3/14/2019

USB Game Controller

Paul Churchill, James Poirier, Nathan Saccary

# Introduction

For our senior project our group, Paul, James and Nathan were inspired by our own hobbies to create something that we and many others have wanted but does not exist currently in the market. The three of us are gamers with a dislike for the standard console controller due to the cheap feel of the chassis and buttons. Paul’s passion for mechanical keyboards combined with James’ and Nathan’s care for quality inspired this project.

# Goal Statement:

Our goal is to create a USB game controller for a PC. This game controller has feel and build quality as it's number one priority. Being sturdy, tough, comfortable grip, balanced weighting, satisfying low delay key presses, key mapping. An overall high-quality product.

To achieve comfort, we plan on carefully sculpting a handle and body that will hug the hand and provide a shape that evenly distributes the weight.

To achieve sturdiness, we plan on carving a 3D model based on the sculpture out of wood and sanding it to perfection. making sure that there is little excess room inside the chassis giving it a hearty feel. A finish will be applied at the end.

To achieve satisfying key presses, we plan to do something no other game controller has done before and use Mechanical key switches (designed for keyboards) they offer a better feel then the typical rubber dome button (The Neo Geo has a mechanical D-pad but is otherwise standard). Hand customizing actuation points and key cap sizes are in consideration.

To achieve key mapping, we plan on having a companion software written in C99 that can detect the attached controller and offer a graphical user interface that can change what input is sent when a button is pushed. We also plan on having a rumble motor.

We want to design the controller in a way that will allow it to be produced. This means having Schematic and Gerber files that could be sent to a PCB manufacturer, having a detailed 3D model that can be used on CNC machines, and having companion software that can run on a variety of devices(Windows/Linux).

# Team Charter

## Members and Roles

## James Poirier

Perfect attendance thought grades 10,11, and 12 and graduated with honors despite a relatively lower English grade. Has won awards for video editing from Atlantic film festival and Mining Association video contest. He came to the CET program to get a formal education inline with his passion for technology.

Strengths: Programming, Logical Circuits, problem solving, critical thinking

Weaknesses: Communication, presentation

Roles: Scrum Master, Companion Software Programmer, Micro-controller Research, Documentation

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## Paul Churchill

Worked for 2 years at a local pub while not in school. Has a passion for building and modifying desktop computers. Entered the CET program to further knowledge and find a path into the industry.

Strengths: Circuitry, CADD, problem solving, attention to detail

Weaknesses: Programming, scheduling

Roles: Circuit design, Circuit Assembly, Micro-controller Research Documentation, Presentation, Proofreading

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## Nathan Saccary

Had distinction (80+) in grade 10, as well as highest distinction (90+) in both grade 11 and 12. Active contributor to benefits and drives in his home town and does fundraising for multiple health organizations (heart & stroke, run for the cure) and local sport teams. In his spare time, he is a computer enthusiast and weightlifter. Came to NSCC for the diverse IT programs and hands-on learning.

Strengths: CADD, semiconductors

Weaknesses: Programming

Roles: Chassis-modeling (Physical and CADD) Micro-controller Research, Documentation, Presentation

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# Preliminary Investigation

## Sharing our learning

We don’t want to use Kickstarter or other crowd funding sites because we feel there is a stigma about quality and the type of company that runs through Kickstarter (though they are a good way of advertising to a large amount of people). We think it would be best to have our product start locally in shops around our home towns (Halifax, Bridgewater, Cape Breton). If they are popular, we may try to increase scale cross Canada. Going outside of Canada will require more work because of laws and shipping.

Alternatively, if we find a unique method or feature implementation, we may opt to share it as an open-source project using a website like Instructables.com.

## Stakeholders

Todd Verge (Funding)

Brian Shewan (Faculty Advisor)

James Poirier, Paul Churchill, Nathan Saccary (Creators)

Business Partners (Sellers/Distributors, Mass Manufacturing)

Customers (If being sold)

Open-source Communities (If not being sold)

## Ideas and features

Mechanical key switches for the best feeling

High quality analog sticks

Wooden chassis

Sturdy/High build quality

Wooden Keycaps

Grips shaped for different hand sizes

Controlled by an Arduino

Software based button-mapping

Rumble support

Windows and Linux Support

## Useful Resources

[Chassis prototyping and design](https://www.youtube.com/watch?v=OTGtbLhldPc)

[Arduino, small USB controller](https://www.instructables.com/id/Making-a-USB-Game-Controller/)

[Same as above but different casing](https://www.instructables.com/id/Lets-make-a-game-controller/)

[Fallback board](https://www.pjrc.com/teensy/index.html)

[Wood carving technique](http://forum.vectric.com/viewtopic.php?f=2&t=25047)

[Modeling Clay for prototype](https://www.sculpey.com/original-sculpey/1-original-sculpey)

[Clay help](https://www.sculpey.com/create/support/faqs/)

[Joystick Library](https://github.com/MHeironimus/ArduinoJoystickLibrary/tree/version-2.0)

[d-pad potentiality](https://twitter.com/SonicFox5000/status/978685886346006528?s=19)

[Tools for modeling clay](https://www.amazon.com/Darice-97803-11-Piece-Clay-Cleaning/dp/B001ED3JMS/ref=pd_lpo_vtph_201_lp_img_3?_encoding=UTF8&psc=1&refRID=N7Y9XTYF3XRG6134RGZZ)

[General mechanical key switches](https://mechanicalkeyboards.com/switches/index.php?brand=&stem=&feel=&sort=Force+%28lightest%29)

[Key switch datasheet](https://datasheet.octopart.com/MX1A-11NW-Cherry-datasheet-34676.pdf)

[Connect an Arduino to a PC via Bluetooth](https://dotslashnotes.wordpress.com/2013/09/21/how-to-setup-a-bluetooth-connection-between-arduino-and-a-pcmac/)

Modeling resources:

<https://www.youtube.com/watch?v=_MPnyFKKH8k>

<https://www.youtube.com/watch?v=EO_2QsekC8g>

<https://www.youtube.com/watch?v=Jerea21nZQs>

<https://www.youtube.com/watch?v=gAmmN-6jR34>

<https://www.youtube.com/watch?v=3Oa1A4aSoWk>

<https://www.youtube.com/watch?v=VPpbaKqTS2c>

<https://www.youtube.com/watch?v=XD7HBFlIFMM>

<https://www.youtube.com/watch?v=Dfxm8irfEhc>

## SMART goal

S – Our group wants to create a 14 button 2 analog stick controller that will work on PC though USB. Our primary focus is build quality. We will be using wood as a chassis, and mechanical key switches for buttons (Cherry MX, Zealios, Gateron, etc). Along with the controller we want software that will make the buttons programmable to keyboard/mouse/controller inputs.

M – This project will be finished when we have a controller that’s sturdy, feels good to hold and press buttons, connects to a computer and functions in games/desktop.

A – All team members agree on the project idea and roles.

R – We need to find a microcontroller that will let us send controller/keyboard inputs to the computer. We’ll need a lot of research and development on creating the chassis.

Creating companion software might be hard depending on the chip in the controller. It might also cause input lag or computer slowdown if not done right so a lot of time will have to be put into it

T – A Functioning controller as well as a way to present all the research and knowledge we discovered along the way by be present for April 4th

# Required resources:

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| Arduino Teensy |
| Polymer Clay |
| Analog Sticks |
| Mechanical Keyswitches |
| Sculpting Tools |
| 18 AWG Wire |
| Soldering Station |
| Wood |
| CNC Machine |
| Wood Polish |
| Rumble Motors |
| Resistors |
| USB Cable |
| Perf board |
| PCB |
| Keycaps |
| Power Tools |
| Sandpaper |
| Lacquer Wood Finish |
| Glue |
| Screws |
| Bread Board |
| Camera |
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# Work Breakdown Structure

# Timeline

Week 1: Arduino sketch for buttons and analog sticks.

Week 2: Perf board protoype

Week 3 (March break): 3D Model complete, PCB ready for manufacturing

Week 4: Companion Software, Wood Chassis

Week 5: Finished Product

Week 6: Write-up, presentation prep