HACKING HARDWARE

Version 1.0
BSc Computing for Games
COMP140

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Introduction

In this assignment, you will work as an individual to design a novel game controller and implement a physical prototype. Your prototype should function as an input device the game developed for the first coursework. Your prototype should use a hardware platform, such as Arduino, to convert player actions into game inputs.

Experimentation, ingenuity, and creativity are at the heart of everything that professional game developers do. To this end, building your own custom game controller is the perfect place to exercise these characteristics. However, you will also gain invaluable exposure to working with computer hardware. In recent years, there has been considerable growth in the development of new fabrication technologies, such as 3D printers. In addition, electronics, from primitive transistors to complex computer chips, have all become much cheaper. Accessibility to these tools has, therefore, unveiled an unprecedented opportunity to invent and innovate in this space. Increasingly, app developers are augmenting mobile software with new wearable devices, and so to will game developers with the advent and increasing popularity of augmented reality games.

Hacker definition: "A person who enjoys exploring the details of programmable systems and stretching their capabilities, as opposed to most users, who prefer to learn only the minimum necessary."

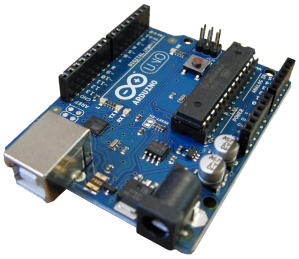
— Jargon File

This assignment is formed of several parts:

(A) **Write**, a revised proposal for a novel game controller that will:
  i. **state and justify** the game that will be the basis for your interface;
  ii. **outline** an initial design in detail;
  iii. and **list** the key requirements the prototype must fulfil.

(B) **Implement** a final physical prototype which will:
  i. **revise** the design based on your component research
  ii. **Implement** a revised version of your game which will:
    i. **improve** upon the design of the original prototype;
    ii. **integrate** the controller with the game

(C) **Present** a practical demo of the game controller to your tutor that will:
  i. **demonstrate** your academic integrity;
  ii. as well as **show** your programming knowledge **and** communication skills.



Arduino is an open-source prototyping platform based on easy-to-use hardware and software.

Assignment Setup

Continue on the assignment 1 code base

You may have to modify the `.gitignore` to take into account Ardunio

Part A

Part A consists of a **single formative submission**. This work will be assessed on a **threshold** basis. The following criteria are used to determine a pass or fail:

(a) Submission is timely;
(b) Choice of game is feasible;
(c) Range of controllers are assessed is comprehensive;
(d) Design is distinctive and has creative merit.

To complete part A, write your proposal in the `readme.md` document. Show this to your tutor in-class. If acceptable, this will be signed-off.

Part B

Part B is a **single summative submission**. This is **individual** work will be assessed on a **threshold** basis. The following criteria are used to determine a pass or fail:

(a) Enough work is available to hold a meaningful discussion;
(b) Clear evidence of programming knowledge and communication skills;
(c) No breaches of academic integrity.

To complete Part B, prepare a practical demonstration of the game controller. Ensure that the source code and related assets are pushed to GitHub and a pull request is made prior to the scheduled viva session. Then, attend the scheduled viva session.

You will receive **immediate informal** feedback from your **tutor**.

Additional Guidance

Falmouth University is internationally renowned for the arts. Despite the fact that you are studying for a BSc degree in a technical discipline, you are still expected to strive for the same level of innovation and creative flair as your peers. This assignment is more heavily weighted towards the creative than the assignments you have completed thus far. On this assignment, a competent execution of an unimaginative idea is unlikely to achieve a high grade, as opposed to an imperfect execution of a unique and ambitious concept, which will be seen favourably by examiners. Consider this when working on your design. One approach to promote creativity is divergent thinking: generate ideas by exploring many possible solutions. Often the most interesting ideas are subversive: they deliberately go against the accepted or most obvious solution.

The history of video games is littered with failed peripherals. They were perceived as expensive gimmicks rather than legitimate enhancements to gameplay. Your creativity should be balanced by commercial awareness: your design should be informed by research into products that have succeeded and failed in the past, and what underexploited niches exist in the present. A great project will be highly divergent, but one that has clear commercial viability. Do not be discouraged if you fall short: professionals find it difficult!

We have given you some of the materials you need: an Arduino and other useful components. You will need to add your own materials to produce a functional physical prototype. A *Blue Peter* style prototype made from household items is fine, as is something made out of modelling clay. However you should still choose your materials carefully, as overly flimsy construction may impair functionality.

You may also wish to connect electronic components such as LEDs, buzzers, photoresistors etc to the Arduino, or even use a different, more flexible hardware platform such as RaspberryPi. However you are discouraged from spending large sums of money on extra hardware, and doing so is not required to achieve a high mark. If you choose to go down this route, it is possible to purchase a RaspberryPi and other useful peripheral online for around the price of a textbook (up to £40).

You should aim to demonstrate a high level of sophistication in the technical execution of your prototype. An important part of sophistication is having the insight to choose the right tool for the job: if a simpler technique fulfils all the requirements, use it. The use of unnecessarily complicated techniques, serving only to showcase one's own cleverness, is a dangerous habit.

The sole purpose of the recorded demonstration is to aid the external moderators and examiners. Furthermore, any photos and/or videos submitted do not need to be entertaining or highly polished.

FAQ

- **What is the deadline for this assignment?**
  Falmouth University policy states that deadlines must only be specified on the MyFalmouth system.
- **What should I do to seek help?**
  You can email your tutor for informal clarifications. For informal feedback, make a pull request on GitHub.
- **Is this a mistake?**
  If you have discovered an issue with the brief itself, the source files are available at:
  `https://github.com/Falmouth-Games-Academy/bsc-assignment-briefs`.
  Please raise an issue and comment accordingly.

Additional Resources

- Wilkinson, K. and Petrich, M. (2014) The Art of Tinkering: Meet 150 Markers Working at the Intersection of Art, Science & Technology. Weldon Owen: London.
- Alicia Gibb. Building Open Source Hardware: DIY Manufacturing for Hackers and Makers. Addison Wesley, 2014.
- Jeremy Blum. Exploring Arduino: Tools and Techniques for Engineering Wizardry. John Wiley, 2013.
- Kelly, K. (2014) Cool Tools: A Catalogue of Possibilities. Cool Tools.
- Hatch, M. (2013) The Maker Movement Manifesto: Rules for Innovation in the New World of Creators, Hackers, and Tinkerers. McGraw Hill: New York.
- https://www.sitepoint.com/heuristic-evaluation-guide/
- https://www.usability.gov/how-to-and-tools/methods/heuristic-evaluation.html

Marking Rubric

Criterion	Weight	Refer for Resubmission	Basic Competency	Basic Proficiency	Novice Competency	Novice Proficiency	Professional Competency
Basic Competency Threshold	40%	At least one part is missing or is unsatisfactory. There is little or no evidence of an iterative development process and no improvement over time in regards to the quality of the design and build of the prototype.	Submission is timely. Enough work is available to hold a meaningful discussion. Clear evidence of a 'reasonable' iterative development process Clear evidence of programming knowledge and communication skills. Clear evidence of reflection on own performance and contribution. Only constructive criticism of pair-programming partner is raised. No breaches of academic integrity.				
Design of the solution	15%	No evidence of upfront design	The correspondence between design and implementation is tenuous.	The design somewhat corresponds to the final implementation.	The design corresponds to the final implementation.	The design clearly corresponds to the implementation.	The design clearly and comprehensively corresponds to the implementation.
Innovation and creative flair	10%	No evidence of innovation and/or creativity.	Some evidence of emerging innovation and/or creativity. The solution is purely derivative of existing products. There is no evidence of divergent thinking.	Little evidence of emerging innovation and/or creativity. The solution is mostly derivative, with some attempts at innovation. There is evidence of an attempt at divergent thinking.	Much evidence of emerging innovation and/or creativity. The solution is an interesting and somewhat innovative product. There is some evidence of divergent thinking.	Considerable evidence of mastery of innovative and creative practice. The solution is a novel and innovative product. There is much evidence of divergent thinking.	Significant evidence of mastery of innovative and creative practice. The solution is a unique and innovative product. There is significant evidence of divergent thinking.
Functionality of physical prototype	15%	A physical prototype is not produced, or the prototype is completely non-functional.	The physical prototype has no functionality. There are serious technical and/or constructional flaws.	The physical prototype has some functionality. There are obvious technical and/or constructional flaws.	The physical prototype has much functionality. There are minor technical and/or constructional flaws.	The physical prototype has considerable functionality. There are superficial technical and/or constructional flaws.	The physical prototype has significant functionality. The technical execution and physical construction are flawless.
Sophistication: Software Electronics Physical construction	15%	The solution lacks even a basic level of sophistication in any of the three areas.	The solution evidences some sophistication in one or more of the three areas. Some insight has been demonstrated in any area.	The solution evidences little sophistication in one or more of the three areas. Little insight has been demonstrated in at least one of the areas.	The solution evidences much sophistication in two or more of the three areas. Much insight has been demonstrated in at least one of the areas.	The solution evidences considerable sophistication in all three areas. Considerable insight has been demonstrated in at least two of these areas.	The solution evidences significant sophistication in all three areas.. Significant insight has been demonstrated in all three areas.
Use of Version Control	5%	GitHub has not been used.	Source code has rarely been checked into GitHub.	Source code has been checked into GitHub at least once per week. Commit messages are present. There is evidence of engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of somewhat meaningful engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of meaningful engagement with peers (e.g. code review).	Source code has been checked into GitHub several times per week. Commit messages are clear, concise and relevant. There is evidence of effective engagement with peers (e.g. code review).