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Data Article

Ten meter walk test with mobile devices: A dataset with accelerometer, magnetometer, and gyroscope

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ABSTRACT

This paper presents a dataset related to the performance of the Ten Meter Walking Test, a test to allow locomotor capacity in different research and clinical settings. One of the most important parameters to measure is the gait speed during a path of ten meters. The data available in this dataset consists of accelerometer, magnetometer, and gyroscope data acquired with a mobile device in a waistband. The experiments were performed two times by 109 individuals (30 males and 79 females) in different senior residences in the

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Keywords:
Ten meter walk test
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Health
Physical tests
Measurement

Fundão municipality (Portugal). The dataset includes 208 samples because the sensors reported some failures. The acquisition of the sensors data allows the creation of a technological method for the automatic measurement of features related to the Ten Meter Walk Test, promoting patient independence in measuring their physical health status.

Specifications Table

Subject	Signal Processing, and Health and medical sciences
Specific subject area	Evaluation of the results of Ten Meter Walk Test based on accelerometer, magnetometer, and gyroscope data
Type of data	Table
How the data were acquired	Data acquisition was performed from the accelerometer, magnetometer, and gyroscope sensors available in a Xiaomi Poco X3 Pro [1] with a simple mobile application that saves the raw data from the sensors in text files for further analysis. The mobile device has a Qualcomm Adreno (TM) 640 CPU with 8 cores and 8 GB of RAM. During the data acquisition, the smartphone was placed in a waistband, and it automatically acquired the sensors' data related to the Ten Meter Walk Test. The user will have to begin entering data of the start time, user identity, lifestyle, age, usage of walking aids, location, and physical test performed.
Data format	Raw JSON
Description of data collection	The selected individuals placed the smartphone in a waistband. The individual fulfil their data. The procedure that must be accomplished during the data acquisition related to Ten Meter Walk Test was explained to the individual. The user presses the button to start the capture, and the user performed the test. After the test, the user press the button to stop the data acquisition.
Data source location	Primary data sources: Institution: Centro Comunitário das Lameiras City/Town/Region: Silvares Country: Portugal Latitude and longitude for collected samples/data: 40º 8′ 31.003″ N 7º 40′ 13.543″ W Institution: Lar Nossa Senhora de Fátima City/Town/Region: Fundão Country: Portugal Latitude and longitude for collected samples/data: 40º 8′ 12.827″ N 7º 30′ 4.3″ W Institution: Centro Comunitário das Minas da Panasqueira City/Town/Region: Minas da Panasqueira Country: Portugal Latitude and longitude for collected samples/data: 40º 9′ 5.45″ N 7º 44′ 33.599″ W Institution: Lar da Misericórdia da Santa Casa da Misericórdia do Fundão City/Town/Region: Fundão Country: Portugal Latitude and longitude for collected samples/data: 40º 8′ 8.893″ N 7º 30′ 28.702″ W Institution: Centro de Dia de Alcongosta City/Town/Region: Alcongosta Country: Portugal Latitude and longitude for collected samples/data: 40° 7′ 0.84'' N 7° 29′ 1.68'' W
Data accessibility	Repository name: Raw dataset with accelerometer, magnetometer and gyroscope data related to Ten Meter Walk Test in Center of Portugal Data identification number: 10.17632/k6jcy7cjs2.3 Direct URL to data: https://data.mendeley.com/datasets/k6jcy7cjs2/3

1. Value of the Data

The presented dataset has greater importance for creating an accurate method for automatically diagnosing different diseases based on the Ten Meter Walk Test. The main reasons that led to obtaining this dataset are presented below:

- The dataset allows the creation of a framework for the automatic diagnosis of physical status, diseases evolution, and measurement of different parameters to help in the control of some health problems.
- The data allow the development of automatic feature extraction methods and diagnosis methods for the promotion of healthy living and patient independence [2,3].
- The identification and monitoring of physical state based on the Ten Meter Walk Test is made possible by the use of mobile devices for inertial data collecting, which supports the development of a Personal Digital Life Coach [4].
- It allows the creation of intelligent methods for patient empowerment, allowing the promotion of remote monitoring and telemedicine in different regions;
- The data continuously obtained may be merged in the present method based on user input to improve the methods and future diagnosis [5,6].
- With the support of big data and artificial intelligence technology, the design of the technological methods can be enhanced with the help of patient feedback [7,8].

2. Objective

The Ten Meter Walk Test is a physical test that analyses different functional parameters related to mobility, gait, and vestibular function, mainly based on measuring the gait speed and number of steps during a path with ten meters. Technological devices and sensors can be used to accurately measure these parameters with the in-person visualization of healthcare professionals. Still, more research is urging us to improve the methods for calculating these crucial parameters. Currently, there are different published studies related to this subject that refer to different datasets, but the datasets are private to perform a correct comparison with our published dataset. However, some relevant studies referred to private datasets related to the performance of the Ten Meter Walk Test. For example, Timmermans et al. [9] presented a dataset of 40 participants captured with Microsoft Kinect inertial sensors during the Ten Meter Walk Test performance with or without obstacles. O'Brien et al. [10] presented a dataset captured by fifty-one participants during the Ten Meter Walk Test performance in an instrumented walkway named GAITRite (CIR Systems, Inc., Franklin, NJ, USA), capturing different inertial movements. The authors of [11] presented using an optical motion capture system named Optotrak Certus (Northern Digital, Waterloo, Ontario, Canada) to measure different inertial parameters as our dataset in eleven patients. The authors of the study [12] used the ActiMyo device (Sysnav, Vernon, France) composed of a magneto-inertial sensor to capture the linear acceleration, the angular velocity, and the magnetic field of the movement in all directions in 82 patients for the performance of Ten Meter Walk Test. In general, the datasets used a similar sensor to our dataset, but we used a smartphone to produce a low-cost and highly used solution for the population. Also, the Ten Meter Walk Test is not yet explored to obtain reliable results with sensors. Therefore, our public dataset may promote the comparison with other new datasets and methodologies to improve the quality of life and commodity for the performance of the test.

The major problem found is that the datasets are private, making it difficult for the obtention of results by the scientific community. Also, the device cost can be another breakdown for correctly comparing the results obtained. Nevertheless, the dataset presented in this paper would allow the researchers to start working on creating industrial and academic solutions for the different measurements with this kind of test.

Although the Ten Meter Walk Test implementation with sensors is less studied, it is expected to be significant research for developing a standard technological solution for the different phys-

ical tests to promote a new personalized medicine [13,14]. Therefore, the presented dataset contains data acquired from the accelerometer, magnetometer, and gyroscope sensors that allow the creation of solutions for different physical functional tests that will be integrated into a Personal Digital Life Coach for Physical Therapy [4,15,16].

Data from three sensors were included in the dataset presented in this paper, namely accelerometer, magnetometer, and gyroscope sensors. The data was collected with a Xiaomi Poco X3 Pro [1] on a waistband during the Ten Meter Walk Test performance. The experiments were performed with 109 individuals (30 males and 79 females) that live in senior residences in the Fundão municipality (Portugal).

The dataset is included in a study to develop a framework for automatically diagnosing different parameters related to the Ten Meter Walk Test with a mobile device. Fig. 1 presents the architecture flowchart for the construction of this stage of the framework.

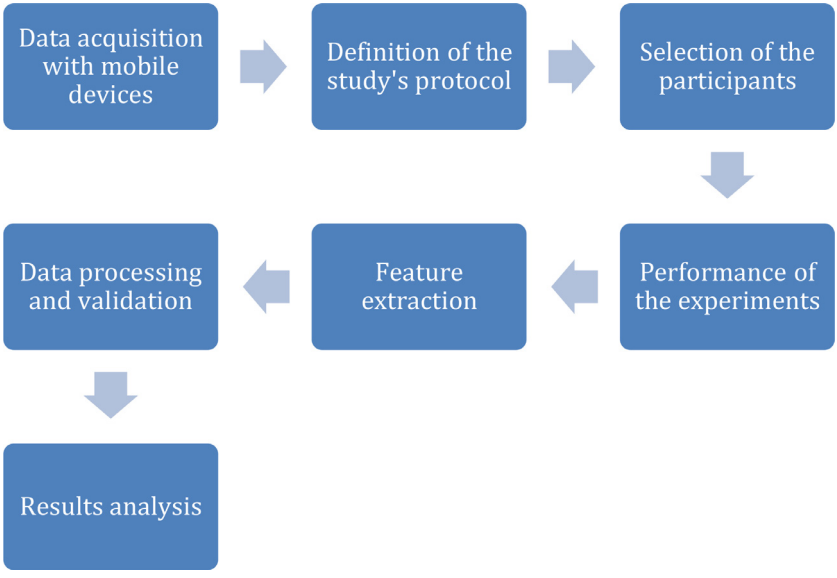

Fig. 1. Architecture flowchart for the dataset creation and data analysis.

3. Data Description

The dataset related to the Ten Meter Walk Test performance described in this paper is available in a Mendeley Data repository [17]. It contains 208 folders, each representing one capture with the files related to the different sensors. Each folder has three files named "accelerometer.txt", "gyroscope.txt", "magnetometer.txt", and "user_data.json". Firstly, the "accelerometer.txt" files contain the values represented in m/s^2. Secondly, the "gyroscope.txt" files contain the values expressed in rad/s. Thirdly, the "magnetometer.txt" files contain the values defined in µT. Finally, the "user_data.json" files contain a JSON object describing the individual habits and characteristics and the description of the sensors used.

The following columns are presented in the files related to the accelerometer data:

- First column: Timestamp of each sample (ms).
- Second column: Value of the *x*-axis of the accelerometer (m/s^2).
- Third column: Value of the *y*-axis of the accelerometer (m/s^2).
- Fourth column: Value of the *z*-axis of the accelerometer (m/s^2).

The following columns are presented in the files related to the magnetometer sensor:

- First column: Timestamp of each sample (ms);
- Second column: Value of the *x*-axis of the magnetometer (μT).
- Third column: Value of the *y*-axis of the magnetometer (μT).
- Fourth column: Value of the *z*-axis of the magnetometer (μT).

The following columns are presented in the files related to the gyroscope sensor:

- First column: Timestamp of each sample (ms).
- Second column: Value of the *x*-axis of the gyroscope (rad/s).
- Third column: Value of the *y*-axis of the gyroscope (rad/s).
- Fourth column: Value of the *z*-axis of the gyroscope (rad/s).

Figs. 2–4 present an example of the acquired data from the accelerometer, magnetometer, and gyroscope sensors related to one individual during the Ten Meter Walk Test performance.

For each sensor, *i.e.,* accelerometer, magnetometer, and gyroscope, the Euclidean norm [18] was measured for each row of the different files. Then, it was used to measure a set of features for further analysis of each sensor.

The source code used for measuring the different parameters was explained in the Jupyter Notebook available at https://github.com/impires/JupyterNotebooks10MWT, as detailed in the Code Availability section.

Table 1 presents the average of the different measured parameters of the data acquisition samples related to the Ten Meter Walk Test.

This raw data may be processed using machine learning techniques to better understand the complicated relationships between the data. However, even these overall descriptive statistics show that such trained models could differentiate between the traits of various individuals.

Table 1
Average of the parameters calculated for Ten Meter Walk Test experiments.

Parameters	Results
Total time (s)	16.093056
Steps	66.425121
Mean stepping time (s)	0.398567
Mean speed (m/s)	108.117042
Mean force (N)	1.634196
Distance (m)	25.180326
Mean power (W)	14,615.075400
Mean inclination (rad)	0.631712
MainDirXX (μT)	−0.009523
MainDirYY (μT)	0.013558
MainDirZZ (μT)	−0.000101

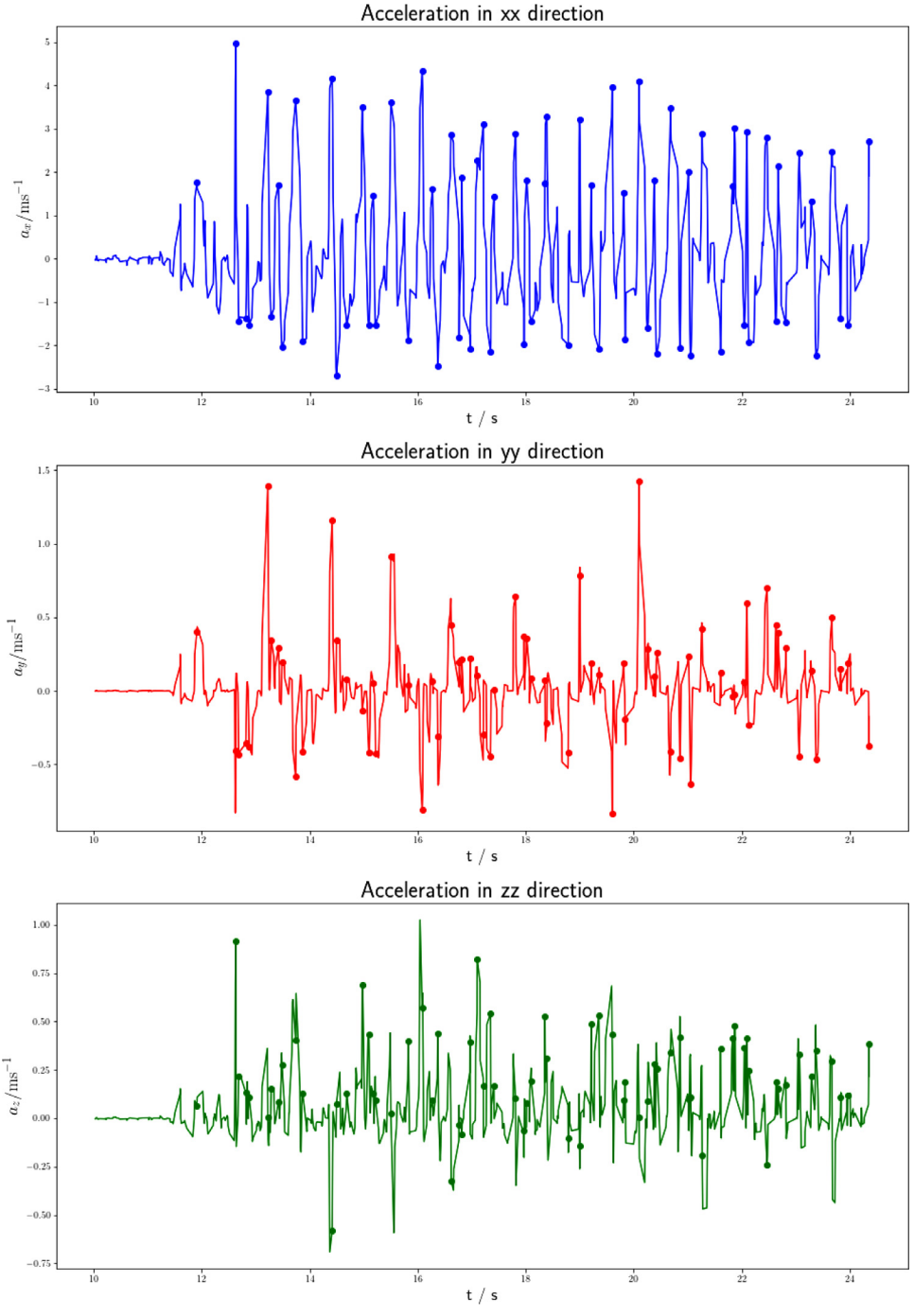

Fig. 2. Accelerometer data related to Ten Meter Walk Test.

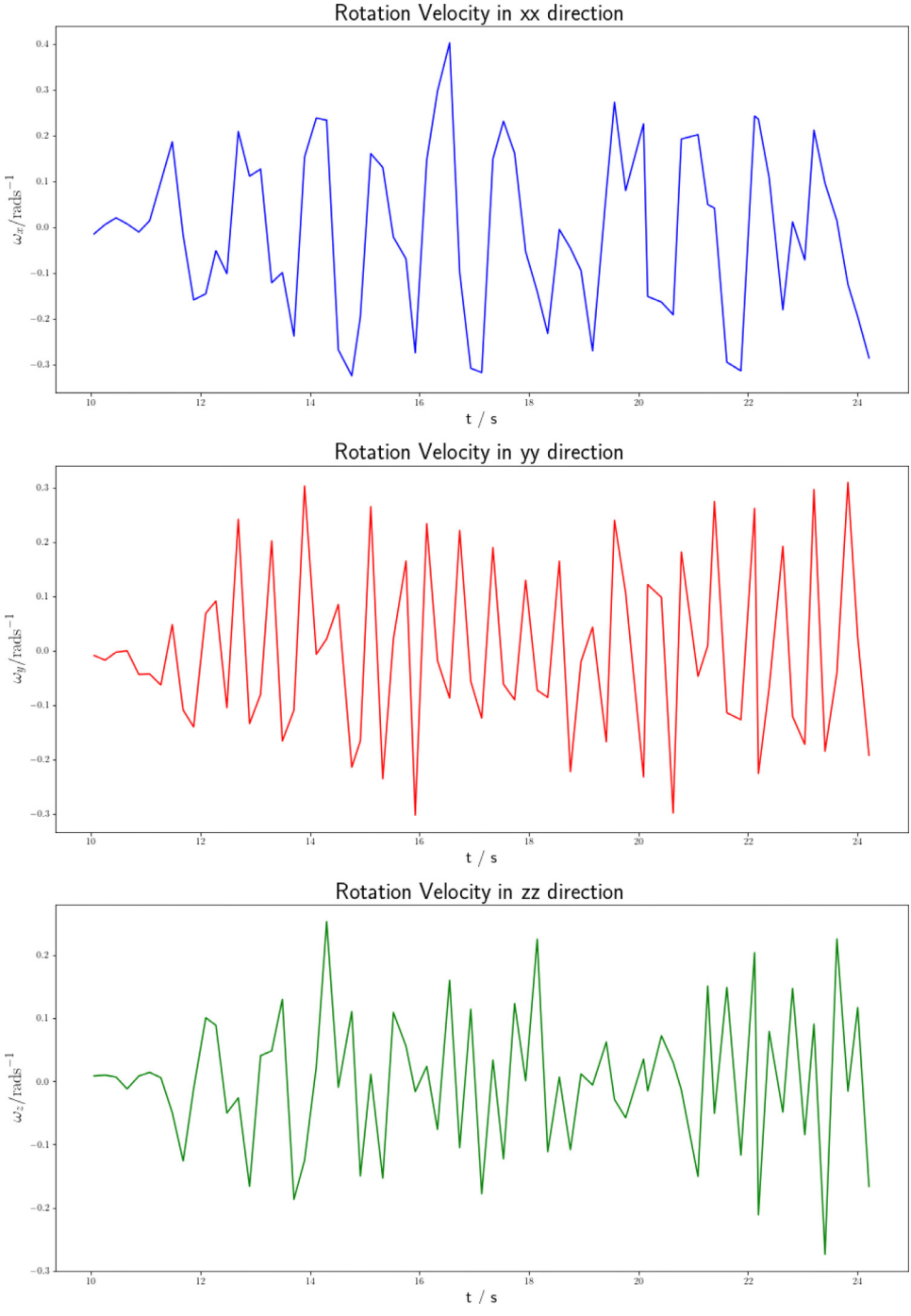

Fig. 3. Gyroscope data related to Ten Meter Walk Test.

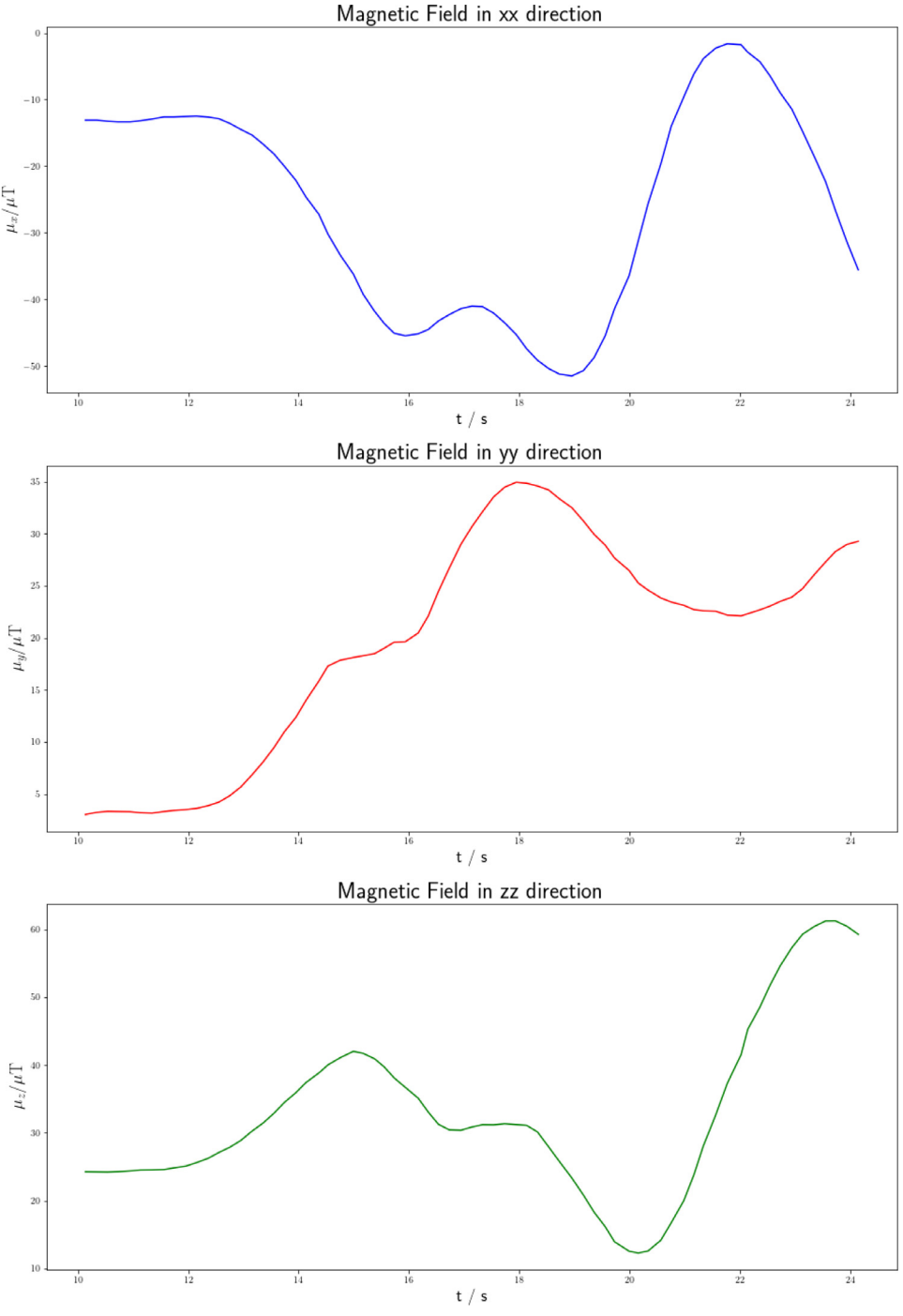

Fig. 4. Magnetometer data related to Ten Meter Walk Test.

4. Experimental Design, Materials, and Methods

4.1. Participants

The experiments related to this study were performed by 109 volunteers (30 males and 79 females) aged between 55 and 97 (81.0642 ± 9.2849) years old. All participants accurately read the study protocol, and they or their legal responsible signed an informed consent regarding the experiment procedures to allow the publication of the data acquired in a repository of Mendeley Data and the study results anonymously. The signature of the authorization form, and the fulfilment of the requirements related to the study, which are the capability to walk ten meters in a defined path, are essential for the realization of the test. Also, before the performance of the test, the participant or responsible people provided some data related to the physical status and habits of the individual. As different diseases were found in the sample, the diseases were categorized as presented in Table 2. The different data provided about the individuals is presented in Table 3. In addition, Tables 4–10 presents the details about the sample categories by age groups, gender, institution, weight intervals, height intervals, use of walking aids, and diseases groups. Ethics Committee from Universidade da Beira Interior approved the study with CE-UBI-Pj-2020-035. The data were acquired in some senior residences in Fundão municipality (Portugal), including 17 individuals in Silvares, 12 in Alcongosta, 17 in Minas da Panasqueira, and the remaining 63 in Fundão. Fifty-three individuals that performed the test were able to walk independently. Other data related to the different individuals can be anonymously found in the published dataset.

4.2. Data acquisition

Data acquisition was performed from the accelerometer, magnetometer, and gyroscope sensors available in a Xiaomi Poco X3 Pro [1] with a simple mobile application that saves the raw data from the sensors in text files for further analysis. The interface of the application is presented in Fig. 5. The mobile device has a Qualcomm Adreno (TM) 640 CPU with 8 cores and 8 GB of RAM. During the data acquisition, the smartphone was placed in a waistband, and it automatically acquired the sensors' data related to the Ten Meter Walk Test. The user will have to begin entering data of the start time, user identity, lifestyle, age, usage of walking aids, location, and physical test performed. The source code of the mobile application is available at https://github.com/impires/SensorsDataAcquisition.git.

Data collection for posterior analysis can begin as the user straps the mobile device to their waist. The accelerometer, magnetometer, and gyroscope sensors use the three axes. The accelerometer and gyroscope sensors use the LSM6DSO model [19]. It is a component with a power consumption of 0.55 mA, up to ±16 g full scale, up to ±2000 dps full scale, and a maximum analog supply voltage of 3.6 V. The data were captured from these sensors with a frequency of 100 Hz. The magnetometer is included in another hardware component, the ak0991x [20]. It is a component with a power consumption of 2.4 mA, a measurement range of ± 4900 μT, and a maximum analog supply voltage of 3.6 V. The data were captured with a frequency of 50 Hz.

Each row of the data of the various sensors is labeled with the matching Unix timestamp as to when the data was recorded. For example, the Unix timestamp represents the milliseconds between January 1st, 1970, and the current date and time. The synchronization issue is irrelevant to the proposed usage since data from all sensors are taken on the same mobile device. As a result, the data may be analyzed independently and has timestamps from the same clock.

Table 2
Diseases categories.

Categories	Diseases
Cardiovascular:	Arterial hypertension; Arterioscopic plaque in the right carotid bulb; Atrial fibrillation; Atrioventricular block; Cardiac arrhythmia; Cardiac insufficiency; Cardiovascular disease; Cardiomyopathy; Chronic arterial disease; Chronic atrial fibrillation; Chronic venous insufficiency; Coronary heart disease; Deep vein thrombosis; Dilation of the left auricle; Heart failure; Hypertensive Congestive Heart Failure; Ischemic Heart Disease; Left atrial dilation; Left Ventricular Hypertrophy; Moderate Mitral Insufficiency; Obstructive Venous Alteration; Occlusive peripheral arterial disease; Pacemaker; Pulmonary Arterial hypertension; Pulmonary edema; Sinus bradycardia; Stroke; Transient ischemic attacks; Vascular dementia; Venous thrombosis; Ventricular fibrillation; Ischemic stroke
Neurological:	Alzheimer's disease; Cognitive deficit; Confusion syndrome; Deficit of verbal expression; Dementia; Dizziness Syndrome; Down's syndrome; Epilepsy; Ephaptic Gnosis; Hallucinations; Insomnia; Insanity; Intellectual Deficit; Ménière's Syndrome; Mental disability; Neurotic depression; Oligophrenia; Parietal Meningioma; Parkinson's disease; Schizophrenia; Stuttering; Tremor; Vertigo syndrome
Musculoskeletal:	Bifascicular block; Bilateral gonarthrosis; Bilateral Omarthrosis; Cervical Hernia; Cervical spondylosis; Coxarthrosis; Discopathy; Distal Radio; Dorsal Spondylosis; Fracture; Gonarthrosis; Hernia; Hip amputation; Hip Prosthesis; Knee Prosthesis; Lumbar hernia; Lumbar Spondylosis; Left rhizarthrosis; Osteoarthritis; Osteopathic Dorsal Trauma; Osteopenia; Osteoporoses; Rheumatoid Arthritis; Right Gonarthrosis; Sinusoidal Hypertrophy of the Prostate; Spine problems; Tension headaches; Wrist osteoarthritis
Digestive:	Barrett's esophagus; Basalioma; Bulbar Ulcers; Cholecystectomy; Cholesterol; Colon adenocarcinoma; Colonic neoplasm; Constipation; Dacryocystorhinostomy; Diarrheic; Diverticular disease; Duodenal ulcer; Esophagitis; Gastric ulcers; Gastritis; Hemorrhoids; Intestinal bands; Ischemic leukoencephalopathy; Post-Cholecystectomy Syndrome; Right hemicolectomy; Sequelae of Peritoneal; Sigmoidectomy; Supraumbilical hernia; Temporary colostomy and laparotomy; Ulcer
Respiratory:	Asthma; Chronic obstructive pulmonary disease; Chronic Sinusitis; Obstructive sleep apnea syndrome; Silicosis; Rhinoconjunctivitis; Allergic rhinitis; Smoking; ex-smoker; Tuberculosis
Endocrine:	Diabetes; Hyperplasia; Morbid Obesity; Obesity; Dyslipidemia; Hypercholesterolemia; Thyroid nodules; Modular goiter; Hyperthyroidism; Hypertrophy of the interventricular septum; Primary hyperuricemia; Hypothyroidism; Vitamin D deficiency
Urinary:	Benign Prostate Hyperplasia; Chronic Kidney Disease; Kidney disease; Prostate; Renal Lytrase; Right nephrectomy; Urosepsis
Vision:	Age-related macular degeneration; Blind on the right; Cataract; Glaucoma
Hearing:	Hearing problems; Perceptual hypoacusis
Dermatological:	Dermatitis; Psoriasis
Psychiatric:	Aggressiveness; Alcoholism; Anxiety; Bipolar disorder; Depressive Syndrome; Depressive-anxious syndrome; Endogenous Depression; Hyperactivity; Psychosis
Hematological:	Chronic Anemia; Anemia; Anticoagulated
Lifestyle:	Ethanolic habits
Cancer:	Lymphoma; Melanoma
Infectious:	Herpes; Tuberculosis
Circulatory:	Varicose veins

4.3. Procedure

For the performance of the experiments, some auxiliary materials are needed, such as a mobile device, waistband, measurement tape, and two cones. The experiments were performed in a room in the different institutions with reliable lighting conditions and without obstacles other than the cones to mark the path. Before applying the test, a path of ten meters was measured and marked with cones. The sensors' data acquisition was performed with a mobile application installed on an Android device. The procedures for the performance of the test are detailed as follows:

1. Installation of the mobile application.
2. Open the mobile application;

Table 3
Description of the data acquired.

Category	Data acquired	Distribution (Total)
Personal data	Age	81.0642 ± 9.2849 years old
	Gender	30 (Male), and 79 (Female)
	Region	17 (Silvares – Fundão), 12 (Alcongosta – Fundão), 17 (Minas da Panasqueira – Fundão), and 63 (Fundão)
	Country	Portugal
	Weight (kg)	66.4312 ± 15.7058
	Height (cm)	152.7064 ± 9.3900
	COVID-19 vaccinated	106 (Yes), and 3 (No)
	Walking aids	53 (No), and 56 (Yes)
Physical activity	Gym Practice	20 (Yes), and 89 (No)
	Gym Frequency (times/week)	0.4312 ± 0.9848
	Sports practice	No
	Physical Activity Frequency (days/week)	2.1835 ± 2.4913
	Physical Activity Duration (hours/session)	0.3440 ± 0.3018
	Exercise Type	37 (None), 43 (Walking), 2 (Individual Sports), and 27 (Team Sports)
Nutrition	Specific Diet	No
	Fruit or Vegetables (number/day)	5.2018 ± 2.1072
	Sweets (times/week)	1.0550 ± 1.4583
	Water (liters/day)	1.6789 ± 0.7593
Health	Diseases Categories	Cardiovascular (69), Neurological (33), Musculoskeletal (31), Digestive (24), Respiratory (15), Endocrine (47), Urinary (11), Vision (5), Hearing (3), Dermatological (2), Psychiatric (33), Hematological (4), Lifestyle (1), Cancer (2), Infectious (2), and Circulatory (1)
	Smoking Habits	2 (Yes), and 107 (No)
	Sleeping time (hours)	8.1284 ± 1.2026
	Alcoholic beverages	No
Conditions during the test	Physical Status	96 (Normal), 8 (With Energy), and 5 (Tired)
	Time	52 (Morning), and 57 (Afternoon)
	Interest (1..5)	3.2018 ± 0.4256

3. Select the button “Edit Personal Data” to fill in the correct data related to the participant, where a defined identifier was registered as it is the most important data to anonymize the final data.
4. Put the mobile device in the waistband of the participant.
5. Press the “Start capture” button to initialize the procedure for data acquisition.
6. Wait 10 s for the initialization of the data acquisition that is signalized by an acoustic signal.
7. Walk the ten meters between the cones.
8. Stop the test by pressing the “Stop capture” button.
9. Remove the mobile device from the waistband of the participant.

5. Data Validation and Quality Control

5.1. Invalid data information

For the data analysis, some invalid acquisitions were found that were discarded for the analysis presented in the Jupyter Notebook (https://github.com/impires/JupyterNotebooks10MWT). Therefore, the dataset’s rationale is to contain 2 captures for each of the 109 individuals during the Ten Meter Walk Test performance, representing 218 captures. However, the dataset available only contains 208 captures because some of the captures failed for some hardware or software

Table 4
Description of the data acquired by age groups.

Category	Data acquired	$N < 60$	$60 \leq N < 70$	$70 \leq N < 80$	$80 \leq N < 90$	$N \geq 90$
Personal data	Gender	2 (Male)	6 (Male), and 10 (Female)	4 (Male), and 14 (Female)	11 (Male), and 41 (Female)	5 (Male), and 11 (Female)
	Region	2 (Fundão)	2 (Silvares – Fundão), 2 (Alcongosta – Fundão), 4 (Minas da Panasqueira – Fundão), and 6 (Fundão)	4 (Silvares – Fundão), 3 (Alcongosta – Fundão), 2 (Minas da Panasqueira – Fundão), and 9 (Fundão)	9 (Silvares – Fundão), 4 (Alcongosta – Fundão), 8 (Minas da Panasqueira – Fundão), and 31 (Fundão)	2 (Silvares – Fundão), 3 (Alcongosta – Fundão), 3 (Minas da Panasqueira – Fundão), and 8 (Fundão)
	Weight (kg)	76.25 ± 17.3853	66.5825 ± 15.7763	66.3861 ± 15.3323	65.7629 ± 14.7527	66.1075 ± 14.6060
	Height (cm)	164.5 ± 98.5440	152.7087 ± 9.5205	152.8416 ± 9.4676	152.3299 ± 9.1682	152.7634 ± 9.2753
	COVID-19 vaccinated	2 (Yes)	14 (Yes), and 2 (No)	18 (Yes)	51 (Yes), and 1 (No)	16 (Yes)
	Walking aids	1 (No), and 1 (Yes)	13 (No), and 3 (Yes)	12 (No), and 6 (Yes)	22 (No), and 29 (Yes)	5 (No), and 11 (Yes)
Physical activity	Gym Practice	2 (Yes)	4 (Yes), and 12 (No)	1 (Yes), and 17 (No)	7 (Yes), and 44 (No)	3 (Yes), and 13 (No)
	Gym Frequency (times/week)	3	0.4563 ± 1.0076	0.3960 ± 0.9495	0.4124 ± 0.9656	0.4301 ± 0.9824
	Sports practice	No	No	No	No	No
	Physical Activity Frequency (days/week)	3	2.2427 ± 2.4713	2.2871 ± 2.5351	1.8969 ± 2.2889	2.1290 ± 2.3967
	Physical Activity Duration (hours/session)	0.5	0.3592 ± 0.3007	0.3515 ± 0.2962	0.3299 ± 0.3052	0.3548 ± 0.3002
	Exercise type	2 (Team Sports)	4 (None), 4 (Walking), 1 (Individual Sports), and 7 (Team Sports)	5 (None), 12 (Walking), and 1 (Team Sports)	19 (None), 20 (Walking), and 12 (Team Sports)	6 (None), 5 (Walking), 2 (Individual Sports), and 3 (Team Sports)
Nutrition	Specific diet	No	No	No	No	No
	Fruit or Vegetables (number/day)	5	5.1262 ± 2.1129	5.1287 ± 2.1338	5.1959 ± 2.2157	5.0753 ± 2.1831
	Sweets (times/week)	1	1.1165 ± 1.4773	1.0792 ± 1.5012	1.1231 ± 1.5156	1.1613 ± 1.5343
	Water (liters/day)	1	1.6748 ± 0.7564	1.6782 ± 0.7733	1.6392 ± 0.7560	1.6613 ± 0.7702

(*continued on next page*)

Table 4 (*continued*)

Category	Data acquired	$N < 60$	$60 \leq N < 70$	$70 \leq N < 80$	$80 \leq N < 90$	$N \geq 90$
Health	Diseases	Cardiovascular (1), Vision (1), and Dermatological (1)	Cardiovascular (8), Neurological (5), Urinary (2), Musculoskeletal (2), Digestive (2), Respiratory (5), Endocrine (5), Vision (1), Dermatological (1), and Psychiatric (9)	Cardiovascular (12), Neurological (6), Digestive (3), Musculoskeletal (6), Respiratory (1), Endocrine (7), Urinary (1), Vision (1), Hearing (1), Psychiatric (6), Infectious (1), and Circulatory (1)	Cardiovascular (37), Neurological (19), Digestive (12), Respiratory (7), Urinary (6), Musculoskeletal (17), Endocrine (29), Psychiatric (16), Cancer (2), Hematological (4), Lifestyle (1), and Infectious (1)	Cardiovascular (11), Neurological (3), Digestive (7), Musculoskeletal (6), Respiratory (2), Endocrine (6), Urinary (2), Vision (2), Hearing (2), and Psychiatric (2)
	Smoking habits	2 (No)	1 (Yes), and 15 (No)	18 (No)	1 (Yes), and 51 (No)	16 (No)
	Sleeping time (hours)	8	8.1165 ± 1.2311	8.0891 ± 1.2256	8.1134 ± 1.2065	8.1183 ± 1.2323
	Alcoholic beverages	No	No	No	No	No
Conditions during the test	Physical Status	2 (Normal)	12 (Normal), 3 (With Energy), and 1 (Tired)	17 (Normal), and 1 (With Energy)	45 (Normal), 3 (With Energy), and 4 (Tired)	15 (Normal), and 1 (With Energy)
	Time	2 (Afternoon)	10 (Morning), and 6 (Afternoon)	11 (Morning), and 7 (Afternoon)	21 (Morning), and 31 (Afternoon)	10 (Morning), and 6 (Afternoon)
	Interest (1..5)	3	3.2136 ± 0.435	3.2178 ± 0.4383	3.2268 ± 0.445	3.2366 ± 0.452

Table 5
Description of the data acquired by gender.

Category	Data acquired	Male	Female
Personal data	Age	81.1546 ± 9.4531 years old	81.3663 ± 9.3699 years old
	Region	7 (Silvares – Fundão), 2 (Alcongosta – Fundão), 2 (Minas da Panasqueira – Fundão), and 17 (Fundão)	10 (Silvares – Fundão), 10 (Alcongosta – Fundão), 14 (Minas da Panasqueira – Fundão), and 42 (Fundão)
	Weight (kg)	66.8247 ± 15.3616	65.8119 ± 14.6005
	Height (cm)	153.2784 ± 9.3237	152.3762 ± 9.1212
	COVID-19 vaccinated	27 (Yes), and 1 (No)	74 (Yes), and 2 (No)
	Walking aids	17 (No), and 11 (Yes)	39 (No), and 37 (Yes)
Physical Activity	Gym Practice	6 (Yes), and 22 (No)	11 (Yes), and 65 (No)
	Gym Frequency (times/week)	0.4124 ± 0.9656	0.3960 ± 0.9495
	Sports practice	No	No
	Physical Activity Frequency (days/week)	2.3814 ± 2.5431	2.0990 ± 2.4556
	Physical Activity Duration (hours/session)	0.3660 ± 0.2933	0.3366 ± 0.3009
	Exercise Type	6 (None), 10 (Walking), 1 (Individual Sports), and 11 (Team Sports)	31 (None), 33 (Walking), 1 (Individual Sports), and 13 (Team Sports)
Nutrition	Specific Diet	No	No
	Fruit or Vegetables (number/day)	5.0722 ± 2.1372	5.1881 ± 2.1712
	Sweets (times/week)	1.1031 ± 1.5240	1.0792 ± 1.5012
	Water (liters/day)	1.6856 ± 0.7817	1.6535 ± 0.7544
Health	Diseases	Cardiovascular (17), Neurological (9), Musculoskeletal (7), Digestive (6), Respiratory (6), Endocrine (13), Urinary (7), Vision (2), Dermatological (2), Psychiatric (5), Hematological (3), and Lifestyle (1)	Cardiovascular (52), Neurological (24), Musculoskeletal (24), Digestive 18), Respiratory (9), Endocrine (34), Urinary (4), Vision (3), Hearing (3), Psychiatric (28), Hematological (1), Cancer (2), Infectious (2), and Circulatory (1)
	Smoking Habits	1 (Yes), and 27 (No)	1 (Yes), and 75 (No)
	Sleeping time (hours)	8.0722 ± 1.2437	8.1089 ± 1.2075
	Alcoholic beverages	No	No
Conditions during the test	Physical Status	24 (Normal), 2 (With Energy), and 2 (Tired)	67 (Normal), 6 (With Energy), and 3 (Tired)
	Time	15 (Morning), and 13 (Afternoon)	37 (Morning), and 39 (Afternoon)
	Interest (1..5)	3.2268 ± 0.445	3.2178 ± 0.4383

problems, involuntary movements, or some physical or psychological incapacity of the individual. Table 11 presents the data related to the valid captures available in the dataset, where we can conclude that 98.07% of the dataset is completely fulfilled.

5.2. Technical validation

The data quality is essential for correctly valuing the different parameters related to the Ten Meter Walk Test. The fulfilled data were used to perform the relation between the sensors' data, the Ten Meter Walk Test, and the gender and diseases of the individuals analyzed. For that purpose, different machine learning methods were used, including k-Nearest Neighbors, Linear SVM, RBF SVM, Decision Tree, Random Forest, Neural Networks, AdaBoost, and Naive Bayes. The configurations of the different methods are detailed in Jupyter Notebook

Table 6
Description of the data acquired by Institution.

Category	Data acquired	Centro Comunitário das Lameiras	Centro Comunitário das Minas da Panasqueira	Lar Nossa Senhora de Fátima / Lar da Misericórdia da Santa Casa da Misericórdia do Fundão	Centro de Dia de Alcongosta
Personal Data	Age	82.2353 ± 8.3780 years old	79.3529 ± 11.2469 years old	81.2429 ± 9.3475 years old	81.1667 ± 8.8814 years old
	Gender	7 (Male), and 10 (Female)	3 (Male), and 14 (Female)	16 (Male), and 42 (Female)	2 (Male), and 10 (Female)
	Weight (kg)	73.2941 ± 17.5562	59.0 ± 15.2725	66.4286 ± 14.2783	65.25 ± 17.4226
	Height (cm)	158.5882 ± 7.4083	145.3529 ± 10.2221	153.1857 ± 8.4292	153.4167 ± 9.7371
	COVID-19 vaccinated	16 (Yes), and 1 (No)	17 (Yes)	56 (Yes), and 2 (No)	12 (Yes)
	Walking aids	8 (No), and 9 (Yes)	7 (No), and 10 (Yes)	30 (No), and 28 (Yes)	9 (No), and 3 (Yes)
Physical Activity	Gym Practice	17 (No)	17 (No)	17 (Yes), and 41 (No)	12 (No)
	Gym Frequency (times/week)	0	0	0.5714 ± 1.0977	0
	Sports practice	No	No	No	No
	Physical Activity Frequency (days/week)	6.1176 ± 1.7967	2.1835 ± 2.4913	1.7857 1.9328	0.8333 ± 0.8348
	Physical Activity Duration (hours/session)	0.4706 ± 0.1213	0.0588 ± 0.1660	0.3786 ± 0.3120	0.3333 ± 0.2462
	Exercise Type	1 (None), 15 (Walking), and 1 (Individual Sports)	15 (None), 1 (Walking), and 1 (Team Sports)	17 (None), 16 (Walking), 1 (Individual Sports), and 24 (Team Sports)	2 (None), and 10 (Walking)
Nutrition	Specific Diet	17 (No)	17 (No)	58 (No)	No
	Fruit or Vegetables (number/day)	5	5.8824 ± 1.4090	5.0771 ± 2.4957	2.3333 ± 1.3707
	Sweets (times/week)	0	0.4118 ± 0.5073	1.4571 ± 1.6479	2.3333 ± 2.3484
	Water (liters/day)	2.1176 ± 0.9275	1.4118 ± 0.5925	1.6286 ± 0.7357	1.75 ± 0.6216

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Table 6 (*continued*)

Category	Data acquired	Centro Comunitário das Lameiras	Centro Comunitário das Minas da Panasqueira	Lar Nossa Senhora de Fátima / Lar da Misericórdia da Santa Casa da Misericórdia do Fundão	Centro de Dia de Alcongosta
Health	Diseases	Cardiovascular (15), Neurological (10), Musculoskeletal (9), Digestive (10), Respiratory (7), Endocrine (13), Urinary (2), Vision (2), Hearing (1), Psychiatric (5), Hematological (1), Cancer (1), and Circulatory (1)	Cardiovascular (14), Neurological (6), Musculoskeletal (6), Digestive (3), Respiratory (4), Endocrine (11), Urinary (1), Vision (1), Psychiatric (9), Cancer (1), and Infectious (1)	Cardiovascular (35), Neurological (14), Musculoskeletal (11), Digestive (7), Respiratory (4), Endocrine (20), Urinary (8), Vision (2), Dermatological (2), Psychiatric (17), Hematological (3), Lifestyle (1), and Infectious (1)	Cardiovascular (5), Neurological (3), Musculoskeletal (5), Digestive (4), Endocrine (3), Hearing (2), and Psychiatric (33)
	Smoking Habits	17 (No)	1 (Yes), and 16 (No)	1 (Yes), and 57 (No)	12 (No)
	Sleeping time (hours)	8.3529 ± 1.2719	8.2941 ± 0.6860	7.9857 ± 1.2909	6.9167 ± 1.3790
	Alcoholic beverages	No	No	No	No
Conditions during the test	Physical Status	17 (Normal)	13(Normal), and 4 (With Energy	49 (Normal), 4 (With Energy), and 5 (Tired)	12 (Normal)
	Time	11 (Morning), and 6 (Afternoon)	17 (Morning)	12 (Morning), and 46 (Afternoon)	12 (Morning)
	Interest (1..5)	3	3.2941 ± 0.4697	3.2429 ± 0.4642	3.4167 ± 0.5149

Table 7
Description of the data acquired by Weight Intervals.

Category	Data acquired	$N<50$	$50\leq N<60$	$60\leq N<70$	$70\leq N<80$	$80\leq N<90$	$N \geq 90$
Personal Data	Age	81.0933 ± 8.9006 years old	81.3663 ± 0.3699 years old	81.1546 ± 9.4531 years old	81.4167 ± 9.4964 years old	81.3291 ± 9.3640 years old	81.6282 ± 9.0613 years old
	Gender	1 (Male), and 8 (Female)	3 (Male), and 25 (Female)	13 (Male), and 16 (Female)	5 (Male), and 17 (Female)	1 (Male), and 5 (Female)	5 (Male), and 5 (Female)
	Region	2 (Alcongosta – Fundão), 4 (Minas da Panasqueira – Fundão), and 3 (Fundão)	3 (Silvares – Fundão), 3 (Alcongosta – Fundão), 7 (Minas da Panasqueira – Fundão), and 15 (Fundão)	5 (Silvares – Fundão), 4 (Alcongosta – Fundão), 1 (Minas da Panasqueira – Fundão), and 19 (Fundão)	7 (Silvares – Fundão), 1 (Alcongosta – Fundão), 3 (Minas da Panasqueira – Fundão), and 11 (Fundão)	2 (Minas da Panasqueira – Fundão), and 4 (Fundão)	2 (Silvares – Fundão), 2 (Alcongosta – Fundão), and 6 (Fundão)
	Height (cm)	151.3867 ± 9.2705	152.3762 ± 9.1212	153.2784 ± 9.3237	152.5938 ± 9.2709	151.7975 ± 9.5761	153.9231 ± 8.3910
	COVID-19 vaccinated	9 (Yes)	27 (Yes), and 1 (No)	29 (Yes)	22 (Yes)	4 (Yes), and 2 (No)	10 (Yes)
	Walking aids	3 (No), and 6 (Yes)	10 (No), and 18 (Yes)	20 (No), and 9 (Yes)	11 (No), and 11 (Yes)	4 (No), and 2 (Yes)	6 (No), and 4 (Yes)
Physical Activity	Gym Practice	1 (Yes), and 8 (No)	4 (Yes), and 24 (No)	7 (Yes), and 22 (No)	22 (No)	1 (Yes), and 5 (No)	4 (Yes), and 6 (No)
	Gym Frequency (times/week)	0.0933 ± 0.2929	0.3960 ± 0.945	0.4124 ± 0.9656	0	0.2785 ± 0.7669	0.5128 ± 1.0537
	Sports practice	No	No	No	No	No	No
	Physical Activity Frequency (days/week)	1.2533 ± 2.4913	2.0990 ± 2.4556	2.3814 ± 2.5431	2.1354 ± 2.4306	1.3797 ± 1.8899	2.6795 ± 2.6062
	Physical Activity Duration (hours/session)	0.2933 ± 0.3298	0.3366 ± 0.3009	0.3660 ± 0.2933	0.3490 ± 0.3002	0.3101 ± 0.3233	0.4038 ± 0.2912
	Exercise Type	6 (None), 2 (Walking), and 1 (Team Sports)	14 (None), 8 (Walking), and 6 (Team Sports)	6 (None), 13 (Walking), 1 (Individual Sports), and 9 (Team Sports)	5 (None), 14 (Walking), and 3 (Team Sports)	2 (None), 2 (Walking), and 2 (Team Sports)	2 (None), 3 (Walking), 1 (Individual Sports), and 4 (Team Sports)

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Table 7 (*continued*)

Category	Data acquired	$N<50$	$50\leq N<60$	$60\leq N<70$	$70\leq N<80$	$80\leq N<90$	$N \geq 90$
Nutrition	Specific Diet	No	No	No	No	No	No
	Fruit or Vegetables (number/day)	5.2133 ± 2.5002	5.1881 ± 2.1712	5.0722 ± 2.1372	5.1354 ± 2.1891	5.1646 ± 2.4149	4.9744 ± 2.2619
	Sweets (times/week)	1.2933 ± 1.6585	1.0792 ± 1.5012	1.1031 ± 1.5240	1.1354 ± 1.5191	1.3038 ± 1.6121	1.2436 ± 1.6529
	Water (liters/day)	1.6733 ± 0.7189	1.6535 ± 0.7574	1.6856 ± 0.7817	1.6615 ± 0.7626	1.6456 ± 0.7078	1.7051 ± 0.8156
Health	Diseases	Cardiovascular (4), Neurological (1), Musculoskeletal (2), Digestive (2), Respiratory (1), Endocrine (5), and (1) Psychiatric	Cardiovascular (22), Neurological (9), Musculoskeletal (7), Digestive (7), Respiratory (1), Endocrine (13), Urinary (2), Vision (2), Hearing (1), Psychiatric (11) and Cancer (2)	Cardiovascular (17), Neurological (8), Musculoskeletal (11), Digestive (3), Respiratory (1), Endocrine (10), Urinary (2), Vision (1), Hearing (2), Dermatological (2), Psychiatric (9), Hematological (4), and Lifestyle (1)	Cardiovascular (16), Neurological (9), Musculoskeletal (6), Digestive (8), Respiratory (7), Endocrine (13), Urinary (4), Vision (2), Psychiatric (8), Cancer (1), Infectious (2), and Circulatory (1)	Cardiovascular (4), Neurological (3), Musculoskeletal (2), Digestive (1), Respiratory (1), Endocrine (2), Urinary (2), Psychiatric (1), and, Hematological (1)	Cardiovascular (6), Neurological (3), Musculoskeletal (3), Digestive (3), Respiratory (4), Endocrine (4), Psychiatric (3), and Hematological (1)
	Smoking Habits	1 (Yes), and 8 (No)	28 (No)	1 (Yes), and 28 (No)	22 (No)	6 (No)	10 (No)
	Sleeping time (hours)	8.0933 ± 1.2646	10.89 ± 1.2075	8.0722 ± 1.2437	8.125 ± 1.2161	8.0633 ± 1.2335	8 ± 1.3192
	Alcoholic beverages	No	No	No	No	No	No
Conditions during the test	Physical Status	7 (Normal), 1 (With Energy), and 1 (Tired)	25 (Normal), 1 (With Energy), and 2 (Tired)	25 (Normal), 2 (With Energy), and 2 (Tired)	19 (Normal), and 3 (With Energy)	5 (Normal), and 1 (With Energy)	10 (Normal)
	Time	7 (Morning), and 2 (Afternoon)	16 (Morning), and 12 (Afternoon)	13 (Morning), and 16 (Afternoon)	8 (Morning), and 14 (Afternoon)	3 (Morning), and 3 (Afternoon)	5 (Morning), and 5 (Afternoon)
	Interest (1..5)	3.2911 ± 0.4869	3.2178 ± 0.4383	3.2268 ± 0.45	3.2292 ± 0.4467	3.3785 ± 0.4787	3.2179 ± 0.4457

Table 8
Description of the data acquired by Height Intervals.

Category	Data acquired	$N<150$	$150 \leq N < 160$	$N \geq 160$
Personal data	Age	81.2551 ± 9.4872 years old	81.49 ± 9.3339 years old	81.0642 ± 9.2849 years old
	Gender	2 (Male), and 38 (Female)	7 (Male), and 31 (Female)	19 (Male), and 7 (Female)
	Region	2 (Silvares – Fundão), 3 (Alcongosta – Fundão), 10 (Minas da Panasqueira – Fundão), and 25 (Fundão)	6 (Silvares – Fundão), 6 (Alcongosta – Fundão), 6 (Minas da Panasqueira – Fundão), and 22 (Fundão)	9 (Silvares – Fundão), 3 (Alcongosta – Fundão), 1 (Minas da Panasqueira – Fundão), and 13 (Fundão)
	Weight (kg)	65.8469 ± 14.4895	65.97 ± 14.5868	66.8247 ± 15.3616
	COVID-19 vaccinated	39 (Yes), and 1 (No)	37 (Yes), and 1 (No)	25 (Yes), and 1 (No)
	Walking aids	25 (No), and 15 (Yes)	13 (No), and 25 (Yes)	16 (No), and 10 (Yes)
Physical activity	Gym Practice	8 (Yes), and 32 (No)	4 (Yes), and 34 (No)	5 (Yes), and 21 (No)
	Gym Frequency (times/week)	0.4082 ± 0.9615	0.4 ± 0.9535	0.4124 ± 0.9656
	Sports practice	No	No	No
	Physical Activity Frequency (days/week)	2.1633 ± 2.4650	2.05 ± 2.4178	2.3814 ± 2.5431
	Physical Activity Duration (hours/session)	0.3469 ± 0.2996	0.3305 ± 0.3020	0.3660 ± 0.2933
	Exercise Type	17 (None), 13 (Walking), 1 (Individual Sports), and 9 (Team Sports)	14 (None), 17 (Walking), and 7 (Team Sports)	4 (None), 12 (Walking), 1 (Individual Sports), and 9 (Team Sports)
Nutrition	Specific diet	No	No	No
	Fruit or vegetables (number/day)	5.1327 ± 2.1665	5.19 ± 2.1821	5.0722 ± 2.1372
	Sweets (times/week)	1.1122 ± 1.5120	1.09 ± 1.5048	1.1031 ± 1.5240
	Water (liters/day)	1.6582 ± 0.7584	1.65 ± 0.7004	1.6856 ± 0.7817
Health	Diseases	Cardiovascular (28), Neurological (10), Musculoskeletal (10), Digestive (6), Respiratory (5), Endocrine (18), Urinary (2), Vision (2), Psychiatric (19), Hematological (1), Cancer (1), and Infectious (1)	Cardiovascular (27), Neurological (12), Musculoskeletal (14), Digestive (11), Respiratory (3), Endocrine (16), Urinary (3), Vision (2), Hearing (3), Dermatological (2), Psychiatric (8), Hematological (1), Cancer (1), Infectious (1), and Circulatory (1)	Cardiovascular (14), Neurological (11), Musculoskeletal (7), Digestive (7), Respiratory (7), Endocrine (13), Urinary (6), Vision (1), Psychiatric (6), Hematological (2), and Lifestyle (1)
	Smoking habits	40 (No)	1 (Yes), and 37 (No)	1 (Yes), and 25 (No)
	Sleeping time (hours)	8.1020 ± 1.2225	8.13 ± 1.1947	8.0722 ± 1.2437
	Alcoholic beverages	No	No	No

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Table 8 (*continued*)

Category	Data acquired	$N<150$	$150 \leq N < 160$	$N \geq 160$
Conditions during the test	Physical status	32 (Normal), 4 (With Energy), and 2 (Tired)	36 (Normal), and 2 (With Energy)	21 (Normal), 2 (With Energy), and 3 (Tired)
	Time	19 (Morning), and 21 (Afternoon)	20 (Morning), and 18 (Afternoon)	13 (Morning), and 13 (Afternoon)
	Interest (1..5)	3.2245 ± 0.4433	3.22 ± 0.4329	3.2268 ± 0.445

Table 9
Description of the data acquired based on the use of walking aids.

Category	Data acquired	Yes	No
Personal data	Age	81.2990 ± 9.3354 years old	81.01 ± 9.6332 years old
	Gender	11 (Male), and 39 (Female)	17 (Male), and 37 (Female)
	Region	9 (Silvares – Fundão), 3 (Alcongosta – Fundão), 10 (Minas da Panasqueira – Fundão), and 28 (Fundão)	8 (Silvares – Fundão), 9 (Alcongosta – Fundão), 7 (Minas da Panasqueira – Fundão), and 30′ (Fundão)
	Weight (kg)	65.7629 ± 14.7527	66.55 ± 15.3204
	Height (cm)	152.3299 ± 9.1682	152.92 ± 9.4822
	COVID-19 vaccinated	29 (Yes), and 1 (No)	52 (Yes), and 2 (No)
Physical activity	Gym Practice	6 (Yes), and 44 (No)	11 (Yes), and 43 (No)
	Gym Frequency (times/week)	0.4124 ± 0.9656	0.4 ± 0.9535
	Sports practice	No	No
	Physical Activity Frequency (days/week)	1.8969 ± 2.2889	2.31 ± 2.5374
	Physical Activity Duration (hours/session)	0.3299 ± 0.3052	0.355 ± 0.2955
	Exercise Type	23 (None), 17 (Walking), and 10 (Team Sports)	12 (None), 25 (Walking), 2 (Individual Sports), and 15 (Team Sports)
Nutrition	Specific Diet	No	No
	Fruit or Vegetables (number/day)	5.1959 ± 2.2157	5.13 ± 2.1445
	Sweets (times/week)	1.1237 ± 1.5156	1.09 ± 1.5048
	Water (liters/day)	1.6392 ± 0.7560	1.685 ± 0.7741
Health	Diseases	Cardiovascular (35), Neurological (15), Musculoskeletal (17), Digestive (15), Respiratory (8), Endocrine (23), Urinary (6), Vision (2), Hearing (1), Dermatological (1), Psychiatric (12), Hematological (2), and Cancer (1)	Cardiovascular (34), Neurological (18), Musculoskeletal (14), Digestive (9), Respiratory (7), Endocrine (24), Urinary (5), Vision (3), Hearing (2), Dermatological (1), Psychiatric (21), Hematological (2), Lifestyle (1), Cancer (1), Infectious (2), and Circulatory (1)
	Smoking habits	1 (Yes), and 49 (No)	1 (Yes), and 53 (No)
	Sleeping time (hours)	8.1134 ± 1.2065	8.09 ± 1.2317
	Alcoholic beverages	No	No
Conditions during the test	Physical status	43 (Normal), 4 (With Energy), and 3 (Tired)	48 (Normal), 4 (With Energy), and 2 (Tired)
	Time	24 (Morning), and 26 (Afternoon)	28 (Morning), and 26 (Afternoon)
	Interest (1..5)	3.2268 ± 0.445	3.22 ± 0.3499

Table 10
Description of the data acquired by diseases groups.

Category	Data acquired	Cardiovascular	Neurological	Musculoskeletal	Digestive	Respiratory	Endocrine	Urinary	Psychiatric
Personal data	Age	81.0962 ± 9.4771 years old	81.1262 ± 9.5185 years old	81.49 ± 9.3339 years old	81.4184 ± 9.4114 years old	81.4 ± 9.3152 years old	81.0962 ± 9.4771 years old	81.8780 ± 8.8741 years old	81.0388 ± 9.5053 years old
	Gender	17 (Male), and 52 (Female)	9 (Male), and 24 (Female)	7 (Male), and 24 (Female)	6 (Male), and 18 (Female)	6 (Male), and 9 (Female)	13 (Male), and 34 (Female)	7 (Male), and 4 (Female)	5 (Male), and 28 (Female)
	Region	15 (Silvares – Fundão), 5 (Alcongosta – Fundão), 14 (Minas da Panasqueira – Fundão), and 35 (Fundão)	10 (Silvares – Fundão), 3 (Alcongosta – Fundão), 6 (Minas da Panasqueira – Fundão), and 14 (Fundão)	9 (Silvares – Fundão), 5 (Alcongosta – Fundão), 6 (Minas da Panasqueira – Fundão), and 11 (Fundão)	10 (Silvares – Fundão), 4 (Alcongosta – Fundão), 3 (Minas da Panasqueira – Fundão), and 7 (Fundão)	7 (Silvares – Fundão), 4 (Minas da Panasqueira – Fundão), and 4 (Fundão)	13 (Silvares – Fundão), 3 (Alcongosta – Fundão), 11 (Minas da Panasqueira – Fundão), and 20 (Fundão)	2 (Silvares – Fundão), 1 (Minas da Panasqueira – Fundão), and 8 (Fundão)	5 (Silvares – Fundão), 2 (Alcongosta – Fundão), 9 (Minas da Panasqueira – Fundão), and 15 (Fundão)
	Weight (kg)	66.3365 ± 15.4119	66.3204 ± 15.4864	65.97 ± 14.5869	66.2449 ± 14.5850	66.8211 ± 15.5235	66.3365 ± 15.4119	67.1220 ± 14.2147	66.4175 ± 15.4650
	Height (cm)	152.7885 ± 9.3348	152.6505± 9.2733	152.47 ± 9.1181	152.4898± 9.2103	152.9263± 9.0838	152.7885 ± 9.3348	153.9146 ± 8.2600	152.7961 ± 9.3802
	COVID-19 vaccinated	67 (Yes), and 2 (No)	30 (Yes), and 3 (No)	30 (Yes), and 1 (No)	24 (Yes)	15 (Yes)	46 (Yes), and 1 (No)	9 (Yes), and 2 (No)	32 (Yes), and 1 (No)
	Walking aids	35 (Yes), and 34 (No)	15 (Yes), and 18 (No)	17 (Yes), and 14 (No)	15 (Yes), and 9 (No)	8 (Yes), and 7 (No)	23 (Yes), and 24 (No)	6 (Yes), and 5 (No)	12 (Yes), and 21 (No)

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Table 10 (*continued*)

Category	Data acquired	Cardiovascular	Neurological	Musculoskeletal	Digestive	Respiratory	Endocrine	Urinary	Psychiatric
Physical activity	Gym practice	10 (Yes), and 59 (No)	2 (Yes), and 31 (No)	4 (Yes), and 27 (No)	1 (Yes), and 23 (No)	2 (Yes), and 13 (No)	7 (Yes), and 40 (No)	1 (Yes), and 10 (No)	6 (Yes), and 27 (No)
	Gym Frequency (times/week)	0.3846 ± 0.9380	0.3883 ± 0.9418	0.4 ± 0.9535	0.4082 ± 0.9615	0.4211 ± 0.9739	0.3846 ± 0.9380	0.4878 ± 1.0333	0.3883 ± 0.9418
	Sports practice	No	No	No	No	No	No	No	No
	Physical activity Frequency (days/week)	2.2212 ± 2.5274	2.1748 ± 2.4948	2.05 ± 2.4178	2.0918 ± 2.4244	2.3474 ± 2.5213	2.2212 ± 2.5274	2.3049 ± 2.3918	2.2427 ± 2.5301
	Physical Activity Duration (hours/session)	0.3413 ± 0.2979	0.3398 ± 0.2988	0.335 ± 0.3020	0.3418 ± 0.3012	0.3632 ± 0.2957	0.3413 ± 0.2978	0.3841 ± 0.2971	0.3447 ± 0.2973
	Exercise type	24 (None), 31 (Walking), 2 (Individual Sports), and 12 (Team Sports)	11 (None), 16 (Walking), 1 (Individual Sports), and 5 (Team Sports)	11 (None), 8 (Walking), and 12 (Team Sports)	5 (None), 15 (Walking), and 3 (Team Sports)	4 (None), 8 (Walking), 1 (Individual Sports), and 2 (Team Sports)	17 (None), 18 (Walking), 2 (Individual Sports), and 10 (Team Sports)	4 (None), 4 (Walking), and 3 (Team Sports)	9 (None), 15 (Walking), and 9 (Team Sports)

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Table 10 (*continued*)

Category	Data acquired	Cardiovascular	Neurological	Musculoskeletal	Digestive	Respiratory	Endocrine	Urinary	Psychiatric
Nutrition	Specific diet	No	No	No	No	No	No	No	No
	Fruit or Vegetables (number/day)	5.1827 ± 2.1397	5.1845 ± 2.1500	5.19 ± 2.1821	5.1327 ± 2.1665	5.0421 ± 2.1384	5.1827 ± 2.1396	5.0488 ± 2.3035	5.1553 ± 2.1317
	Sweets (times/week)	1.0481 ± 1.4983	1.0584 ± 1.4939	1.09 ± 1.5048	1.1122 ± 1.5120	1.1158 ± 1.5358	1.0481 ± 1.4902	1.2439 ± 1.6068	1.0583 ± 1.4939
	Water (liters/day)	1.6731 ± 0.7720	1.6602 ± 0.7644	1.65 ± 0.7604	1.6582 ± 0.7584	1.6684 ± 0.7774	1.6731 ± 0.7720	1.6707 ± 0.7786	1.6699 ± 0.7751
Health	Smoking Habits	1 (Yes), and 68 (No)	33 (No)	31 (No)	24 (No)	15 (No)	1 (Yes), and 46 (No)	11 (No)	1 (Yes), and 32 (No)
	Sleeping time (hours)	8.0962 ± 1.2109	8.0971 ± 1.2168	8.13 ± 1.1947	8.1224 ± 1.2036	8.0737 ± 1.2569	8.0962 ± 1.2109	8.0976 ± 1.2825	8.0971 ± 1.2178
	Alcoholic beverages	No	No	No	No	No	No	No	No
Conditions during the test	Physical status	64 (Normal), 4 (With Energy), and 1 (Tired)	32 (Normal), and 1 (With Energy)	30 (Normal), and 1 (Tired)	24 (Normal)	12 (Normal), and 3 (With Energy)	41 (Normal), 3 (With Energy), and 3 (Tired)	10 (Normal), and 1 (With Energy)	28 (Normal), 4 (With Energy), and 1 (Tired)
	Time	34 (Morning), and 35 (Afternoon)	14 (Morning), and 19 (Afternoon)	15 (Morning), and 16 (Afternoon)	13 (Morning), and 11 (Afternoon)	8 (Morning), and 7 (Afternoon)	26 (Morning), and 21 (Afternoon)	3 (Morning), and 8 (Afternoon)	18 (Morning), and 15 (Afternoon)
	Interest (1..5)	3.2114 ± 0.4334	3.2136 ± 0.435	3.22 ± 0.4399	3.2245 ± 0.4433	3.2211 ± 0.4419	3.2115 ± 0.4334	3.2073 ± 0.4371	3.2136 ± 0.435

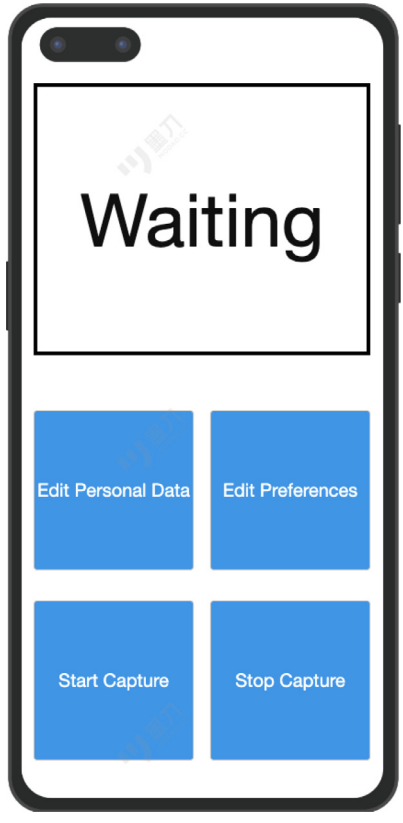

Fig. 5. Mobile application.

Table 11
Number of valid or non-valid samples.

Analysis criteria	Number	Statistical analysis
Number of individuals	109	100% (Total)
Expected number of captures	218	100% (Total)
Real number of captures	208	95.41% (Real)
Number of captures valid	204	98.07% (Real)
Number of individuals with 2 captures valid	100	91.74% (Real)
Number of individuals with at least one capture valid	104	95.41% (Real)

(https://github.com/impires/JupyterNotebooks10MWT). After the implementation of the methods for the classification by gender, the reported results are presented in Table 12.

After the implementation of the methods for the classification by diseases classification, the reported results are presented in Table 13. The best results were achieved with Linear SVM and AdaBoost with 22% and 18% accuracy, respectively. The data is very heterogeneous, and the results can be improved with a larger population, but in the case of gender classification, the results are reliable.

The study emphasizes the importance of addressing sensor failures and ensuring data validity and reliability in sensor data acquisition studies. It provides strategies for understanding sensor issues and their root causes, mitigating them for future data collection, and integrating validation mechanisms into the data-gathering process.

Table 12
Classification details by gender.

Classifier	Precision	Recall	F1-Score	Accuracy
k-nearest neighbors	94%	94%	94%	94%
Linear SVM	53%	73%	61%	73%
RBF SVM	96%	96%	96%	96%
Decision tree	87%	86%	85%	86%
Random forest	87%	84%	82%	84%
Neural networks	95%	95%	95%	95%
AdaBoost	95%	95%	95%	95%
Naive Bayes	63%	61%	62%	61%

Table 13
Classification details by disease.

Classifier	Precision	Recall	F1-Score	Accuracy
k-nearest neighbors	12%	12%	11%	12%
Linear SVM	22%	64%	25%	23%
RBF SVM	3%	7%	4%	6%
Decision tree	13%	18%	13%	14%
Random forest	10%	16%	11%	14%
Neural networks	9%	11%	10%	10%
AdaBoost	18%	40%	22%	18%
Naive Bayes	14%	9%	9%	9%

To identify sensor failures, implement robust error logging within the data acquisition system to capture anomalies. Conduct a thorough root cause analysis, examining device hardware, software versions, environmental conditions, and usage patterns. Run controlled experiments to replicate failures and isolate variables causing malfunction. Develop or use existing diagnostic tools to periodically check sensor health, alerting users or researchers to potential issues.

To mitigate sensor issues, ensure devices receive regular firmware and software updates, provide environmental protection guidelines, offer participant training on device handling and maintenance, and regularly calibrate the sensors using automated routines. These techniques help prevent sensor degradation and ensure accurate readings over time.

Data validation mechanisms for sensor performance include real-time checks in software, baseline measurements, recording data quality indicators, cross-validation with external data, regular test routines, fail-safe procedures, preprocessing assessments, and statistical monitoring. Real-time validation checks detect outliers and nonsensical values, while baseline measurements compare against field data. Data quality indicators include signal strength, noise levels, and error codes. Cross-validation with external data is possible, and regular test routines ensure sensor functionality. Fail-safe procedures, preprocessing checks, and statistical monitoring are essential for detecting deviations from expected patterns.

Researchers can improve sensor data reliability by implementing investigative, mitigation, and validation strategies, particularly in large-scale studies, as data quality directly impacts findings and decision-making processes.

5.3. Limitations

There are different limitations related to the data acquisition during the performance of the study, including data privacy and consent, data quality and reliability, data standardization and integration, sensor limitations, battery life, storage limitations, demographic, environmental factors, user engagement, and imbalanced datasets.

Data privacy and consent during the acquisition of health-related data were assured by the General Data Protection Regulation (GDPR), and the participants signed and gave informed con-

sent. The different characteristics of the sample were acquired before the test, and their interest was also reported.

Standardized device placement is crucial for reproducibility and comparability of sensor data across studies, as it significantly impacts data quality. The development of positioning guidelines involves creating a detailed protocol for device placement, conducting validation studies to determine the optimal position, conducting training sessions to minimize variance, providing standardized accessories for consistent positioning, and using in-situ verification methods like photos or video clips to verify the device's position in real-time. These guidelines ensure practicality and reliability in various settings, ensuring accurate sensor data for specific measurements. To improve data reproducibility, provide detailed descriptions of device position, including orientation and other factors influencing sensor readings. It is encouraged that the replication studies follow similar positioning guidelines to validate findings and improve comparability and the use of data from multiple studies for meta-analyses to enhance findings' power and generalizability. Standardized metrics assess sensor data quality and positioning effects while benchmarking data against other studies or known standards ensures alignment. Common Data Elements (CDEs) are developed for device positioning in research to ensure consistent collection and reporting of essential positioning data elements. Implement real-time feedback for participants to correct device position deviations. Develop adaptive algorithms to adjust data processing to minor variations. Perform sensitivity analyses to understand how positioning variations affect data and include this information in research.

The accuracy and precision of sensor data from consumer-grade devices may not always meet clinical standards, which can affect the reliability of the health assessments. Compared to specialized data-collecting systems, mobile devices frequently feature sensors that are less precise and accurate. Mobile device sensors might not be calibrated to the exacting standards needed for some forms of data collecting, which could cause systematic inaccuracies in the gathered data. There can be restrictions on how frequently mobile devices can sample data. One drawback for tracking rapidly evolving events is the potential impossibility of high-frequency data gathering.

The data was acquired with only one device. The data collection protocol that all participants used was defined previously. Some health-related parameters cannot be monitored with existing mobile device sensors. Because of the quality of the sensors or other external variables, data obtained via mobile devices may contain a lot of noise. The acquisition of sensor data can also be affected by the battery life of the mobile devices.

A high frequency of data collection can result in a lot of data. The storage capacity of mobile devices may be limited, which might be a bottleneck for long-term data-collecting operations. Mobile devices may lack the durability necessary to collect data in challenging environments. Variations in temperature, humidity, and pressure can have an impact on the lifespan and functionality of the sensor as well as the device.

The dataset presented in this paper is imbalanced, and it was only acquired with institutionalized people in Fundão (Portugal). Still, it can help analyze this preliminary study, and the experiments can be performed for further validation with a more extensive and varied dataset. Class imbalance in machine learning, particularly in supervised tasks like classification, can lead to issues such as model bias, poor generalization, evaluation metrics misinterpretation, and overfitting. A model trained on imbalanced data may become biased towards the majority class, resulting in poor performance on unseen data and underfitting to the minority class due to a lack of sufficient data. To improve model performance, consider strategies such as resampling the dataset, modifying existing algorithms to focus on minority class instances, using different evaluation metrics, using ensemble methods like bagging and boosting, and using anomaly detection techniques for small minority class instances. Additionally, adjusting existing algorithms to assign higher costs to misclassifications of the minority class, using different evaluation metrics, and adjusting data collection for the minority class can help improve overall performance.

5.4. Re-use potential

Examining the Ten Meter Walk Test outcomes is one of the possible uses for this dataset. The public cannot use the datasets discussed in the literature for more testing, investigation, or the development of fresh approaches to test analysis. The result of precise and acceptable ways for measuring the Ten Meter Walk Test outcomes, where additional details may be detected using sensors instead of a specific monitorization by a healthcare expert, depends on the autonomous diagnosis of many physical characteristics. This dataset can be a starting point for new projects and analysis. However, the limitations are mainly the dataset size and the variety of demographic features. However, data collection should generally pay close attention to such concerns. This dataset addresses this concern through the data collection protocol and participant consent.

Ethics Statement

Ethics Committee from Universidade da Beira Interior approved the study with CE-UBI-Pj-2020-035. Before the performance of the test, the participant or responsible people provided some data related to the physical status and habits of the individual, and the informed consent was signed.

Data Availability

Raw dataset with accelerometer, magnetometer and gyroscope data related to Ten Meter Walk Test in Center of Portugal (Original data) (ANDS)

CRediT Author Statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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