Project Code: 20NUSEMP08

Institution: National University of Singapore, Faculty of Engineering

Programme:

☐ ASP	☐ BP	☐ DSP	☐ NEST	☐ IHPC-MP	☐ I²R-MP
☐ NUS-CMP	☒ NUS-EMP	☐ NUS-SMP	☐ NTU-MP	☐ RP-HPP	☐ RP-SEP
☐ SC-MP	☐ SUTD-MP	☐ YRP			

TITLE OF PROJECT: Gait Monitoring and Analysis for Parkinson Disease Patients
NAME(S) OF MENTOR(S): Arthur Tay
DEPARTMENT: Electrical & Computer Engineering

CONTACT NUMBER: 65166326	**E-MAIL:** eletaya@nus.edu.sg

If you are not the lab owner, please obtain approval for the project from your supervisor / Principal Investigator and complete this section. **NAME OF LAB OWNER:**

CONTACT NUMBER:	**E-MAIL:**

Important note to students:

1. Expectations

   As a guideline, student participants are expected to spend an average of 3 hours per week from Feb to May, and 2 weeks of June (full-time) on the project. Please arrange with your mentor and set aside 2 weeks of June holiday period for full-time attachment.

2. The project can be carried out at mentor's institution's research labs or the schools' labs.

3. Timeline for SMP 2020
   - After mid Feb 2020: Schedule first meeting with mentors and commence project
   - Feb – May 2020: Weekly meetings with mentors (about 3 hours per week)
   - Apr – May 2020: School-based Plenary I sessions
   - *First 2 weeks of June 2020: Full time attachment with mentees
   - Jun 2020: Preparing research paper
   - 10 Aug 2020: Mentees to submit final research paper for vetting by mentor
   - 17 Aug 2020: Submission of vetted research paper to GEB
   - 8 Sep 2020: SMP Project Judging / Plenary II
   - 19 Sep 2020: 26th Youth Science Conference

PROJECT DETAILS

Brief Abstract/Description of Project (100 words or less)

The objective of this project is to monitor the gait patterns for people with Parkinson Disease. We will analyse the gait for PD patients during freezing and non-freezing (normal) events. Various parameters (e.g. cadence, step lengths, stride lengths, etc) related to gait will be derived from motion sensors (accelerometers, gyroscopes, magnetometers) using public datasets of PD patients. We will then investigate which of these parameters is most suitable for classification for freezing of gait in PD patients.

Problem/Question

To make use of signal processing algorithms in extracting gait parameters from motion sensors and identifying most suitable parameters for classification of freezing of gait in PD patients.

Hypothesis/Engineering Goals:

Gait parameters can be derived from Inertia Motion Units (e.g. Accelerometers, Gyroscope)

What can student participants (15/16 year-old) learn?

Signal processing, data analysis. How do you compute gait parameters from motion sensors?

Methodology:

Students will first need to review and understands how to extract gait parameters from motion sensors. There are different algorithms in the literature and they will need to investigate which is most suitable. They will then make use of a PD patient public dataset to test out their methods. If time permits, they will learn basic machine learning tools for classification.

This project involves an experimental/hands-on component: ☐ Yes ☒ No

RISK ASSESSMENT

1. List/identify the hazardous chemicals, activities, or devices that will be used

   NA

2. Identify and assess the risks involved.

   NA

3. Describe the safety precautions and procedures that will be used to reduce the risks.

   NA

4. Describe the disposal procedures that will be used (when applicable).

   NA

5. List the source(s) of safety information.

Approval Review Committee(s)

This project involves**:** (tick all that apply)*

☐ Human subjects   ☐ Vertebrate Animals   ☐ Controlled Substances
☐ Potentially Hazardous Biological Agents^   ☐ Hazardous Substances or Devices^
☒ Not Applicable

*Approval granted by my Institution's Review Board / Scientific Review Committee:
☐ Yes   ☐ No   ☐ Not applicable

Human Subjects
- *All research projects involving human subjects, including any revisions, needs to be reviewed and approved by an Institutional Review Board (IRB) before the research begins.*
- *Human subjects research includes projects involving:*
  (a) Subjects participating in physical activities (e.g., physical exertion, ingestion of any substance, any medical procedure),
  (b) Psychological and opinion studies (e.g., survey, questionnaire, test of any kind),
  (c) Behavioral observations,
  (d) Studies in which the researcher is the subject of the research.
- *When developing the Research Plan, mentors and student researchers must evaluate and minimize the physical and/or psychological risks to their human subjects.*
- *Details at:*
  - *https://member.societyforscience.org/document.doc?id=647 (p. 35)*
  - *https://member.societyforscience.org/document.doc?id=654 (p. 36)*

Potentially Hazardous Biological Agents
- *Projects incorporating microorganisms (including bacteria, viruses, viroids, prions, rickettsia, fungi, and parasites), recombinant DNA (rDNA) technologies or human or animal fresh tissues, blood, or body fluids may involve working with potentially hazardous biological agents. Students are permitted to do research projects with potentially hazardous biological agents as long as every effort is made to ensure that they work safely and that the projects meet the conditions and rules described below.*
- *Details at: https://member.societyforscience.org/document.doc?id=650 (p. 39)*

Controlled Substances
- *Refer to DEA classed substances, prescription drugs, consumable ethyl alcohol, and tobacco.*

CATEGORY Tick only **one** appropriate category. If the project involves more than one, tick the major category.	☐ Chemistry ☐ Biochemistry ☐ Botany ☐ Microbiology ☐ Zoology	☐ Environmental Science ☐ Medicine & Health ☐ DNA Science ☐ Space Science	☐ Computer Science ☐ Physics ☐ Mathematics ☒ Engineering (please specify): <u>signal processing and data analysis</u> ☐ Others (please specify): _____

QUESTIONS FOR SMP PARTICIPANTS TO RESPOND TO WHEN APPLYING FOR THIS PROJECT

Have you heard of Inertial motion unit? How do you think gait parameters can be extracted using motion sensors? What is freezing of gait in PD patients? During freezing, how different would the gait patterns?

PRE-REQUISITE KNOWLEDGE REQUIRED OF STUDENT PARTICIPANTS

Good in mathematics, keen to learn Python programming

READING UP ON THE RESEARCH TOPIC

IMU, Freezing of Gait, Gait patterns
Sources: IEEE Xplore, Pubmed.

AVAILABLE TIME FOR CONSULTATION/MEETING WITH STUDENTS

Bi-weeking meeting, preferably Wed or Thur afternoon.

OTHER REMARKS