

# DCU Engineering Final Year Project Status Report

Title: A Wireless 3D Embedded RTOS Human Computer Interface

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## Description:

This project is to design and implement a wireless 3D Human-Computer Interface (HCI). It will be implemented using next-gen wireless devices and using a real-time operating system. The device should allow the user to be able to wirelessly interact with a 3D-environment within the computer. This device may be implemented by integrating accelerometers, gyroscopes and distance sensors interfaced with an embedded device running the real-time operating system (RTOS).

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# 1. Problem and Boundaries

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## 1.1 Motion control

The design of a wireless 3D human machine interface poses many engineering problems to overcome. One of which is the design of the device in order to track and record movement. The device must be able to perceive its motion and be able to track its position in space as well as its orientation within 3-axis. This may be done via implementing accelerometers, gyroscopes, and distance sensors and through research more solutions may become apparent.

## 1.2 Programming

As well as interfacing these devices the complete device will be programmed using a real-time operating system on an embedded device. This will allow the device to be extremely power efficient, and responsive. However, using a real time operating system means a lot of care will have to be taken to design an efficient operating system. To design such code a lot of research and training will be needed to learn about elements of real-time operating systems such as interrupts, thread, i.o. control, as well as learning to interface with the chosen language and embedded system the device will be based on.

## 1.3 Wireless Communication

Another engineering problem to overcome is the transport of data wirelessly from the device. It will need to be transported from the device to a computer for application within the software of the computer. There are many different wireless communication methods and it is important to design the communication across to the computer so that it is extremely fast, as to keep the input latency from the movement of the device and movement within the program low.

## 1.4 Interfacing with the Computer

It will also be another engineering problem to interface with the computer. It is important that the device can be made functional and therefore the information it generates must be interfaced with a computer in order to achieve interaction with the computer.

## 1.5 Boundaries

This project does not include the need to research and develop for an ergonomic experience with the device. Although steps may be taken to improve the usability of the device throughout the project this is only for the purposes of demonstration and the developer of the device need not spend a vast amount of time designing for ergonomics.

Where application programming interfaces (API) and similar programming repositories are available they may be used. It is not necessary if avoidable for the developer to design code that can be found in publicly available resources. Some examples of this may be API's to interface HCI components with modern desktop operating systems including Windows 10 or Mac OS, or example code resources for the embedded system board the device will use.

## 2 Background Theory

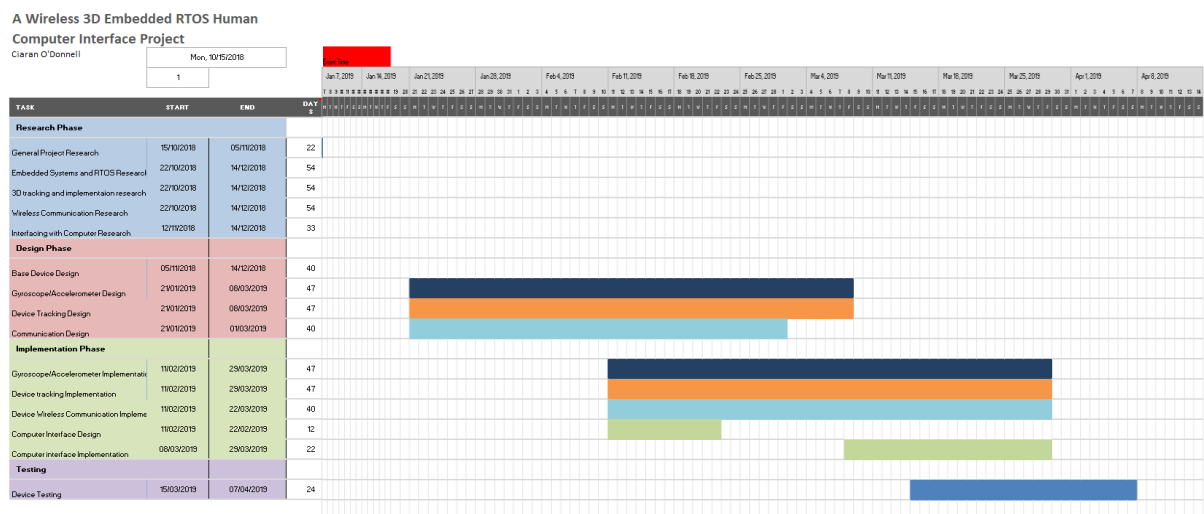
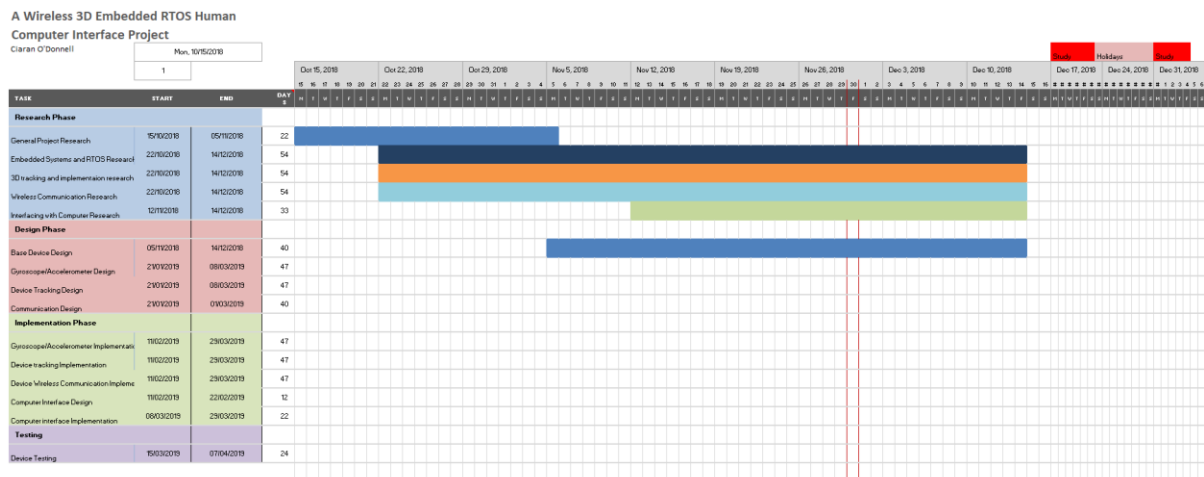
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## 3 Proposed Design

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## 4. Work Schedule / Plan

As this project has many different elements that must all be implemented to have a functional device the organisation of work so that one element of design is not overlooked is important. To accomplish this the work should be split into sections for each element and timetabled accordingly.



In the design of the schedule it was estimated that some phases of the project will take longer than others, and consideration was taken that some phases cannot commence until work has been completed on others, one such example is the interfacing of the device with the computer. If the device is not sending relevant data to the computer interfacing this data with the computer will be counterproductive and therefore work on interfacing with the computer will begin at a later date than the implementation of the rest of the device.

It will be important to have a complete design for the device by the 1<sup>st</sup> week in February as to begin the implementation phase. This deadline will ensure enough time to have a complete implementation of the device by the 1<sup>st</sup> of April.

It is also important that the device is capable of interpreting and recording usable data by the first week of march so that work can begin on interfacing this data with the computer.

The testing of the device will begin the second week in March, this is to ensure that a sufficient amount of testing can be complete and recorded within the project report before its deadline week 11 or 12(8<sup>th</sup>/12<sup>th</sup> of April), for this reason testing should be complete by at the latest the 1<sup>st</sup> of April.

Of course, with all of these deadlines is preferably to allow more time for later elements but if this schedule is adhered to the project should attain satisfying accomplishment.

As can be seen based on the proposed Gantt chart a lot of elements of the project will need to be worked on in tandem with one another. Organizing the work on a weekly basis is therefore very important to ensure all areas of the work is complete. So, to do this a weekly work schedule was also designed for when elements must be complete in tandem.

Project Weekly Schedule							>
TIME	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
9:00 AM			Device Tracking	Embedded System Board	Device Tracking	Computer Interface	
10:00 AM		IN CLASS					
11:00 AM							
12:00 PM							
1:00 PM			Wireless Communication	IN CLASS	Open Period	Open Period	
2:00 PM							
3:00 PM		Embedded System Board					
4:00 PM			Computer Interface		Wireless Communication		
5:00 PM							
6:00 PM							
7:00 PM							

This is the proposed work schedule for when many elements of the project must work in tandem. Care was taken to include open periods in case additional time must be spent on a particular component. This schedule is intended as a guide to help the work remain on schedule, however it important to note that during these stages it will often be the case that these tasks will overlap, and work will often be complete in other areas during each period. However, if this schedule is used as a base no element of the project will be overlooked.