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Creating a Wearable Device to Help Parkinson's Patients Maintain an Upright Seated Position

Engineering Mechanics

Research Plan/ Project Summary

Rationale:

Parkinson's is a progressive nervous system disorder, therefore it will only get worse as time goes on. This disorder can cause people many different complications that vary among people depending on the severity of their condition. One side effect that some people have from Parkinson's is the inability to hold oneself in an upright seated position. This can cause people trouble eating, talking, and hindering their overall quality of life (Downward 2017). The inability to sit upright is not only an inconvenience but also a harm to one's body. If someone is not being watched at all times they could fall and injure them self. There are currently no devices on the market that can compensate for one inability to sit up in a chair. As well as many devices that are for sale are not practical for everyday use since they are often too large and heavy to be transported with someone and in all types of situations. Thus a device that is practical for everyday use must be created to help one maintain an upright seated position in order to enhance the lives of those with Parkinson's Disease. As well as help decrease a possibly injury in order to help maintain normal life functions.

Research Questions:
- How can a device be created that will aid people with Parkinson's in maintaining an upright sitting position in a chair?
- How can a device sense weight shifting which will increase pressure in the device?
- How can this device be useful in people's daily lives?
- How can sensors be programmed to determine the measurements of a person falling over in their chair?

Hypothesis:
A device that can increase its pressure when weight is exerted on it can reduce harm and help to maintain an upright seated position for those with Parkinson's Disease.

Engineering Goals:
- Create a device that will be able to measure different variables as a person falls over in a chair.
- Collect data to be able to create an algorithm in order to create a device that will be able to distinguish between a person falling and when they are not falling over.

Expected Outcome:
What we expect to happen in the experiment is that when the person will fall over in the chair the sensors will be able to give a measurement that relays that although people fall at different angles

and speeds we can still input this information into a computer program to generate an algorithm that can sense when a person is falling versus when they are not falling. We also expect the people of similar heights, weights and ages will have similar data correlated to their types of falls.

Procedure:
1. Recruit as many high school students as possible of different heights, weights and ages.
2. Each student will be placed on a scale in order to measure their weight.
3. Each student will stand against a wall and we will use a ruler to measure their height.
4. Have each student wear a medical vest, sit in a chair, and fall over to their left 10 times with a pillow underneath them.
5. Use an IMU sensor connected to the vest to measure the amount of degrees and speed at which the person fell over.
6. Have each student wear a medical vest, sit in a chair, and fall over to their right 10 times with a pillow underneath them.
7. Use an IMU sensor connected to the vest to measure the amount of degrees and speed at which the person fell over
8. Have each student wear a medical vest, sit in a chair, and fall forward onto a desk 10 times.
9. Use an IMU sensor connected to the vest to measure the amount of degrees and speed at which the person fell over
10. Have each student wear a medical vest, sit in a chair, and remain upright while the sensor is gathering data

Risk and Safety:
Little to no danger to participants. All participants will fall safely into a pillow as well as be protected from falling to the floor by gym mats.

Data Analysis:
In order to analyze the data, I will organize the data in a chart and then graph it. This graph can allow me to see any trends in the data as well as if there is a correlation between the weight of the person and the speed at which they fall. I will also input all the data into a computer program to be able to generate an algorithm to input into the device to be able to react properly and only when a person is falling over at a specific rate.

Human Participant Research:

Participants:
High school students ranging in ages from 13-18 years old with different heights and weights

Recruitment:
We will use opportunity samples by asking people from different classes at Harrison High School.

Methods:
The participants will be asked to wear a vest and fall over in a chair. We will have the participants fill out a consent form. Each participant will be used in our study for a total of 10 minutes.

Risk Assessment:
We will use pillows to cushion the fall as well as gym mats. The benefit of helping in the study is that each participant will play a role in helping us to create a device that will help people with Parkinson's Disease.

Protection of Privacy:
No identifiable information will be collected. We will keep all participants anonymous by giving each participant a number, that they will be referred to throughout the study. Data will be stored in a computer that only Nellie, Bailey, Ms. Blunt and our mentors (CK and Yarr).

Informed Consent Process:
We will inform participants about the purpose of the study using the Human Informed Consent Form from the WESEF website. The participants will be asked to fall over to their right 10 times, to their left 10 times and fall over 10 times toward the front (on to a table)

Set Up:

Take apart a chair so the legs are not on it and place it on the sofa to give the feel of sitting in a chair but have the sofa on all sides for support.

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