EPQ Experimental Method

Aim:

The aim is to collect a sufficient amount of gyroscope and accelerometer data, enough to effectively analyse and produce a machine learning algorithm that can detect a fall, based on real-time input from the sensors.

Resources:

- Phone with Data Collection App
- Participants
- Gymnastics Mat
- Stopwatch

Process:

The participant(s) will be given a brief on the safety precautions taking place, what they are meant to do, what data is being collected and how the data will be used before the data collection process begins. More detail on this can be found in the 'Safety and Ethics' section. The number of participants will range from 1 to 5 and each data collection step will be repeated 3 times by each participant. This is to ensure that a 'sufficient' amount of data is collected. Any delays below will be recorded by a stopwatch (this data does not need to be saved).

1. The participant(s) receive a phone with the Data Collection App pre-installed. They then open the app and turn on the sensors, allowing data to be collected. The phone will be placed in their trouser pocket for the duration of the test. There will be a 5 second delay before the phone is put into their pocket and the beginning of the data collection process, to mark the start of each process.
2. Motion 1 will be 'normal walking'. (After the 5 second wait), the participant will walk 3 meters forward as naturally and comfortably as they can. They will stop, turn around and return to the original starting point. They will then wait another 5 seconds, this time to mark the end of the process. Finally, the participant will take the phone out of their pocket and turn off the sensors. This will also save the data at the same time.
3. Motion 2 will be 'falling forwards'. Similar to before, the participant will walk 3 meters forwards, this time, they will stop and instantaneously fall over in the direction of travel. A soft object may be placed on the ground to simulate them tripping over more accurately. They will rest on the ground motionless for 5 seconds to mark the end of the process. Then, they will stand up, and turn off the sensors, saving the data.
4. Motion 3 will be 'falling backwards'. Once again, the participant will walk 3 meters forward, stop, but instead of falling forwards, they will fall backwards. They will stay there for 5 seconds before standing back up and disabling access to the sensors, also saving the data.
5. Motion 4 will be 'falling to the side'. The participant will walk 3 meters, stop, and fall to the left or right. It is recommended that they fall onto their dominant side, as this will make it easier to 'breakfall', however, this choice is up to them. Participants will be required to choose which side they fall onto at the start of the experiment. This is so they do not injure themselves or break the phone by falling onto it. Once they have fallen, the participant will lay there for 5 seconds before standing up and turning off the sensors, saving the data.

6. Motion 5 will be ‘dropping the phone’. This is the last data collection process. The participant will walk 3 meters, stop, take the phone out of their pocket, and raise it up so that their elbows are at 90 degrees, forearm parallel to the ground. Once they have reached this position, they will instantly drop the phone and let it stay on the ground for 5 seconds, before picking it up and doing the usual ending procedure.
7. Datasets will be saved in the following form:
    i. CandidateInitials_MotionNumber_RepeatNumber.

Reliability and Validity:

To make the primary research valid, the data collection will be following the basic scientific method.

Control variables are constants, variables that are unchanged throughout the process. In this experiment, the control variables include the sensors used to collect the data, the distance the participant(s) walk, the way they walk, the position of the phone and the surface at which they fall onto. This ensures that the dependent variable is only changed by the independent variable and no other factor. In other words, the data collected is only changed by the motion of the participant(s), and how they fall.

Repeating the experiment, and each data collection process will make the data more reliable. It will help to look for and remove any anomalies as well as supply the data analysist step with more resources. Moreover, the data from this primary research will be compared with other data from secondary sources to further confirm its validity.

Safety and Ethics:

To ensure the safety of the participant(s), the following procedures will be taking place:

1. The participant(s) must be able to withstand repeated falls, therefore, anyone participating in this experiment will require a background in Judo and have completed the basic gradings that cover ‘Ukemi’, or Judo falling techniques. These include forward breakfalls, side breakfalls, and backward breakfalls. These techniques will be used in the falling process to make sure the participant(s) are unharmed. Moreover, they will have had lots of experience doing this as it’s the most basic element of this martial art.
2. The participant(s) will be falling onto gymnastic mats, to minimize the impact of each fall, and the possibility of them hurting themselves.
3. During the collection process where participant(s) fall to the side, the phone will be placed in the opposite pocket to the direction of the fall. For example, if the participant chooses to fall to the right, they will put the phone in their left pocket, and vice versa. During falls backwards and forwards, the participants can put the phone in pockets on either side, but this must be consistent throughout the repeats.
4. The participant(s) can take a break of any amount of time in between each data collection process and may stop whenever they wish. The data of any participant who chooses to stop before completing the experiment will not be used.
5. The identity of the participants will remain anonymous. To ensure this is the case, the name of the dataset that they record during the experiment will only include their candidate number and/or their initials.
6. The usage of their data and the involvement of the participant(s) will only proceed if they have given consent and met the conditions mentioned above.