### MSc Independent Engineering Scholarship (IES) Proposal

**Personal Details**

|  |  |  |
| --- | --- | --- |
| 1 | Family Name | Okon |
| 2 | Other Names | Brian |
| 3 | Email Address (University) | [B.Okon1@unimail.derby.ac.uk](mailto:B.Okon1@unimail.derby.ac.uk) |
| 4 | Award Title | MSC Control and Instrumentation |
| 5 | Proposed Supervisor | Dr. Ahmad Kharaz |
| **NOTES:** You can paste material into this form if you wish and expand the sections but the proposal must not exceed 8 pages in length overall, excluding the risk assessment record and the ethics form attached at the end of this proposal. All sections of the risk assessment and ethics form should be completed. | | |

**Dissertation Proposal**

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| --- | --- |
| 6 | **Proposed Title**  Design And Implementation Of Human Posture Recognition Using Accelerometer |

**What is the rationale for the proposed IES?**

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| --- | --- | --- |
| 7 | **Background**  The impact of bad body posture resulting to health issues has been of serious concern to our society in recent years. Healthcare research has established that inappropriate body posture could lead to skeleton and muscular pathologies and an increased risk of heart disease.  In order to combat this rising trend, ergonomics require a more scientific technique in recognizing and evaluating body postures that are detrimental to the health of a person especially in people that work long hours in a relatively static position.  Because human body is characterized by high degree of freedom, it is not an easy task to accurately determine the posture without the aid of scientific techniques. Also, the quest to reliably predict human behaviour has seen the emergence of different algorithms developed by control engineers to systematically classify body postures.  A good number of research works has been done and some are ongoing in attempt to recognize human gesture using various techniques. However, differentiating different body postures such as sitting, walking, bending and a person falling is still lacking.  Electronic sensor based systems such as the accelerometer has also emerged as a new and improved method for analyzing and classifying human body postures highlighting possible areas of concern and for measuring the speed of acceleration by a person. This is the focus of this project. | |
| 8 | | **Aims**  To develop a human posture recognition system and measure distance accurately using 3D accelerometer |
| 9 | | **Objectives**   * To build a portable system with accelerometer and data logging * To develop an algorithm to measure accurately the speed of a person walking or running * To differentiate one posture pattern from another * To detect a person falling |
| 10 | | **Plan of work**   * Develop a portable system with a tri axial accelerometer such as developed by Ravi, S. K. Et al (2013). The system will include the data acquisition system with data logger. The data logger will hold the outputs of the accelerometer representing the XYZ coordinate of the human posture (walking, running and climbing) as they are assumed. * Create a database system to hold the sample data obtained from the human posture. For this project, the Microsoft SQL would be used. Using the LabVIEW database connectivity tool, an interface would be created to enable storage and retrieval of sampled data. * Feature extraction. The content of the data logger reflecting the human posture would be extracted and stored in a database tables. * Develop an algorithm to analyze and classify human postures similar to Nooritawati et al. (2007) and Kayembe (2012). * Evaluate the workings of the system and how accurately the speed of a person walking or running can be determined. Using Five (5) volunteers for this purpose. The portable system will be attached to each volunteer to perform translational movement under the following subset * Slow Walking * Normal Walking * Fast Walking * Running |

**Constraints that may restrict the success of the work**

|  |  |
| --- | --- |
| 11 | **Foreseeable constraints**  None |

**Identifiable risks to the successful completion of the work**

|  |  |
| --- | --- |
| 12 | **Foreseeable risks**  None |

**Resources you envisage utilising to help complete the work**

|  |  |
| --- | --- |
| 13 | **Textbooks** |
| 14 | **Journals**  Ravi, K. S., Bala, G. S., Venkataramanaiah, B., Prathyusha, K. (2013) Design of a Wearable System for Interactive Caption and Posture Recognition Using Wireless  Sensor Networks: *International Journal of Engineering Trends and Technology* **4** (5)  Nooritawati, M. T., Hussain, A., Samad, S. A., Husain, H., Jin, A. T. B. (2007) On The Use of Advanced Correlation Filters For Human Posture Recognition. [Internet]. Available from: < http://docsdrive.com/pdfs/ansinet/jas/2007/2947-2956.pdf> [Accessed: 25 April 2013]. |
| 15 | **Electronic (internet)**  Kayembe, S. (2012) Human Posture Recognition and Good Posture Recommendation. MSc dissertation. University of Nairobi, Kenya.  <http://www.analog.com/en/mems-sensors/mems-inertial-sensors/adxl345/products/product.html> |
| 16 | **Laboratory equipment and software**  Computer running LabVIEW |

**Anticipated cost**

|  |  |  |
| --- | --- | --- |
| 17 | **Please enter all costs. Brief Description or explanation.** (£150 maximum) | Cost (£) |
| ADXL345 from Analog Device | 4 |

**Gantt chart**

Produce a Gantt chart here to provide a clear visual plan of your IES. It should be based on scheduling the different activities of your IES against a time scale.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 18 | Gantt Chart   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activity | Weeks | | | | | | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | Preliminary system design |  |  |  |  |  |  |  |  |  |  |  |  | | Design of data acquisition system |  |  |  |  |  |  |  |  |  |  |  |  | | Database connectivity Design |  |  |  |  |  |  |  |  |  |  |  |  | | Develop pattern recognition algorithm |  |  |  |  |  |  |  |  |  |  |  |  | | Analyze posture data using algorithm |  |  |  |  |  |  |  |  |  |  |  |  | | System testing |  |  |  |  |  |  |  |  |  |  |  |  | | System modification and re-evaluation |  |  |  |  |  |  |  |  |  |  |  |  | | Report Generation |  |  |  |  |  |  |  |  |  |  |  |  | |

Has the IES been agreed with the proposed supervisor? Yes

Explain, if your answer is No……………………………………………………………………………

|  |
| --- |
| **SUBMISSION:** The completed proposal must be submitted electronically by 11.59 pm on Friday 24th May 2012. |

**Record of Risk Assessment**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assessment Reference | | | | | | | | | MS123 | | | | | | | |
|  | | | | | | | | |  | | | | | | | |  | | |
| Activity assessed | | | | | | | | | | | Implementation of Human Posture Recognition Using Accelerometer | | | | | | | | | | | | | | | | | | | |
| Persons who may be affected by the activity | | | | | | | | | | | **Nobody** | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | |  | | | | |  |  | | | | | | | | | | | | | | |
| SECTION A : Initial Assessment Overview | | | | | | | | | |
| *Consider the activity or work area and identify if any of the hazards listed below are significant.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Fall of person | | |  | 7 | Machinery | | | | |  | 13 | | Electricity | | | |  | 19 | Substances | | | |  | | 25 | | Drowning | |  |
| 2 | Fall of objects | | |  | 8 | Tools/Equipment | | | | |  | 14 | | Noise or Vibration | | | |  | 20 | High Pressure | | | |  | | 26 | | Psychological effects | |  |
| 3 | Tripping/Slipping | | |  | 9 | Mobile work equipment | | | | |  | 15 | | Hot / Cold Surfaces | | | |  | 21 | Fire/ explosion | | | |  | | 27 | | Human error | |  |
| 4 | Manual handling operations | | |  | 10 | Mechanical lifting equipment | | | | |  | 16 | | Workstation –  layout / space | | | |  | 22 | Lighting | | | |  | | 28 | | Violence | |  |
| 5 | Repetitive work | | |  | 11 | Display screen equipment | | | | |  | 17 | | Radiation | | | |  | 23 | Confined space | | | |  | | 29 | | Peripatetic / lone working | |  |
| 6 | Housekeeping / waste material | | |  | 12 | Sharp objects | | | | |  | 18 | | Temperature / weather | | | |  | 24 | Buildings & glazing | | | |  | | 30 | | Other(s) | |  |
|  | | | | | | | | | | | |  | |  | | | |  | | | | | | |
| SECTION B : Second Stage Assessment | | | | | | | | | |  | | | |  | | | | [S = Severity](Risk%20Evaluation%20matrix.doc) | | | | | | |
| *For each hazard identified in Section A complete Section B* [*L = Likelihood*](Risk%20Evaluation%20matrix.doc) | | | | | | | | | | | | | | | | | | | | | | | | |
| Hazard  No. | | Hazard  Description | | | | | | EXISTING CONTROL MEASURES | | | | | | | | | | | | | | S | L | | | | RESIDUAL RISK | |
| **11** | | **Prolonged stare at the computer screen** | | | | | | **Periodic break away from the screen** | | | | | | | | | | | | | | **1** | **2** | | | | **Tolerable Risk** | |
| No. of Section B Continuation sheets used: | | | | | | | | | | | | | | | | | | | | | | | | | | |  | |
| Assessor(s) | | | Dr. Ahmad Kharaz | | | | | | | | | | | | | | Signed | | | | Brian Okon | | | | | | | |
| Date of Assessment | | | | **21/5/2013** | | | Revision No. | | | | | | **1** | | | |

**Request for ethical approval for students on taught programmes**

**Please complete this form and return it to your supervisor as advised in your module handbook. Feedback on your application will be via your supervisor or co-ordinator.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Name:** | **Brian Okon** | | |
| **Student ID:** | **100230654** | | |
| **Unimail address:** | **B.Okon1@unimal.derby.ac.uk** | | |
| **Other contact information** |  | | |
| **Programme name and code** | **MSC Control and Instrumentation (MH6AA)** | | |
| **Module name and code** | **Independent Engineering Scholarship (7EJ998)** | | |
| **Name of supervisor** | **Dr. Ahmad Kharaz** | | |
| **Name of co-ordinator** | **Dr. Ahmad Kharaz** | | |
| **Title of proposed research study: Design and Implementation of Human Posture Recognition Using Accelerometer** | | | |
|  | | | |
| **Supervisor Comments** | | | |
| Are the ethical implications of the proposed research adequately described in this application? | | | Yes ❑ No ❑ |
| Does the overall study have low, moderate or high risk in terms of ethical implications? | | | Low ❑ Moderate ❑ High ❑ |
| Does the study method describe a process of research that is ethically sound? | | | Yes ❑ No ❑ |
|  | | | |
| **Signatures** | | | |
| **The information supplied is, to the best of my knowledge and belief, accurate. I clearly understand my obligations and the rights of the participants. I agree to act at all times in accordance with University of Derby Policy and Code of Practice on Research Ethics:** http://www.derby.ac.uk/research/ethics-and-governance/research-ethics-and-governance | | | |
| **Signature of applicant** | | **Brian Okon** | |
| Date of submission by applicant | | 21/5/2013 | |
| **Signature of supervisor** | |  | |
| Date of signature by supervisor | |  | |
| For Committee Use Reference Number (Subject area initials/year/ID number)………………….  Date received……………… Date approved ……………. Signed………………………  Comments | | | |

|  |
| --- |
| 1. **What is the aim of your study? What are the objectives for your study?**  * The aim is to develop a human posture recognition system and measure distance accurately using 3D accelerometer. The objectives are * To build a portable system with accelerometer and data logging * To develop an algorithm to measure accurately the speed of a person walking or running * To differentiate one posture pattern from another * To detect a person falling |
| **2. Explain the rationale for this study (refer to relevant research literature in your response).**  The impact of bad body posture resulting to health issues has been of serious concern to our society in recent years. Healthcare research has established that inappropriate body posture could lead to skeleton and muscular pathologies and an increased risk of heart disease.  In order to combat this rising trend, ergonomics require a more scientific technique in recognizing and evaluating body postures that are detrimental to the health of a person especially in people that work long hours in a relatively static position.  Because human body is characterized by high degree of freedom, it is not an easy task to accurately determine the posture without the aid of scientific techniques. Also, the quest to reliably predict human behaviour has seen the emergence of different algorithms developed by control engineers to systematically classify body postures.  A good number of research works has been done and some are ongoing in attempt to recognize human gesture using various techniques. However, differentiating different body postures such as sitting, walking, bending and a person falling is still lacking.  Electronic sensor based systems such as the accelerometer has also emerged as a new and improved method for analyzing and classifying human body postures highlighting possible areas of concern and for measuring the speed of acceleration by a person. This is the focus of this project |
| **3. Provide an outline of study design and methods.**   * Develop a portable system with a tri axial accelerometer such as developed by Ravi, S. K. Et al (2013). The system will include the data acquisition system with data logger. The data logger will hold the outputs of the accelerometer representing the XYZ coordinate of the human posture (walking, running and climbing) as they are assumed. * Create a database system to hold the sample data obtained from the human posture. For this project, the Microsoft SQL would be used. Using the LabVIEW database connectivity tool, an interface would be created to enable storage and retrieval of sampled data. * Feature extraction. The content of the data logger reflecting the human posture would be extracted and stored in a database tables. * Develop an algorithm to analyze and classify human postures similar to Nooritawati et al. (2007) and Kayembe (2012). * Evaluate the workings of the system and how accurately the speed of a person walking or running can be determined. Using Five (5) volunteers for this purpose. The portable system will be attached to each volunteer to perform translational movement under the following subset * Slow Walking * Normal Walking * Fast Walking * Running |
| **4. Research Ethics**  **Does the proposed study entail ethical considerations Yes (please delete as appropriate) If you are unsure please seek advice before submitting this form.**  **If ‘No’ provide a statement below to support this position.**  **If ‘Yes’ move on to Question 5.**  **Please note: PROPOSALS INVOLVING HUMAN PARTICIPANTS MUST ADDRESS QUESTIONS 5 - 11.** |
| **5. Please provide a detailed description of the study sample, covering selection, sample profile,   recruitment and if appropriate, inclusion and exclusion criteria.**  The study sample will be a portable data acquisition system bundled with a 3D accelerometer and a data logger. Volunteers for the system testing will wear the device which is unobtrusive around the arm to record position coordinates. The recruitment criteria will be strictly voluntary. |
| **6. Are payments or rewards/incentives going to be made to the participants? Yes 🞎 No ✓   If so, please give details below.** |
| **7. Please indicate how you intend to address each of the following ethical considerations in your study. If you consider that they do not relate to your study please say so.**  **Guidance to completing this section of the form is provided at the end of the document.**   1. **Consent:** Consent form will be issued to volunteers to fill and sign. 2. **Deception:** No deception is anticipated 3. **Debriefing:** No formal debriefing is applicable 4. **Withdrawal from the investigation:** Volunteer will be free to withdraw at any time desired. It will be stated on the consent form. 5. **Confidentiality:** Data to be obtained are XYZ coordinates of posture and may be shared during analysis 6. **Protection of participants:** The participants are not at any risk or danger as a result of the project. 7. **Observation research:** Observational research without prior consent will not be applicable 8. **Giving advice:** Where necessary participants will be directed to project supervisor for advice 9. **Research undertaken in public places:** The research shall be done in the school laboratory 10. **Data protection:**  The project shall comply with the University’s regulation about data protection 11. **Animal Rights:**  No animal shall be involved in the project 12. **Environmental protection:** The project has no environmental impact. |
| **8. Are there any further ethical implications arising from your proposed research? Yes 🞎 No ✓**  **If your answer was no, please explain why.** All ethical issues have been addressed in 7 above |
| **9. Have / do you intend to request ethical approval from any other body/organisation? Yes 🞎 No ✓**  **If ‘Yes’ – please give details** |
| **10. What resources will you require? (e.g. psychometric scales, IT equipment, specialised software, access to specialist facilities, such as microbiological containment laboratories).**  Computer System running LabVIEW |
| **11. What study materials will you use? (Please give full details here of validated scales, bespoke questionnaires, interview schedules, focus group schedules etc and attach all materials to the application)** |
| **Which of the following have you appended to this application?**   |  |  | | --- | --- | | ❑ Focus group questions | ❑ Psychometric scales | | ❑ Self-completion questionnaire | ❑ Interview questions | | ❑ Other debriefing material | ❑ Covering letter for participants | | ❑ Information sheet about your research study | ✓ Informed consent forms for participants | | ❑ Other (please describe) |  | |

**PLEASE SUBMIT THIS APPLICATION WITH ALL APPROPRIATE DOCUMENTATION**

**Advice on completing the ethical considerations aspects of a programme of research**

**Consent**

Informed consent must be obtained for all participants before they take part in your project. The form should clearly state what they will be doing, drawing attention to anything they could conceivably object to subsequently. It should be in language that the person signing it will understand. It should also state that they can withdraw from the study at any time and the measures you are taking to ensure the confidentiality of data. If children are recruited from schools you will require the permission, depending on the school, of the head teacher, and of parents. Children over 14 years should also sign an individual consent form themselves. If conducting research on children you will normally also require Criminal Records Bureau clearance. You will need to check with the school if they require you to obtain one of these. It is usually necessary if working alone with children, however, some schools may request you have CRB clearance for any type of research you want to conduct within the school. Research to be carried out in any institution (prison, hospital, etc.) will require permission from the appropriate authority.

**Covert or Deceptive Research**

Research involving any form of deception can be particularly problematical, and you should provide a full explanation of why a covert or deceptive approach is necessary, why there are no acceptable alternative approaches not involving deception, and the scientific justification for deception.

**Debriefing**

Debriefing is a process of reflection once the research intervention is complete, for example at the end of an interview session. How will participants be debriefed (written or spoken feedback)? If they will not be debriefed, give reasons. Please attach the written debrief or transcript for the oral debrief. This can be particularly important if covert or deceptive research methods are used.

**Withdrawal from investigation**

Participants should be told explicitly that they are free to leave the study at any time without jeopardy. It is important that you clarify exactly how and when this will be explained to participants. Participants also have the right to withdraw their data in retrospect, after you have received it. You will need to clarify how they will do this and at what point they will not be able to withdraw (i.e. after the data has been analysed and disseminated).

**Protection of participants**

Are the participants at risk of physical, psychological or emotional harm greater than encountered ordinary life? If yes, describe the nature of the risk and steps taken to minimise it.

**Observational research**

If observational research is to be conducted without prior consent, please describe the situations in which observations will take place and say how local cultural values and privacy of individuals and/or institutions will be taken into account.

**Giving advice**

Students should not put themselves in a position of authority from which to provide advice and should in all cases refer participants to suitably qualified and appropriate professionals.

**Research in public places**

You should pay particular attention to the implications of research undertaken in public places. The impact on the social environment will be a key issue. You must observe the laws of obscenity and public decency. You should also have due regard to religious and cultural sensitivities.

**Confidentiality/Data Protection**

You must comply with the Data Protection Act and the University's Good Scientific Practice <http://www.derby.ac.uk/research/policy-and-strategy> This means:

* It is very important that the Participant Information Sheet includes information on what the research is for, who will conduct the research, how the personal information will be used, who will have access to the information and how long the information will be kept for. This is known as a 'fair processing statement.'
* You must not do anything with the personal information you collect over and above that for which you have consent.
* You can only make audio or visual recordings of participants with their consent (this should be stated on the Participant Information sheet)
* Identifiable personal information should only be conveyed to others within the framework of the act and with the participant's permission.
* You must store data securely. Consent forms and data should be stored separately and securely.
* You should only collect data that is relevant to the study being undertaken.
* Data may be kept indefinitely providing its sole use is for research purposes and meets the following conditions:
* The data is not being used to take decisions in respect of any living individual.
* The data is not being used in any which is, or is likely to, cause damage and/or distress to any living individual.
* You should always protect a participant's anonymity unless they have given their permission to be identified (if they do so, this should be stated on the Informed Consent Form).
* All data should be returned to participants or destroyed if consent is not given after the fact, or if a participant withdraws.

**Animal rights.**

Research which might involve the study of animals at the University is not likely to involve intrusive or invasive procedures. However, you should avoid animal suffering of any kind and should ensure that proper animal husbandry practices are followed. You should show respect for animals as fellow sentient beings.

**Environmental protection**

The negative impacts of your research on the natural environment and animal welfare, must be minimised and must be compliant to current legislation. Your research should appropriately weigh longer-term research benefit against short-term environmental harm needed to achieve research goals.

**RESEARCH ETHICS: SAMPLE CONSENT FORM Form RE5**

Design and Implementation of Human Posture Recognition Using Accelerometer

By: Brian Okon: MSc Control and Instrumentation,

University of Derby

[B.Okon1@unimail.derby.ac.uk](mailto:B.Okon1@unimail.derby.ac.uk)

|  |  |
| --- | --- |
|  | Please Initial Box |
| 1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. |  |
| 1. I understand that my participation is voluntary and that I   am free to withdraw at any time, without giving reason. |  |
| 3. I agree to take part in the above study. |  |
| 4. I understand that anonymity will be ensured in the write-up by  disguising my identity. |  |
| *Note for researchers:*  *Include the following statements if appropriate, or delete from your consent form:*  4. I agree to the interview consultation being audio recorded |  |
| 1. I agree to the interview consultation being video recorded |  |
| 1. I agree to the use of anonymised quotes in publications |  |

Name of Participant Date Signature

Name of Researcher Date Signature