**Daily thoughts and experience dairy**

**Project:**

**Robotics and manufacturing: structures**

Model cheaply purchasable components e.g., 2x4 planks, nuts and bolts and create them in three.js/bullet with appropriate physics properties, including weight, friction. Objects should include costs and links for purchase.

Create models of physical parts with appropriate bending, twisting and breaking effects (model that they can occur) so that structures of suitable strength can be developed and limitations under forces can be incorporated into the design of machines.

Creating models of physical attachments e.g. nuts and bolts, nails, glue etc. that have parameters and can replicate plausible behaviours when subject to physical forces within a physics engine (including vibration)

**Week 1**

15/01/2021

On Thursday I was assigned my project area for this module in manufacturing and robotics simulation as well as given some resources that included a tutorial to install three.js/ammo.js and a sample project from another student, Today is my first day following up on the information given to me, I was a little bit nervous and overwhelmed getting started because I feel a bit over my head for choosing this module but I do feel I made some progress today through getting ammo/three.js working and beginning to learn java script. I also want to learn visual studio code, so I am trying tutorials to be able to use it throughout my project.

18/01/2021

This is my second day doing research for my project, Today I continued learning JavaScript by following a tutorial online about JavaScript, it taught me both constructor and factory functions for creating object. I also started looking into three.js by watching a short tutorial on it and checking out their website which has excited me about what I am going to be doing over the next few months because there are some cool things on that website.

19/01/2021

Today I investigated further details of three.js. As part of that I have had a lot of fun today following tutorials and following some of the documentation to create moving geometry objects in the browser, although I know it is basic, it is still really satisfying to do and is getting me excited for receiving my project which I hope will be on Friday where my group has been assigned a slot for a meeting our courses lecturer.

20/01/2021

Today was just me going over the concepts of the js library that I had learned the day before and learning them further in depth like learning the geometry section, and some other stuff like lighting, I also tried to create a skybox and add an orbital camera, although I had some issues with the orbital camera as the debugging console kept saying that I had not added enough parameters to the orbital camera instantiation even though I was copying from the tutorial, I spent a while trying to figure it out and could not get a solution today. The problem with the orbital camera stalled my attempt at creating the skybox.

21/01/2021

This is my fifth day doing stuff for this project, I did not do much more work today because I was doing some work for my other modules, I did however read the documentation on ammo.js and watch some of the videos where people had created projects using ammo.js. Tomorrow my group cuttlefish has a meeting with our lecturer where hopefully I will get a push in the right direction which will give me more of an idea as to what I should be doing to get prepared for this project. ( I did not know what a cuttlefish was even though it sounded familiar so I ended up spending an good 20 minutes of my evening watching YouTube videos about them.)

22/01/2021

Today was the day of the meeting with our lecturer for computer science challenges during this meeting I was given my project for this module and given some information about what I should be doing during the next week to continue with this project?

The project I was given:

* Ammo.js is a port of bullet physics engine which is used in c language.
* Simulate items from a hardware store mainly raw materials like plywood at the start then potentially connecters later on in the project and show how they would be affected by the physics that are applied to them, e.g., if a weight was put on a plywood it should bend, If too much weight is applied it should break. These materials should be able to be put together in a simulation to create stuff eventually like a table. This is where I should look at a skilling tutorial. Should connect multiple boards together which are only affected by certain forces for a natural material like a wooden plank.
* The two main things that the marks are given for this module are for the diary entries and how useful the project is for people building something like what I am building in this project.
* I need to set up a GitHub repo to contain the contents of my project and add our lecturer as a contributor.
* For the how to guide I should focus on making it simple for someone to learn and use the tools needed to do something like I am doing for this project, by linking useful video and documentation as well as other example projects that I find.
* \*use clock ticks during the program to do calculations for this project.
* For next week: Continue with learning and getting comfortable with ammo.js and three.js and do some journalistic work on finding information for the how to guide and example projects like the one that I am doing. Also, I am going to try to create the world in which I am going to create these simulations and create a piece of plywood in this world using the three.js geometry.

**Week 2**

25/01/2021

I have been doing this project for a bit more than 2 weeks now, and although I have got more of a grasp and idea of what I am doing there is still a lot of work to do to solve the problems of my project. Some of the things that I want to do this week are:

* Get more comfortable using ammo.js and improve in using three.js libraries.
* Find projects like mine and tutorials which can help people for me how to guide.
* Set up my how to guide web page.
* Set up the GitHub repository for the project.
* Figure out how I am going to simulate objects like a wooden plank that is going to be affected by different forces.

Today I mainly focused on researching and preparing. I found some good tutorials today on ammo and three.js on setting up a world, how to get objects to interact and collision physics.

I followed these tutorials today and got some good results. As well as this I set up my folder for the project as well as setting up my GitHub.

26/01/2021

Today I started off the day by learning how to install intellisense for three to make it easier for me to program using the three libraries as it will allow me to autocomplete code. I ran into an issue during following tutorials of how to do this because visual studio code would not let me run scripts from my machine, from this I had to change the execution policy for my machine in admin PowerShell to Remote Signed, after that I also continued just doing some sample projects using three.js and ammo.js which have allowed me to get more comfortable with the syntax. I also found some tutorials which I am going to link in my how-to guide which explained getting started with three and ammo, how to move objects and how the collision detection works. I am still working my way through these tutorials because I ran into some issues including a version control and syntax errors. I did fix these syntax errors and the issue with the version of three.js where gamma input and output had been removed by copying and pasting the three.js file from the sample project of a previous year’s student into my js folder.



27/01/2021

Today is Wednesday, I started the day off by going over work from other lectures after I started to continue work on this project. Mainly today I was looking for projects using three and ammo which were like what has been asked from me to get ideas to how I am going to apply bending to objects and so on. I went through multiple GitHub repos showing examples of ammo and three.js and honestly, I struggled to find anything very similar to the structures project I am going to be working on. What I did see were some custom-made objects like cars which I will need to use later in my project for creating bolts and other more custom looking objects. Also, I found dynamic objects like a balloon whose geometry changed when forces impacted, these two sample projects have given me ideas as to how I can add bending to objects in my project when force is applied to them, although I still do not know how am going to simulate objects breaking. I also continued learning how to use ammo.js, I ran into some issues with that today mainly just that objects were not loading into the scene I eventually found that I was not using renderer. Render (scene, camera); in my game loop function which solved the issue I was having, and I found some documents and tutorials on.

28/01/2021

I worked on a sample project that was given me by the lecturer by just hacking it through changing certain property values like cylinder mass and positions to see how they were affected and to get a better understanding of what does what in ammo.js. Today allowed me to learn how vector 3 works and get a better understanding of how to work with ammo.js and how it can be applied to objects created in three.js.

29/01/2021

Today I had my second meeting with lecturer about my project in this meeting we were told about how to do the how to guide.

After the meeting I started trying to find some examples on GitHub of cloth like structures which were affected by physics and ended up coming across <https://github.com/THISISAGOODNAME/learn-ammojs> which had several examples of cloth material as well as cars and other objects.

30/01/2021

I started off pretty stressed thinking about this project as I still did not know how I was going to simulate an object that could be affected by physics and could carry out functions like bending, So I carried on working, I also started thinking about what I should do for my how to guide however I still don’t know there’s a lot that I have done in the past 2 weeks but most of it has been covered well by the tutorials I have went through. After that I continued looking through tutorials and learned about collision filtering and constraints. The constraints gave me an idea of how I am going to do my project. I think I am going to create several blocks in three and in ammo.js to represent them in the physics world and connect them via the hinge constraint. I am going to try implement a p2p constraint tomorrow on some objects and see how that works and whether it is the best solution to simulating the bending of an object.

**Week 3**

01/02/2021

Today I started working on my how to guide. I have decided that I am going to create a how to guide that I wish I had when I was starting, so if someone was to start with three.js and ammo.js they will not run into the same time-consuming issues of searching hard the internet for tutorials. Therefore, this website is going to target a beginner user of ammo.js and three.js. I am planning to have my how to guide contain 5 main sections, the first explaining what both three.js and ammo.js are. The second containing information about setting up ammo.js and three.js linking to the installation guides. Also linking a guide to the ide I am using visual studio code and finally a tutorial on setting up your project folder and vs code workspace to allow the user to get started working with ammo.js. The third part I will show a tutorial of setting up a physics world. And the fourth will be about creating objects in the world which will be affected by physics and show some examples of different objects which can be added and finally I am going to have the last part of my how to guide about where to go from this point. I am doing the how to guide in a format that I think would be helpful to someone in my shoes when I began this project therefore I did it in a step by step building a project up format building the project from the start to the finish explaining all the code in the simplest way possible using brief paragraph format explanations and comments on the code. And on the final section I want to some more advanced tutorials and examples I have used to help me with learning ammo.js and three.js. Also, I found a good resource today when I was doing some research an ammo.js lab that showed me examples of code and objects that could be created using ammo.js and three.js: <https://github.com/lo-th/Ammo.lab>.

02/02/2021

Today I started working with constraints like p2p and I also tried the slider hinge as well, I had some issues which took me a while to figure out since the debugging was not giving me a specific reason why the project was not working so I just ended up copying setUpCode from a previous project I did which I knew work and it just started working. I also tried adding THREE.OrbitControls() again but it still did not work using the way in three.js documentation, So I ended up searching through solutions on stack overflow and found a suggestion to put new THREE.OrbitControls(); instead of just using new OrbitControls(); and it started working, In hindsight I should have tried this before but stupid is as stupid does. At the end of the day, I also found my template for the how to guide webpage using the recommended website and started compiling the script for the website <https://www.html5webtemplates.co.uk/templates.html>. I ended up creating the welcome page of the website I done this using inspirations from popular programming tutorial websites like <https://www.pyimagesearch.com/>, I tried to mimic the style of keeping the user engaged through the use of short but informative explanation of what ammo.js and three.js and an introduction which is easy to read as well as this I added an image at the bottom of the page to make the page not look so bland in an attempt to keep a user of the tutorial engaged. I also got the script done with and screenshots I needed for the second part which is going to be a guide to setting up the ammo.js and three.js environment for the script I used examples from set up guides like:( <https://docs.microsoft.com/en-us/visualstudio/install/install-visual-studio?view=vs-2019>) and tried guide Showing the user step-by step the process of getting set up to use ammo.js and three.js with screenshots of each step and explanation. I also linked an install guide for ammo.js/three.js that I had used (https://github.com/mattr862/Ammo.js-Three.js/blob/master/Setting%20up%20ammo.js%20Three.js.pdf) and linked the install to visual studio code (<https://code.visualstudio.com/download>) to make it simple for the user.

03/02/2021

Mainly I focused on my website today, I ended up adding lots of code snippets too to show incremental examples of putting the world together and as well as that added comments on as many statements as I could that were not self-explanatory, I also tried my best to explain the code as simple and explaining the code snippets through adding comments and paragraphs describing what was happening. I got my inspiration for doing my how in this way from a great guide I have user by blue magnificent on ammo.js and three.js (https://medium.com/@bluemagnificent/intro-to-javascript-3d-physics-using-ammo-js-and-three-js-dd48df81f591)as well as this I have seen it used in other tutorials like (<https://krpc.github.io/krpc/>) to explain how to use their libraries to create scripting of a game called ksp.

04/02/2021

I have one more day till I must submit my guide I am not far from being done now since today I finished my setting up physics world part and skipped to the final part and finished that too, I also wrote the script for the fourth part which will be adding objects to the physics world and have code snippets ready I just need to add it tomorrow to the website and then do some clean up. I am glad that this part is almost done it was getting a bit tedious but my 2 years doing BTEC ICT has been helping me a lot get through this part of the project.

05/02/2021

Today I completed my how to guide. I mainly focused on finishing the adding objects to the physics world section and organizing everything in an easy-to-understand format using different text tags and separate titles, I also finished my last section linking tutorials that I found useful and giving some concepts which would be useful for the viewer of the tutorial to learn to continue their journey in using ammo and three.js in the future. I am happy with how it turned out and glad it is finished. It also definitely helps me get a better understanding of the libraries through attempting to explain how everything worked because I did not know how to explain everything mostly for the creating physics function, so I had to do some further research to be able to explain that I also believe that it will help someone that is getting started with the libraries save a lot of time doing research trying to find separate tutorials and figure out how to get started as this explains all the part at the start which may be difficult I believe this is the main reason why someone would want to follow my tutorial mainly to simplify the process of learning how to use these technologies and as well as this I think the how to guides to setting up the physics world and creating physics objects are fun guides to follow.

I also had my third weekly meeting with my lecturer today where I was given some stuff that I should try to do for next week:

* I was also told that I could use either p2p constraints and springs to connect several blocks to create objects that are affected by physics or I could try using soft bodies to try and apply physics to objects in ammo.js, So I will need to investigate both for next week.

06/02/2021

I continued where I left off today a few days ago just working with hinges trying to understand how they work. I mainly used <https://lo-th.github.io/Ammo.lab/> to see some demos of the constraints like p2p and to allow myself to see the ammo.js code which created the constraints between each of the objects this ammo.lab also allows me to edit each of the properties of the objects to see exactly what they do.

**Week 4**

09/02/2021

I really had to force myself today to get some work done today. I ended up implementing a p2p joint between 3 cubes like in the tutorials I found. Also today I found some soft body examples and had a look at them like this volume demo: <https://threejs.org/examples/physics_ammo_volume.html>, and a cloth demo: <https://threejs.org/examples/physics_ammo_cloth.html>, I’ve been trying to get a grasp on soft bodies as it may be an option for simulating structures.

10/02/2021

Today I focused on organising my project folders. So far, I had left my folder mostly in a mess so there were a lot of different redundant practice projects I ended up deleting. I also created my GitHub repo for the project adding my work so far including my website diary and the world I have created which my project will be based, and I have also created a practice repo where for now on I am going to store any demo’s I do so I can easily use them. I had to watch a tutorial on using github since it has been a while since I have used it. (https://www.youtube.com/watch?v=iv8rSLsi1xo)

12/02/2021

I started off the day with a meeting with the lecturer during which he discussed the next stages of the project including the how to guide blog and the project. For the how to guide I need to improve on my last and make it more useful and cover something not as well covered in ammo.js like soft bodies or springs. During the meeting I also asked about implementing springs as during the week I have struggled to find any information on it apart from on other physics engine forums like pybullet, essentially, I was told I could use them tutorials but there were some things that I needed to change in order to get springs working. So today I read about spring constraints in pybullet and bullet physics forums.

13/02/2021

Today I started off with the goal of implementing a spring between two objects but ended up getting very lost although I could understand the main aspects of building a spring, I could not figure out how I was going to implement this in ammo.js I found an example in ammo.lab were a spring was used as part of a car but I ended up cutting my loses and decided to just continue working with the concepts I understand at the minute like soft bodies and hinges and maybe come back to this once I have a better understanding of ammo.

**Week 5**

15/02/2021

I’ve been thinking about what I should do with my how-to-guide and I think I am going to do a guide on soft bodies as it’s an area which is important to my project but something I have struggle to get a grasp on due to how little information there is on this for ammo.js, So I started today creating a sample project soft bodies project taking some screenshots and putting them into a word document so that I can use them later for my web page.

17/02/2021

I went back to working on the soft bodies project I added some comments today explaining the code that I have done so far. I am going to create few examples of soft bodies that can be created some that are hard. Some soft and show how they interact with each other and rigid bodies.

18/02/2021

I went back to my structures project today I am trying to create a rigid body using hinges as my first example of a plank although I want to create this with a soft body I want to try see if the hinges would work, so I created a nested for loop which would create a 1\*1 blocks beside each other covering the width and the height of a wooden plank which would usually be 12\*2, in the for loop I also created the correlating ammo.js.blocks. I tried testing these blocks in the physics world and came across an issue that each of the block kept falling through the map I ended up realising that it was not a problem with the ammo.js code it was an issue of the blocks making up the plank having the same collision mask I ended up changing the mask for the blocks and the block collided. I will be adding the hinges tomorrow.

22/02/2021

Today I spent some time trying to work on the plank project, I ended up running into an issue where I could not figure out how to connect all the blocks I was creating using joints. So I ended up asking my lecturer for a suggestion as to how to get out of this slump I was having he told me to:

Do it in 2 passes. The first constructs the blocks and stores them in a 2d javascript array (of the same dimensions) then loop for(let z = 0; z<(length-1);z++) and the same for x and then connect the block to the next in z and the next in x. This will create the connections between all the blocks together.

I had to learn how to do 2d arrays in javascript today I did not know that this could be done but I ended up following a tutorial and now understand what I have to do.

24/02/2021

Today I create the 2d array for my block objects in the plank project.