearable sensors would be attached to the patients' bodies, collecting data about their gait. Machine learning algorithms would analyse this data in real-time, identifying any anomalies. The sensors would then alert doctors, enabling them to manage the patients' conditions effectively.
- A hybrid methodology could be employed to track athlete’s fitness using wearable sensors attached to their bodies. These sensors collect data about their movements, which is then analysed using machine learning algorithms. The data is then sent to a central cloud server for

storage and long-term analysis. The cloud server uses machine learning algorithms to identify trends in performance and generate personalised training plans for the athletes.

Conclusion and Future Scope

Gait networking, a technology utilising wearable sensors and databases connected to the Internet of Things (IoT), has the potential to revolutionise fields like healthcare, fitness, and sports. By tracking and analysing human movement patterns, gait networking can provide valuable insights into health, performance, and safety. Wearable sensors collect data about foot pressure, joint angles, and walking speed, while databases store and manage large volumes of data. The IoT cloud provides a platform for connecting these sensors and databases, allowing applications to access and analyse gait data in real-time. Although still in its early stages, gait networking has the potential to develop diagnostic tools and treatment plans for neurological disorders, fall prevention programmes for older adults, personalised fitness programmes, and performance tracking. As this technology continues to develop, more impactful applications are expected to emerge. FallSafe and GaitTronics are examples of how wearable sensors and databases connected to the IoT cloud are already being used to improve people's lives. As this technology continues to develop, it will have even more innovative and impactful applications in the years to come.

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