# *Data Visualization of Road Traffic Accidents in Ireland*
# *By Colin Synnott*
# *4th Year - Creative Media Technologies*
# *N00174143*
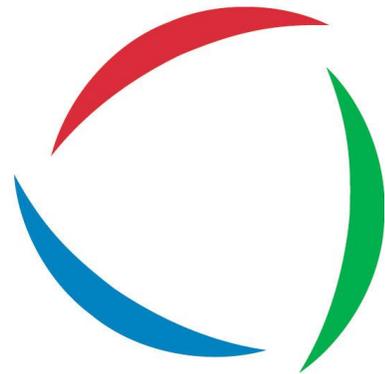
# Acknowledgements

I would like to thank and acknowledge my supervisor Cyril Connolly for his advice, guidance and assistance throughout the year, which was particularly difficult from home. I'd like to acknowledge Paul Comiskey who sat in during presentations throughout the year and showed interest in the project. My fellow classmates, particularly Bryan Agar and Anton Candelaria who motivated me throughout the year with similar projects.

Lastly I'd like to acknowledge my family at home for the encouragement throughout the year to make the project as best it could possibly be.

# Declaration of Originality

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to Dun Laoghaire Institute of Art Design & Technology (IADT) or to any other institution for assessment or any other purpose.

# Abstract

According to an article on InjuryFacts, statistically the odds of dying in a car accident are 1 in 107. This figure is alarmingly high when taking into consideration the number of people who don't own a car or drive. ("Odds of Dying - Injury Facts", 2021).

This project focuses on the visual analysis of road collisions in Ireland between 2011 and 2016. The degree of severity in each collision is also included in the analysis, along with the type of collision i.e single vehicle or pedestrian and a range of other variables, the details of which are shown in the data dictionary in Appendix 1.

This project's purpose is as an educational and research tool to allow insights into the key characteristics of road collisions.

# *Table Of Contents*

# 1) Introduction

This project is based around providing a user with an insight into the data surrounding road traffic accidents in Ireland. Initially, the project was set out as a research project to educate and raise awareness about collisions. The target user group was set as the general population.

By using different methods including mapping, general illustrations and charts, the intention was to identify places around the country that are prone to collisions and hopefully determine appropriate remedial measures to reduce the incidence of accidents.

As the year went on, the project became directed towards a more general user base. This meant providing the tools to allow a user to visualise the data and gain insights using a software called Tableau.

Tableau is used by business and multinational organizations around the globe as a way to visualize data.

This report will begin with the research chapter where the project area as a whole was outlined. The areas covered in this chapter include researching the hardware involved in gathering data, the impact of social media on data and also the different applications of data.

The design chapter is where the overall layout and design of the project was considered. The considerations being taken on board include the array of raw data, the size of the data (population), trying to find the best way to

present the data etc. This section of the project was where Tableau and the bulk of the work was done overall.

The testing chapter involves a user testing the application, the user was asked questions in order to provide feedback on any improvements that could be made to the interface together with any other features regarding the application.

The report concludes with a conclusion where this writer reflects on the project.

# 2) Research Report

## 2.1 Introduction

This final year project is based on the theme of data visualization. The aim is to visualize and map data on road traffic accidents in Ireland that have occured over the past number of years. The project will be used to find trends and raise awareness on the extent of accidents which could potentially lower the annual toll in injuries and deaths.

Data and more specifically big data is an ever growing sector with considerable employment opportunities. The idea of embarking on a project in this field is exciting to the writer.

Big data is not only confined to research projects such as this but is a feature of all businesses where it is used to track trends in sales and customer behaviour. Collecting data benefits business as they can use

the data collected in order to steer the business in the direction that will maximise sales.

## 2.2 Technologies

There are two different technological aspects to this project, there is the hardware side as well as the software side.

A number of examples of the hardware associated with data and data visualisation include satellites, cameras and arduinos. In order to inform readers on these topics, some research was conducted into the areas.

### 2.2.1 Satellites

According to [www.space.com](www.space.com), ''A satellite is an object in space that orbits or circles around a bigger object.''.

The first general application of satellites came around in the mid to late 60s during the Cold War - Russia vs America.
Both of these superpowers were engaged in the Space Race, where they were competing against each other in a race to place the first man on the moon, which America won in 1969 when Neil Armstrong walked on the moon.

This was a huge spectacle back in the late 1960s and made the news on a global level, the event was even broadcasted live to the entire nation. Cameras attached to a satellite gave viewers at home a view of our planet from space. This sort of technology amazed the public as it hadn't yet been showcased on such a big stage before.

It was only a matter of time before satellites became part of everyday life. Another example of how satellites are used include forecasting the weather. Satellites that are up in space are able to track cloud formations and movements, this in turn gives meteorologists an insight into future weather patterns.

It was only a matter of time before satellites were going to be incorporated by big businesses and multinational organisations as a method of collecting, analysing and visualising data.

The biggest example of a company using satellites would be Google with Google Earth. Google uses satellite technology to have a street view of anywhere in the world from your computer at home, this type of technology has a vast area of potential.

Primarily, Google Earth is used as a method of how the general public can interact and view the planet at the click of a button, messages can be sent to the public through these interactions for example, we can view the melting ice caps which in turn could motivate us to make a difference regarding climate change.

Satellites are now used by companies in order to map data and create visuals for people to see. Having data on charts and graphs is a great way to portray information, an even better way is to accompany this data along with real maps, with the data plotted.

For example, if you wanted to know the average house price in Ireland, you could map Ireland and plot the average prices for the houses where they are positioned on the map. This would give the viewer an interactive feel as to where the best place to buy a house could be from an economical point of view. Satellites now play a pivotal role in the field of this particular project. GPS (Satellite Navigation) is now built into most modern cars. The RSA also uses GPS to record X and Y variables which are used for mapping.



Figure 2.1 An Image of Google Earth
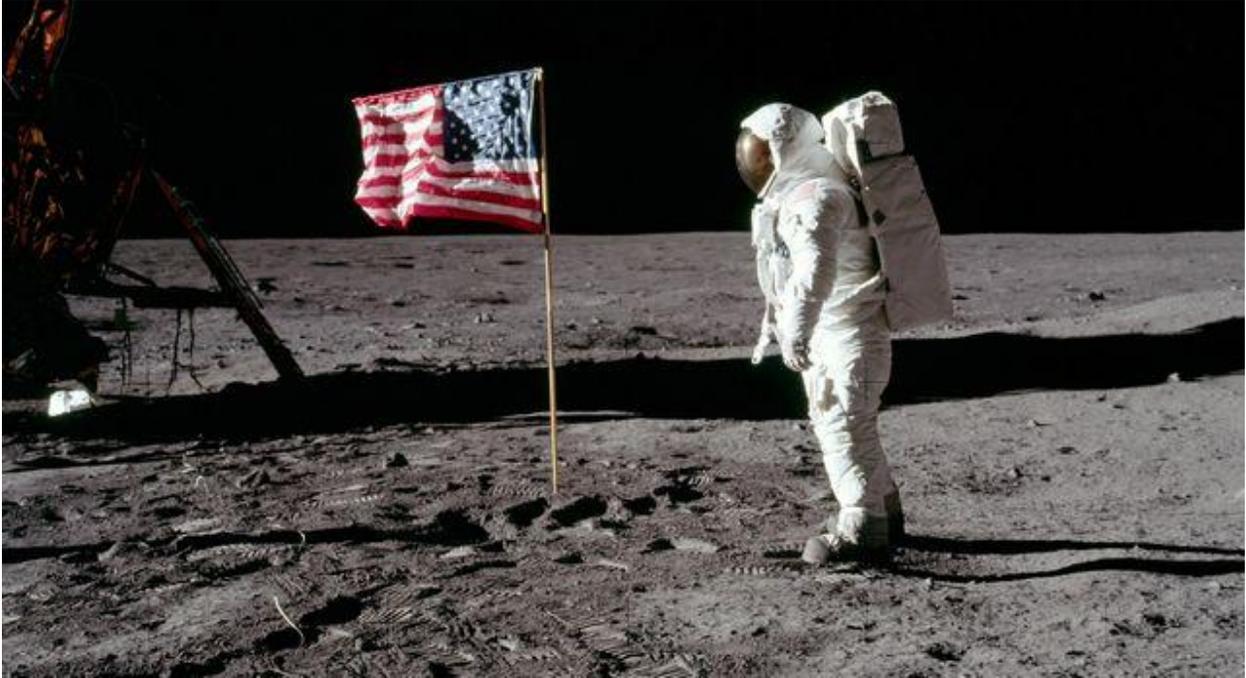
Figure 2.2 An Image of Neil Armstrong on the Moon, 1969.

## 2.2.2 Cameras

Another piece of hardware used frequently in the data field are cameras. Cameras have a vital role in collecting discrete data from almost any business you can think of.

Cameras have greatly advanced how data is collected for businesses. For example, a car salesman in a local town may want to know what the most popular colour of car is in the town. This will give him an idea in trends of which cars to import into his garage for the future.

In the past to get this data, labour would have to be employed involving 'hands on' manual data collection on site by writing down the colour of all cars that pass by over a period of time and then analysing the data to find the most popular colours.

Now, this type of data collection is done automatically using cameras. Cameras can be seen on the side of roads around Ireland. They look like speed cameras but are collecting a range of data.

An Garda Siochana use speed cameras in attempts to slow speeds of road users in the hopes of minimizing collisions.



Figure 2.3 - Image of man setting up camera to collect data

2.2.3 Arduino

Arduino is another example of a piece of hardware that can be used to collect and store data. Arduino also links in with software, as the arduino

based projects that would be collecting the data physically would be storing it on a piece of software called Arduino IDE (Integrated Development Environment) which would then be of use later.

https://create.arduino.cc/projecthub/157863/data-collection-system-with-sd-card-and-arduino-f2792c , ("Data Collection System with SD Card and Arduino", 2020),

Above is an example of a project using an arduino and sensors to collect and store data from a user.

Arduino projects are predominantly small scale and used by people like students who are demonstrating a 'proof of concept' with some software and hardware aspects. Although the idea of Arduinos and sensors being used on the bigger scale is feasible.

Companies use sensors and programmers to take data from consumers regularly for their own benefit, for example, using sensors to track how many customers pass by a shop window one day in a particular area. This data could then be used later by the business to have specific advertising measures in place outside this building where the data was gathered in order to have the appropriate advertising for the bypassing civilians, in the hopes of boosting sales.

The RSA uses sensors under the road called induction loops. Two sensors are placed under the road, when a car travels over these sensors a number of data can be drawn from them. This data includes the

classification of the car and can also monitor the speed the vehicle was travelling.

We have outlined some hardware technologies associated with data collection and will now examine some software technologies:

2.2.4 Social Network

Social Networking is arguably the biggest phenomenon of the modern era in technology. It is how the vast majority of the world connect and how businesses now interact with customers on a sales level as well as advertising. The RSA uses social media campaigns in order to communicate with road users.

The most common way social networking sites take data from users is by monitoring what websites they are browsing, what ads they click and how they navigate within sites. When we click into most websites, we are

asked if we accept that the website uses cookies, by clicking yes, the site owners can monitor certain aspects of our browsing.

Social networking companies such as Facebook can then target what advertisements pop up for each user once the data is harvested on where users browse most. This is how Facebook generates most of their revenue, through advertising.



Figure 2.4 Facebook logo

Social Networks can also be used by the general public as a way of collecting data. One of the most common ways of collecting discrete data is by conducting surveys. There have been tremendous advancements in how surveys are conducted over the last number of years with the majority of surveys moving online.

Data scientists can create surveys online, share them via social network, take all the results and place them directly into excel where the data can then be placed into a software where the data can be plotted, mapped or displayed, e.g Tableau.

Upon researching into the two different ways of surveying, there are pros and cons to both online surveying and conducting surveys at a face to face level. For example, surveys conducted online are very time efficient and far more simplistic for the data scientist, although by gathering data this way you dont get a true feel for how the overall population truly feels, the results can be biased.

If the data is gathered face to face, aspects such as facial expressions and tones of voice when answering survey questions can be taken into account which can then be used to the data scientists advantage.

''However, incentives may have a negative impact on data quality as respondents
can be tempted to distort data by, for example, entering the survey several times'' (Ilieva, Baron & Healey, 2002)

Above is a quote taken from an academic journal made in 2002. The quote mentions how sometimes conducting online surveys as a way of gathering information for market research can be negative a lot of the time due to participants potentially submitting the survey several times or by not being completely truthful in their answers. These types of problems

are not encountered as much when gathering survey answers face to face.



Figure 2.5 Survey Monkey - popular online surveying application

With all of these hardware and software technologies mentioned above, the biggest and most common headline about data is Data Protection, which is the general public's rights when it comes to data. Facebook, a company mentioned early in the chapter, were recently in trouble for allegedly mishandling user data. The company faced lawsuits involving a considerable sum of money, ''Facebook CEO exploited ability to access data from any user's friend network, US case claims'' (The Guardian, 2018)

''The GDPR allows citizens considerable rights relating to how their personal data is stored and collected. The key to this regulation is that people now more so have to opt in to their data being stored and used rather than opt out'' (Business and Analytics, Lecture Slides 6, 2020)

## 2.3 Applications

The applications of data, specifically big data have briefly been mentioned in this research report. The biggest application is to use the big data gathered to find trends and insights. The results can then steer your business / energy to a place where the trend and your goals intersect.

The most common example of this process is in business. It is important for business owners to perform analytics on their business so they can see where the business is excelling and which parts need improvements. There are different types of plans and analysis that businesses can do e.g SWOT analysis, which gives certain individuals with a specific skill set the understanding of reading the information that can be drawn from these tests. One of the most important uses is the visualization of data, which

makes it easy for everybody to understand the patterns, trends and opportunities.

We all learn about pie charts, bar charts and histograms from such an early age that it is almost our second nature to be able to understand them.

Big data doesn't only apply to business or anywhere that motivates profit, data visualization can be used in almost every walk of life, even if it's just to raise awareness on a current issue, such as car accidents.

We see numerous campaigns each year trying to encourage road users to slow down in the hopes of lowering death figures from Irish roads. People know not to speed, but sometimes when they see the statistics and figures about how many people actually die per year, the visualizations can have a greater impact.

The human brain is actually designed to be affected greater by colour and illustrations, this is another reason why data is so effective in everyday life.

''High-profile, impactful TV campaigns are a key part of the RSA's strategy to educate road users about the perils of dangerous driving '' - (("RSA.ie - Current Campaigns", 2020)). The RSA website has a section dedicated to their road safety campaigns, which are often under scrutiny due to the gruesome nature of the ads, the intention is to raise awareness on how horrendous some crashes can be.

## 2.4 Requirements

There will be a number of requirements involved in order to make the project a success. The overall aim of the project is to raise awareness on road accidents in Ireland and then create a small website showcasing the findings.

Good time management is one of the elements required to make any project a success. There are going to be different sections of the report due at different stages in the year, it is important to plan out which stages need to be done by certain times. Time management ties in with organizational skills.

Tremendous organization is going to be required in order to keep all the files in the correct places, as well as organizing them all in the best possible way when it comes to creating illustrations.

Cooperation levels are going to have to be on point due the constant communication with the project supervisor, as well as co-operating with

any users of the website or people that the project itself will be viewed by. It is intended to make the project as interactive as possible.

As well as personal requirements, there will also be technological and academic requirements involved in making the project a success.

A detailed knowledge of all of the software being used in the project will be required, e.g Tableau, Microsoft Excel, and possibly SurveyMonkey if used.

Throughout our final year in CMT, we have been learning how to use Tableau which seems to be the most used software for people working in the field of data.

Mapping is comparatively easy now with software such as Tableau.
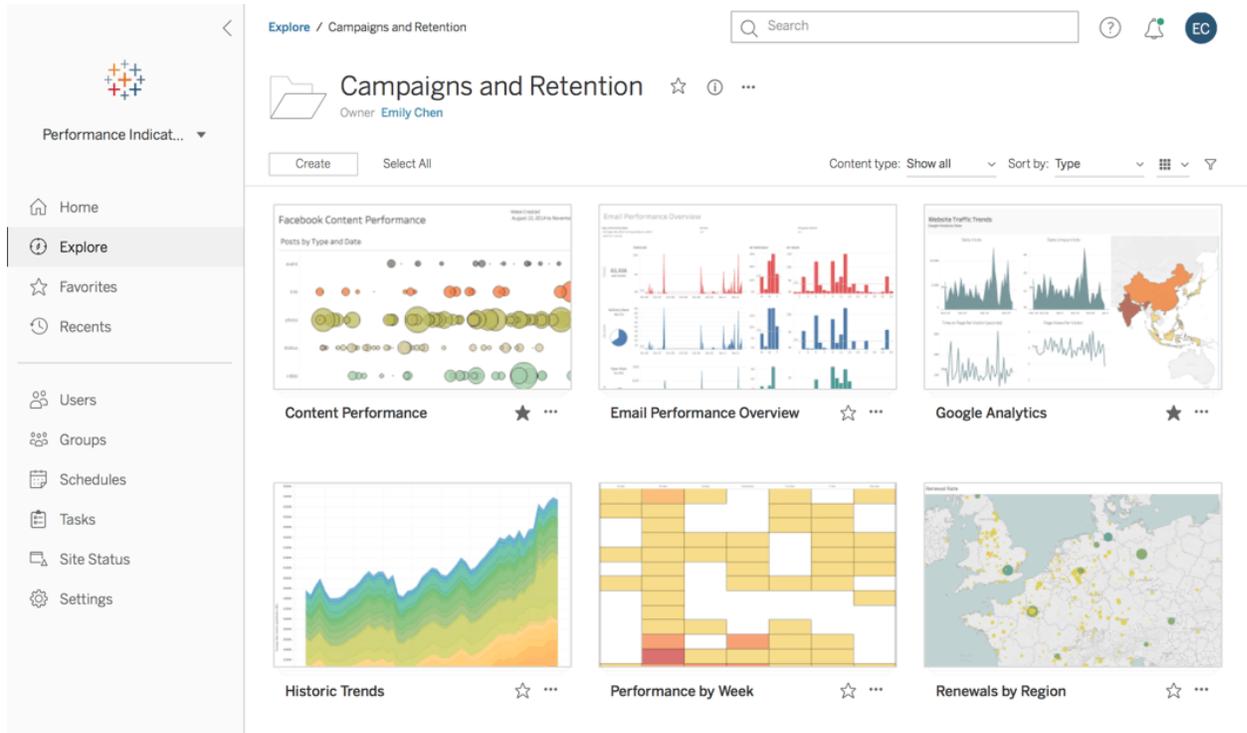
Figure 2.6 Screenshots from Tableau showing showing a range of graphics

## 2.5 Conclusion

In conclusion, the technologies included in the project are primarily software involving data collection, visualization and analysis.

The role of hardware and software in data collection, analysis and visualisation using several examples was learned while completing this section of the project.  These concepts are new to this writer and have

provided an appetite to learn more and hopefully lead to the creation of an interesting project.

# 3) Design Chapter

## 3.1 Introduction

This section of the report will summarise the design process behind making an interactive data visualised project using Tableau. This will form part of the final year Creative Media Technologies course. Technologies used in this project include Tableau, Microsoft Excel, GridInQuest and Brackets. The necessary skills to use these technologies were obtained in current and previous years of the course.

## 3.2 Design Considerations

When building a project that is primarily based upon visuals and illustrations, design is a key factor to provide the user with a pleasurable experience. The following design requests had to be considered.

### 3.2.1 Raw Data

The data used in this project was obtained from the Road Safety Authority (RSA), The data set involved 22,000 rows where each row represented an accident. The file also had a large number of columns where each column or variable was a particular feature of the accident i.e hour, weekday, location etc.

A file this size provides the designer with a wide number of options for analysis.

Figure 3.1 Data taken from Excel

Figure 3.1 shows the first 40 rows of data within the Excel file prior to being imported into Tableau. The entire data file contains 22,000 rows of data, and illustrates how powerful an application such as Tableau can be by allowing large files to be processed and statistical analysis to be undertaken.

This raw data contains the filters needed to zone in on specific aspects of the data within Tableau once the data has been encoded.

### 3.2.2 Usability

Usability is another integral element of this project. When creating the worksheets, graphics and layout within Tableau, it's important to keep all the data in a format that is easily readable and understandable.

For example, the data based on road collisions is considerably large, so it is important to use filters to zone in on certain elements of the data. This filtered data can allow dashboards to be created in Tableau.
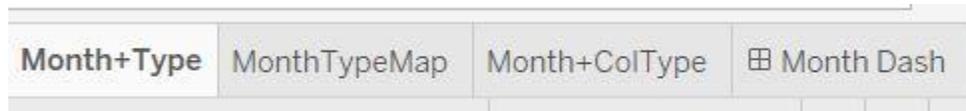


Figure 3.2.Example of organising the worksheets and dashboard

The figure above shows a panel of three worksheets and a dashboard labeled 'Month Dash'. These three worksheets are all correlated to the 'Month' data file that was inside of the Excel file (fig 3.1). Creating random dashboards and having no organisation behind the layout of your Tableau file creates clutter and the user will feel uninterested in viewing the data. This project separates all the elements of the file and then joins them together using a dashboard.
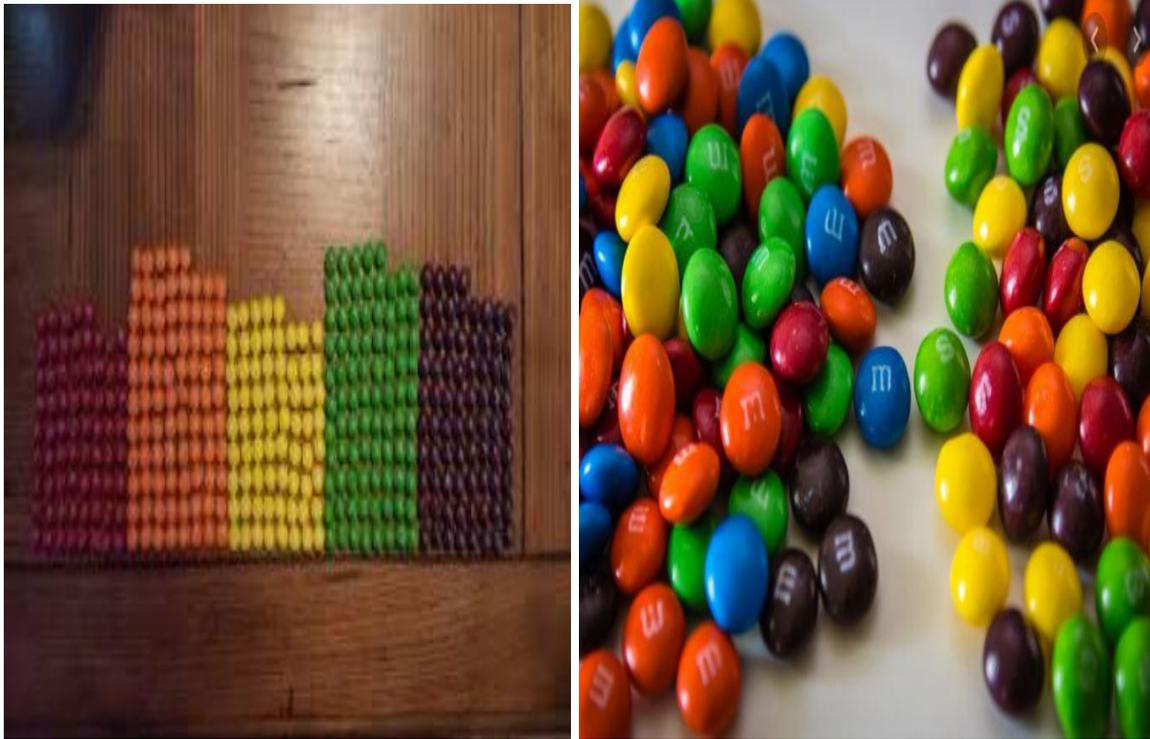
Figure 3.3 Tableau filtered data vs Excel Data

Figure 3.3 is a visual representation of the organized, filtered, well laid out data within Tableau vs the same raw unstructured array of data within the Excel file.

## 3.3 Interactive Dashboards

This project involves the creation of numerous graphs. For example, a graphic will be created specifically focusing on the days that accidents are taking place. On top of the 'days' filter, the severity of the accident will be added and made interactable so that the user can explore the relationship between day and severity, and gain insights.

A dashboard is the amalgamation of these graphics. The user can use the dashboard to change one filter and see the impact on other graphics immediately.

As mentioned earlier in the report, this project will consist of numerous filters to interact with regarding road collisions. These include the type of collision , the month it occurred in, whether or not it was on a main road, the time of the collision etc.

Below are screenshots taken from the project showcasing some of the dashboards that have been created.
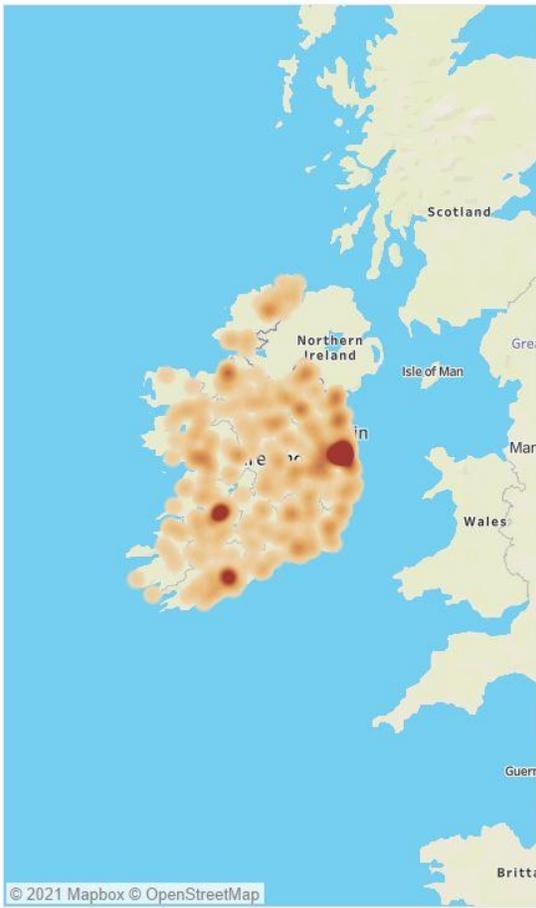
Figure 3.4. Month & Type Dashboard, (All) filter selected showing every month that all collisions occurred

This is an example of a dashboard that has been constructed in relation to the type of collision (Fatal, Minor or Serious) and the month the collision occurred.

Figure 3.5 The same dashboard with July selected

In figure 3.5, the 'July' filter has been selected, showcasing only the collisions in relation to the month of July.
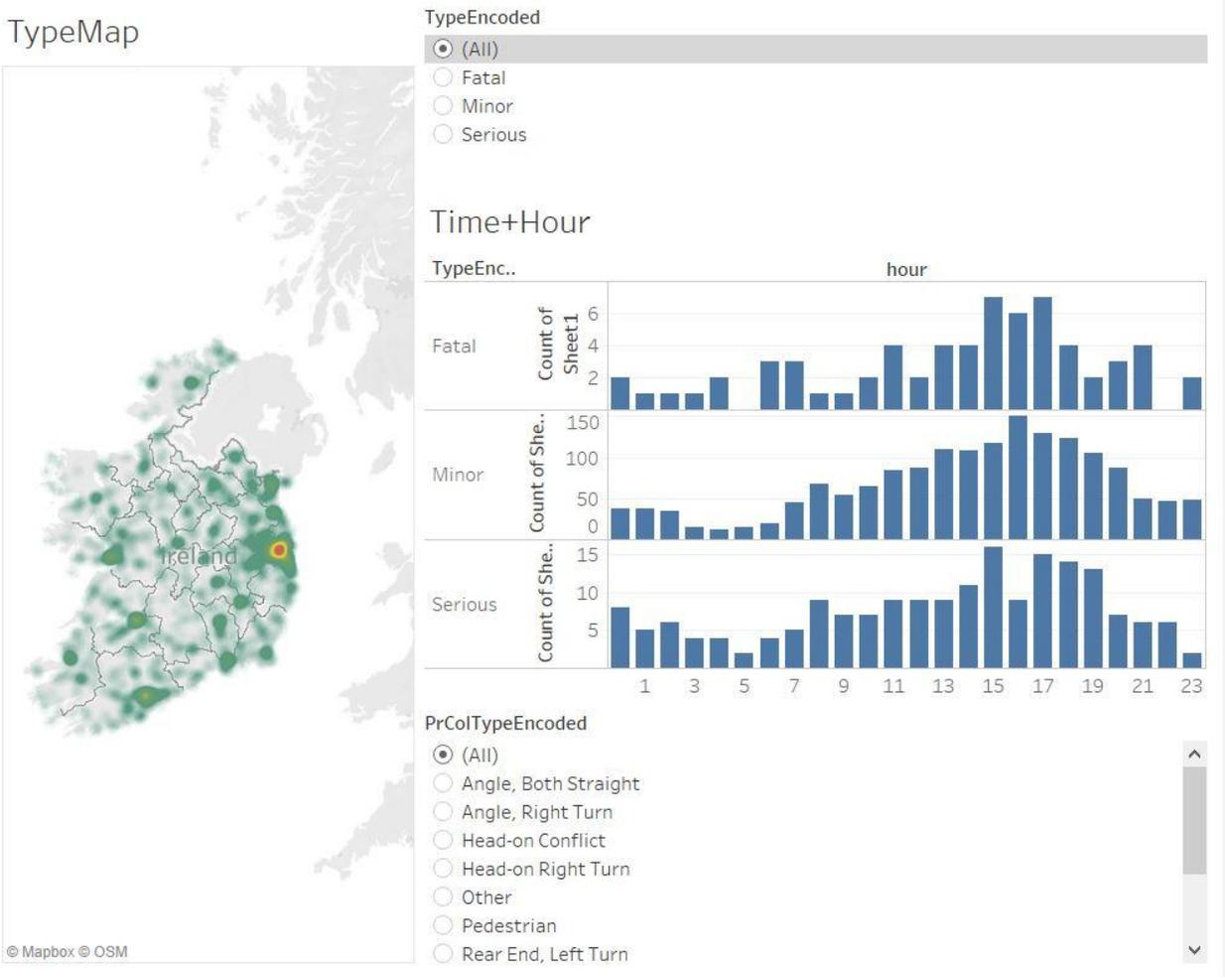
Figure 3.6 Dashboard containing variables *Type, PrColType and Time Dashboard*

In figure 3.6, by selecting 'Fatal' on the TypeEncoded graphic, the Time+Hour graphic will just display the fatal collisions, the map will also adjust accordingly.

## 3.4 Website

Along with designing and making the Tableau diagrams and illustrations that are interactable for the user, an interactive website that works alongside the data may be a unique way of showing the cold data that has been transformed into clean graphics.

Upon researching online different ways of embedding the Tableau graphics into a website, it was discovered there is a way of using HTML language and a script found at TheInformationLab.co.uk.
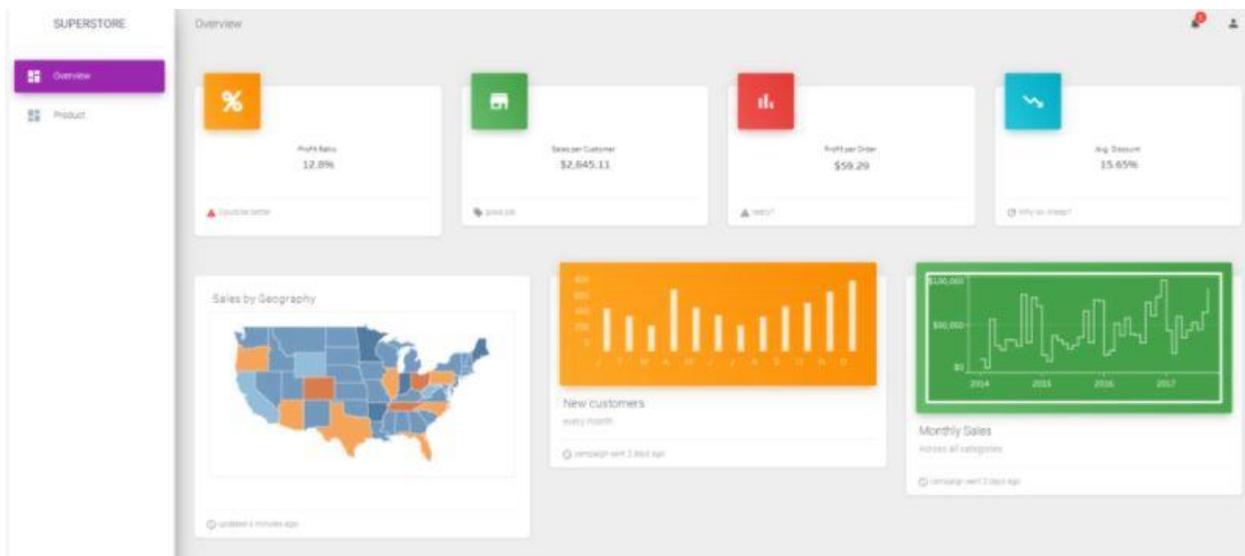


Figure 3.7 An example taken from TheInformationLab.co.uk showing how Tableau data may look when embedded onto a website.

While the emphasis of the project is Data Visualization rather than a web design project, the priorities are still heavily based on creating more graphics and illustrations on Tableau, with extra focus being put toward creating dashboards.

The website will only be considered at this point if the Tableau file is completed entirely.

## 3.5 Conclusion

This chapter of the report was based around the overall design with the intention to show the reader where the final project will be at by the end of the year.

Regarding design, the key topics covered were :

- The design considerations. Whether or not the entire population of data was going to be used in order to achieve the highest quality graphics or would a smaller sample size be better?

- Interactive dashboards. This element of the project is pivotal in achieving the overall goal of the project itself. The most important aspect is to take raw data and transform this data into usable, interactive data that's well organised and simple to filter for users to gain insights.

- The website. TheInformationLab provided an example of how the
  data can be embedded onto a website using HTML. The website
  aspect may be considered and used towards the end of the project.

# 4) Testing / Implementation Chapter

## 4.1 Introduction

This section of the report will summarise the testing & implementation process for the interactive data visualisation project using Tableau. This will form part of the final year Creative Media Technologies course. Technologies used in this project include Tableau, Microsoft Excel, GridInQuest and Brackets. The necessary skills to use these technologies were obtained in current and previous years of the course.

## 4.2 Safety

This project differs from the hardware based projects. When working with hardware, it is vital that complete safety checks are carried out prior to attempting any construction. Usually, hardware based projects require the usage of tools such as cutters and screw drivers. It is important when operating tools, particularly power tools, that the user has the appropriate PPE.

As this project is entirely software based, there were no physical dangers being posed to any persons connected to the project. The only dangers to be considered were software related, i.e with downloading software such as Tableau and GridInQuest, it had to be done correctly in order to keep the computer safe from malware. The files being worked on throughout the year are stored on a Google Drive cloud as a backup in the case of any hardware problems.

Another consideration was when gathering data, it was being collected legally and lawfully obtained. Prior to obtaining the data the RSA were contacted and informed about the project.

## 4.3 Prototype

In December, the class was required to present a working prototype showcasing what the project is doing. Again, software and hardware projects would differ hugely.

To recap on where this project was regarding progress in December:

All the data being used had been imported into Tableau and encoded. The coordinates needed in order to map Ireland had been transformed into

Easting and Northing values.Some basic worksheets had been constructed, although with no real organisation.

The work done up to this point in December was then presented, a second presentation in March outlined further progress.

The worksheets were made more interactable and usable. The data was much clearer and simpler to understand. The worksheets had also been connected and placed into dashboards. This is where the project is at currently, with further progression to be made with the dashboards that have been made.

## 4.4 Issues

This segment of the report (Testing) allowed for feedback from a user. This feedback could then be used to improve particular aspects of the project. In order to understand how to further improve, it was important to first determine what issues the users identified. This was done by asking a classmate a number of questions regarding the usability of the project which included requests for feedback on how to make the potential improvements.

An example of how this was done is as follows:
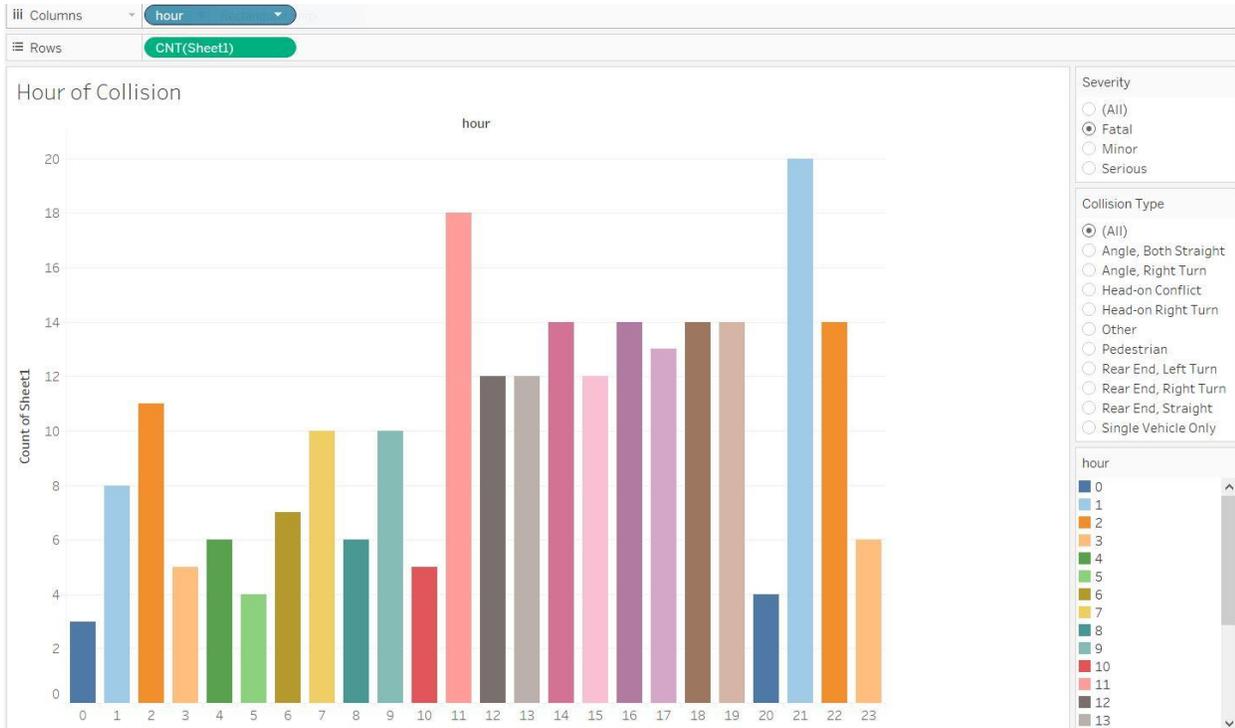
Figure 4.1 Hour of Collisions Worksheet

The user would be shown a worksheet as seen in figure 4.1, then asked can you find how many fatal collisions occur at 9pm? Can you find how many minor pedestrian collisions occur at 2pm?

The idea behind this method of examining the user is to gauge how usable the project is. Questions such as these were asked on numerous worksheets and dashboards in order to make improvements based on their feedback.
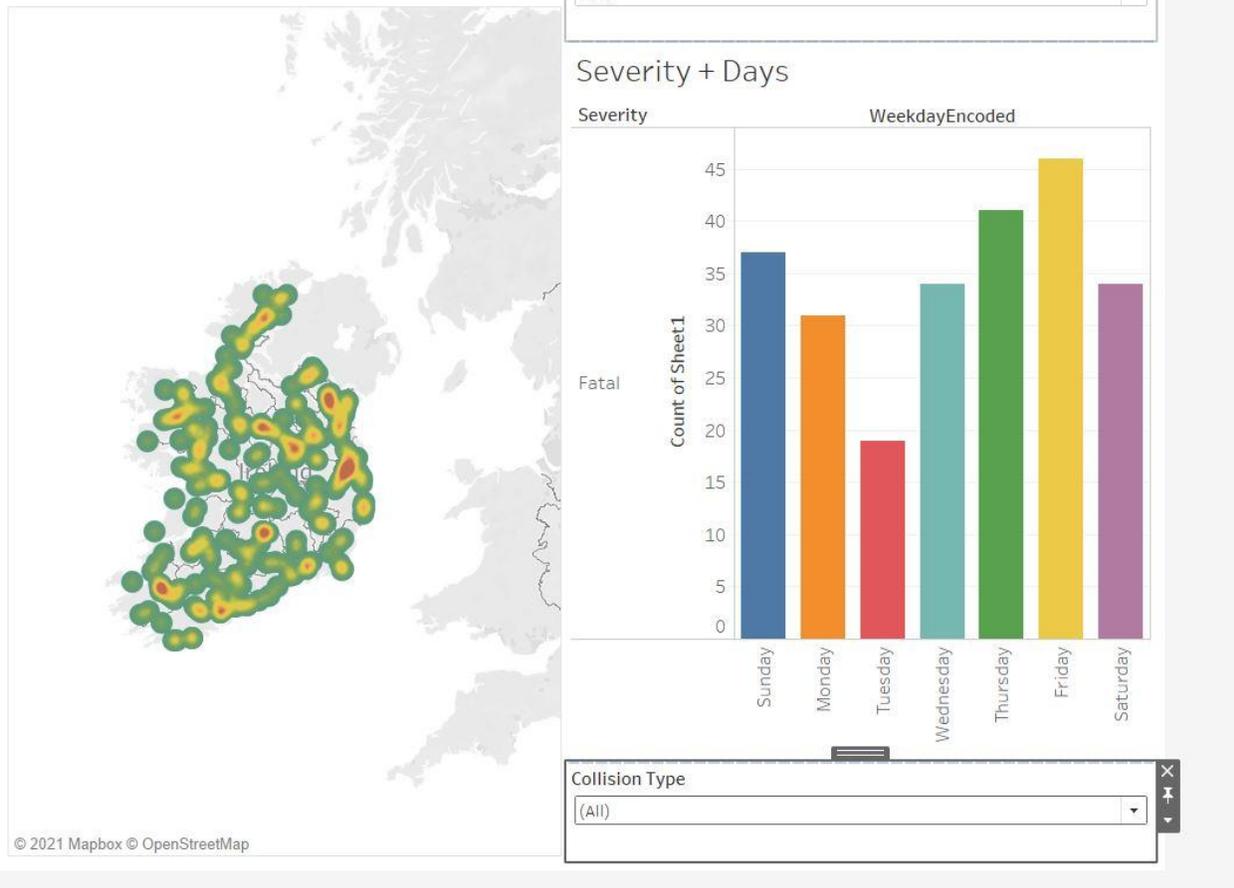
Figure 4.2 Dashboard centered around the days of the week

Figure 4.2 shows a dashboard where the user was asked to obtain data based around collision figures for different days of the week.

## 4.5 Resolution to Issues

The user had numerous improvements that could be made to the worksheets & dashboards. The majority of the suggestions were based around general layout of the dashboards, changing button options and re-naming.

Here is an example of a dashboard with too much information that form a clutter making the data unusable to the user:
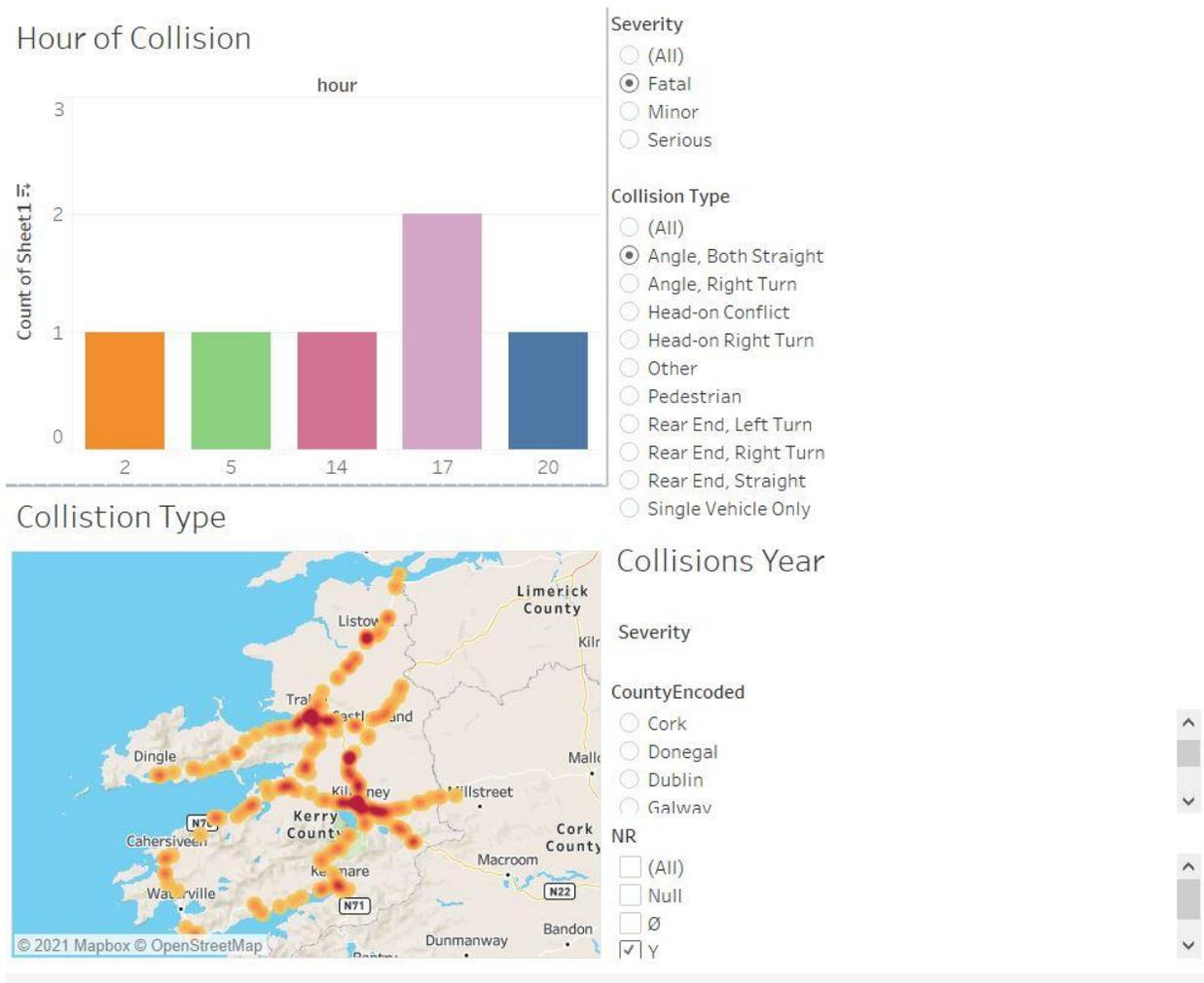


Figure 4.3 - Dashboard before user testing
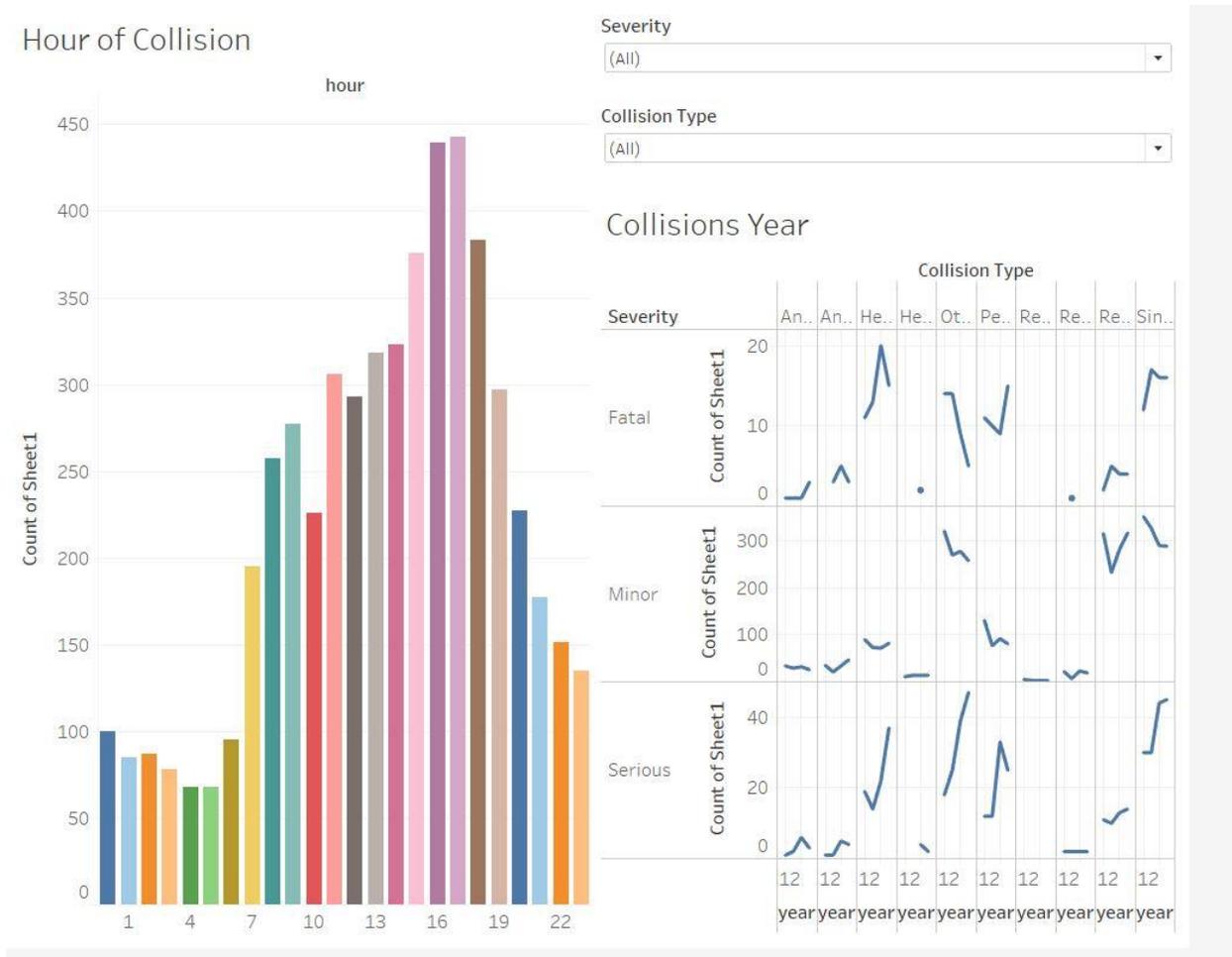
Figure 4.4 - The same dashboard post-user testing

The first observation by the tester was that the dashboards are quite cluttered. There was unorganized information, the user recommended that it would be better if some of the elements were floated off the dashboard freely and just included the most insightful elements.
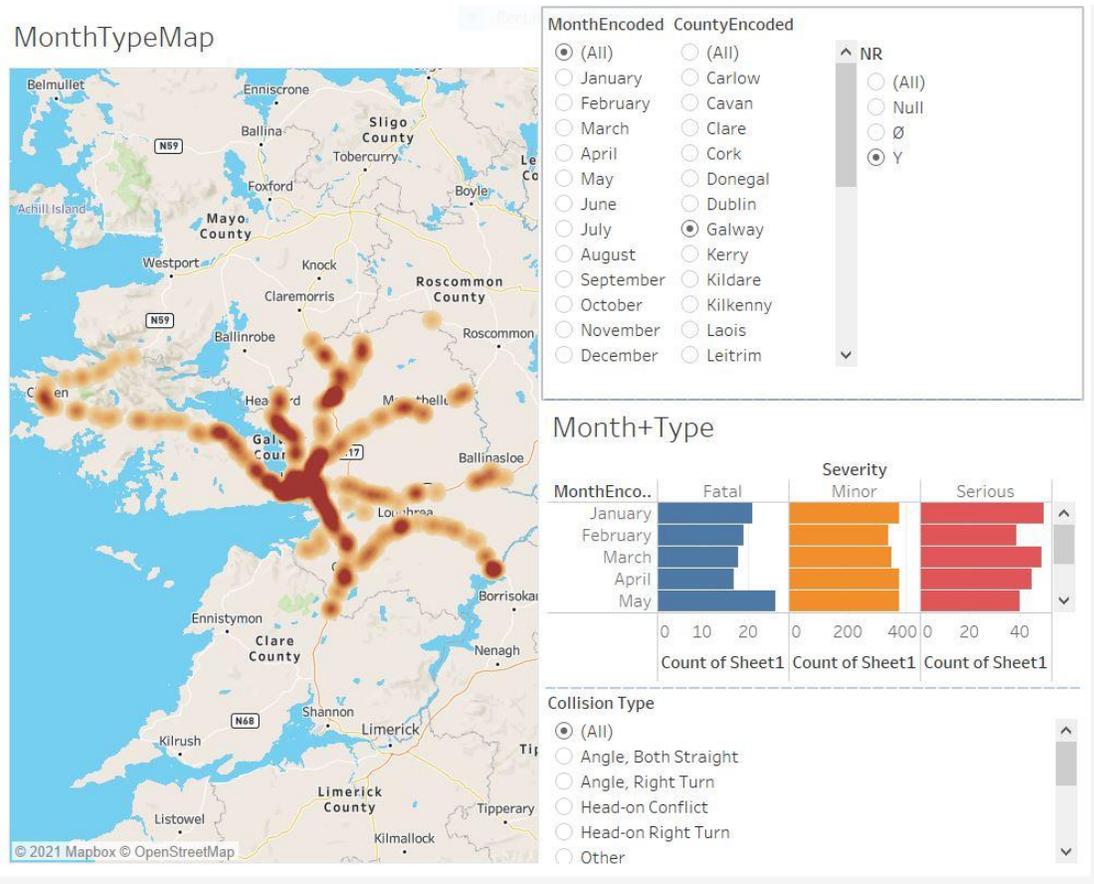
Figure 4.5 Dashboard on Month encoded data

The dashboard was initially made with no crossovers, i.e if a selection was made on the county encoded, it would not affect the rest of the data. It was deemed a better idea to have them all connected. It was also important to make sure the placement of each worksheet element was easy to read and understand for the user.

The user also pointed out that another simple way to free up space on the dashboard and stop clutter is by changing button selection to options such as radio button or drop down list in order to make room on the dashboard for the graphics themselves.
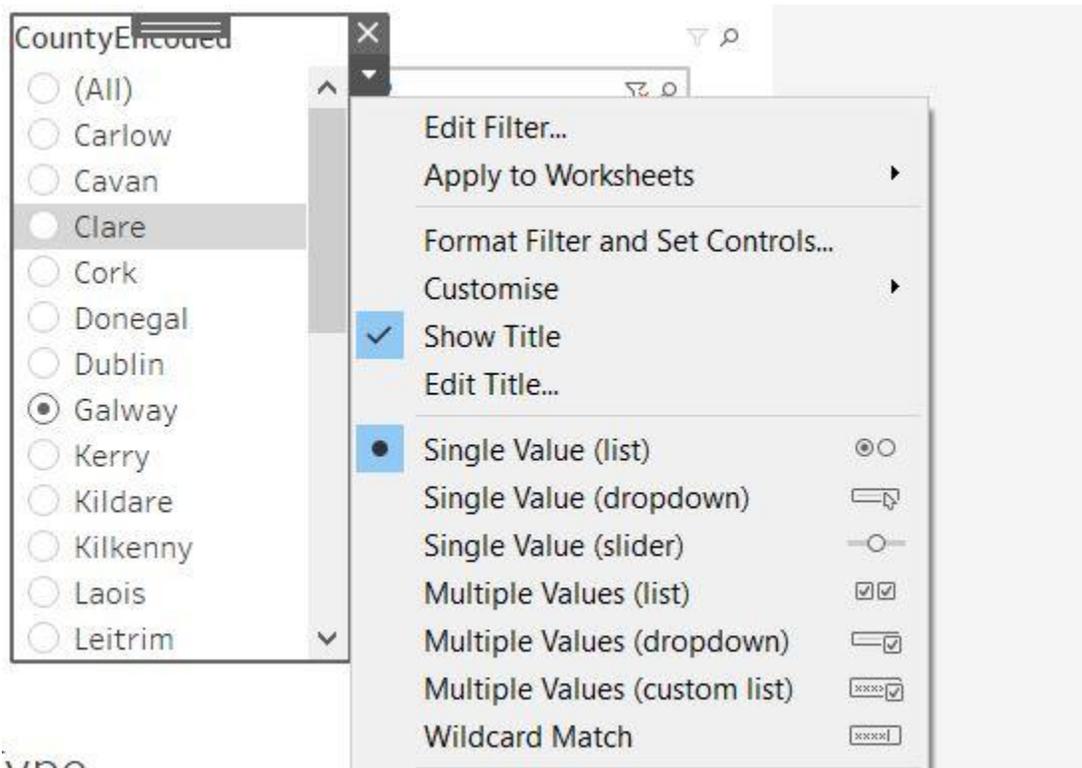
Figure 4.6 The button options

The final recommendation made by the user was to rename the worksheets and filters to clearer names. For example, TypeEncoded was the name for the severity of the injuries i.e Minor Major Fatal. This filter was then renamed to severity.

# 5) Conclusion

The overall objective of this project was to create an intractable user interface where data and information can be obtained easily in relation to road traffic collisions.

Throughout the year there were numerous deliberations on what would be the best way to go about completing the task, although looking back on it now the writer is satisfied with the decision making. The writer felt the research conducted prior to starting the project was credible and provided a solid foundation for the project.

The design of the project was achieved through trial and error, along with some external research on how to best present these graphics. Luckily, students at IADT have free access to Lynda.com, an online tutorial based website that gives fantastic instructional videos on a wide range of skills.

The user testing section of the project provided the most valuable feedback. It allowed the final touches to be implemented into the project that would make it as user friendly as possible.

It is hoped now that the skills developed over the course of completing this project can be brought into a post graduate programme of study or even into employment.

# 6) Risk Assessment

## CMT (DL835) Student Projects

## 'Low Risk'

Standard Risk Assessment Template

For activities carried out in the School of Creative Technologies facilities.

These are projects where all Hazards are Ranked as a 3rd Rating.

See Risk Rating Matrices on Pages 10 and 11.

Project Risk Assessments and the methodology are needed to comply with the Safety, Health and welfare at work act 2005 and all other relevant Legislation. This document is based on the 'Joint Risk Assessments' procedure – IADT – December 2010.

**STUDENT NAME(S): Colin Synnott**

**PROGRAMME/YEAR: Creative Media Technologies, 4th year**

SIGNATURE *Colin Synnott*

DATE: 22/04/2021

SUPERVISOR: Cyril Connolly

SIGNATURE *Cyril Connolly*

DATE: 22/04/2021

By signing this assessment, it is agreed by all parties that:

· the full facts relating to the health and safety aspects of the project have been declared by the student

· All parties are fully aware of the safety risks

· All parties will implement the control measures detailed, in order to reduce the contribution of the hazards to the level of the risks detailed.

| Location of Work: | Working from home due to the Covid-19 pandemic |
|---|---|

| Brief RELEVANT Details of project: 20 words | A software based project on data visualization on road traffic accidents in Ireland from 2011 to 2016 |
|---|---|

## Step 1: Initial Hazards Identification

| Risk Assessment No. | INITIAL HAZARD |
|---|---|
| 1 | Electrocution |
| 2 | Fire |
| 3 | Cutting injuries |
| 4 | Drilling injuries |
| 5 | Heavy equipment |
| 6 | Burn Injury |

| | |
|---|---|
| **7** | Fumes |

**Step 2: Risk Assessment Forms**

**(Start Overleaf)**

| | |
|---|---|
| **Significant Hazard and consequences:** | 1. **Electrocution** |
| | |

| | |
|---|---|
| **Who might be exposed to the hazards:** | Students and staff |

| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Circuit design must include features that will minimise likelihood of electrocution of anybody, when in an unsafe mode, eg use of fuses and circuit breakers. |
| --- | --- |
| | Short circuits should be identified and removed before the testing stage. |
| | Cable and insulation should be checked before testing stage. |
| | Power supply equipment should be PAT tested on a regular basis. |
| | Water sources should be kept away from the project, when in operation. |
| | Components, whether connected to power supplies or not, should be fully discharged before inspections – isolated from power supplies, are commenced. Eg discharge capacitors greater than $50\mu F$ via a $100\Omega$ resistor. |

| Significant Hazard and consequences: | 2. Fire |
| --- | --- |
| | |

| Who might be exposed to the hazards: | Students and staff |
| --- | --- |

| | |
|---|---|
| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Maintain tidy work practices on benches and the laboratory environment. |
| | Keep combustible materials, eg paper, plastic, away from heat sources, such as soldering irons. Stow heat sources away safely when not in use, eg use a sturdy soldering iron stand. |
| | Circuit design must include features that will minimise likelihood of a fire, when in an unsafe mode, eg use of fuses and circuit breakers. |
| | Short circuits should be identified and removed before the testing stage. |
| | Suitable cable and insulation should be used, with a safety margin on the rating and size. |
| | Water sources should be kept away from the project, when in operation. |
| | Be aware of the locations of first aid kit and fire extinguishers, and use these items if suitably competent/trained. |
| | In the event of a fire, leave the laboratory and building in an orderly manner, and sound the fire alarm if it has not already automatically activated. |

|  |  |
|---|---|
|  |  |

|  | **3. Cutting injuries** |
|---|---|
| **Significant Hazard and consequences:** | |
|  | |

| **Who might be exposed to the hazards:** | Students |
|---|---|

| | |
|---|---|
| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Maintain tidy work practices on benches and the laboratory environment. |
| | Develop projects with the minimum requirement for cutting any jagged edged in the final manufactured item. |
| | Use of quality, maintained tools and clamps if necessary. |
| | Use of a cutting board and goggles. |
| | Clear a space around the cutting area before commencing work. |
| | Tie back hair and loose clothing from the cutting area. Remove jewellery. |
| | Be aware of the location of the first aid kit, and use the kit if suitably competent/trained. |

| Significant Hazard and consequences: | **4. Drilling injuries** |
|---|---|
| | |

| Who might be exposed to the hazards: | Students and staff |
|---|---|

| | |
|---|---|
| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Only use the drill equipment if training, given by staff, has been undergone. |
| | Use of quality, maintained drilling equipment and goggles. Secure drill bit and table. Use the drill guard. Check all fastenings are complete before switching on the drill machine. |
| | Drill machine should be tested and checked on a regular basis. |
| | Develop projects with the minimum requirement for cutting any jagged edged in the final manufactured item. |
| | Use of quality, maintained tools and clamps if necessary. |
| | Use of a cutting board and goggles. |
| | Clear a space around the cutting area before commencing work. |
| | Tie back hair and loose clothing from the cutting area. Remove jewellery. |
| | Be aware of the location of the first aid kit, and use the kit if suitably competent/trained. |

| Significant Hazard and consequences: | # 5. Heavy equipment |
|---|---|
|  |  |

| Who might be exposed to the hazards: | Students and staff |
|---|---|

| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Maintain tidy work practices on benches and the laboratory environment. |
| --- | --- |
| | Undertake heavy lifting only if suitable advised and/or trained. Correct posture and lifting procedures. Use mechanical lifting aids where possible and appropriate. |
| | One or more persons to be involved in lifting or supervising the lifting of heavy equipment. |
| | Clear a space around the lifting area before commencing work. |
| | Tie back hair and loose clothing from the cutting area. Remove jewellery. |
| | Use protective footwear, and also headwear if necessary. |

| | |
|---|---|
| **Significant Hazard and consequences:** | **6. Burns** |
| | |

| | |
|---|---|
| **Who might be exposed to the hazards:** | Students and staff. |

| | | |
|---|---|---|
| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Maintain tidy work practices on benches and the laboratory environment. | |
| | Only use soldering irons and other hot-works appliances if training, given by staff, has been undergone. | |
| | Keep combustible materials, eg paper, plastic, away from heat sources, such as soldering irons. Stow heat sources away safely when not in use, eg use a sturdy soldering iron stand. | |
| | Cable and insulation should be checked before using soldering irons, or electrically powered hot-works appliances. | |
| | Use gloves, goggles and other personal protection equipment where necessary. Use cooling equipment, such as wet sponges for soldering irons. Do not allow water from any source to penetrate electrical cables and wires. | |
| | Tie back hair and loose clothing from the cutting area. Remove jewellery. | |

|  | Be aware of the locations of first aid kit and fire extinguishers, and use these items if suitably competent/trained. In the event of a fire, leave the laboratory and building in an orderly manner, and sound the fire alarm if it has not already automatically activated. Electrically powered hot-works equipment, such as soldering irons, should be checked and tested on a regular basis. |  |
|---|---|---|

| **Significant Hazard and consequences:** | **6. Fumes** |  |
|---|---|---|

| | |
|---|---|
| | |

| **Who might be exposed to the hazards:** | Students and Staff. |
|---|---|

| **Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates** | Use fume extraction equipment, eg for solder fumes.<br><br>Keep laboratories well ventilated.<br><br>Take frequent breaks from activities generating fumes.<br><br>Employ a higher level of control measures when an individual suffers from a respiratory condition, such as asthma, taking advice from a GP.<br><br>Solder fume extraction equipment and other similar items, should be maintained checked and tested on a regular basis. |
|---|---|

| Significant Hazard and consequences: | |
|---|---|
| | |

| Who might be exposed to the hazards: | |
|---|---|

| Proposed Control Measures – to be written in conjunction with project supervisor and revised at key project milestone dates | |
|---|---|

# Risk Rating Matrices

**By looking at the hazard and asking how many people will be exposed to it, decide on the probability of an incident/accident occurring.**

Example:  Take an extension lead trailing along the floor up against the wall. The extension lead is a hazard and if it is in an office with one person working in it the probability and likelihood is "improbable" (see table No.1) because the lead is along the wall.  However, if the lead is in a corridor with 200 people walking by there is a chance that someone could kick it out from the wall accidentally and create a greater probability/likelihood of a loss occurring thus upping its rating to "remote".

**When this is done you must decide on the seriousness of the loss, using the four columns on the left side of the Table No.2 below.**

Example:  Firstly taking the one person office example from above the possibility/likelihood is "improbable "but the result might be a "minor injury" e.g. scrape or a bruise. This gives us an "acceptable risk no action required" If we were to put the lead on a building site across an unguarded stairwell with 50 people using it the result is now possibly "fatal". This gives us a "1$^{ST}$ rank action".

## Table No. 1:

| Probability/likelihood | Description |
|---|---|
| Likely/frequent | Occurs |
| Probable | Not Surprised.  Will occur several times. |
| Possible | Could occur sometimes. |
| Remote | Unlikely, though conceivable. |
| Improbable | So unlikely that probability is close to zero. |

## Table No. 2:

| | Likely | Probable | Possible | Remote | Improbable |
|---|---|---|---|---|---|
| Fatal | 1st | 2nd | 2nd | 3rd | |
| Major Injury/ permanent disability | 2nd | 2nd | 3rd | | |
| Minor Injury | 3rd | 3rd | | | |
| No Injury | | | | | |

**By using the matrices above we now have an action needed ranking system. This means we can prioritize the hazards depending on their ranking.**

<u>Example:</u>　　　　A 1st rank action requires immediate remedy

A 2nd rank action requires a less immediate remedy but must be dealt with quickly.

Table No. 3:

| | |
|---|---|
| | 1st rank actions |
| | 2nd rank actions |
| | 3rd rank actions |
| | Acceptable risk – no action |

Taking all this information and pooling it in the Initial Hazard Identification log we can now prioritise the hazards in the left hand column "Risk Assessment No." This number will appear on the top left of the risk assessment forms for easy referencing.

# Low Risk Project – Risk Rating Summary

| Risk Assessment No. | INITIAL HAZARD | Probability | Ranking |
|---|---|---|---|
| 1 | Electrocution | Remote | 3rd |
| 2 | Fire | Remote | 3rd |
| 3 | Cutting injuries | Remote | Acceptable |

| | | | |
|---|---|---|---|
| 4 | Drilling injuries | Remote | 3rd |
| 5 | Heavy equipment | Remote | 3rd |
| 6 | Burns | Remote | 3rd |
| 7 | Fumes | Remote | 3rd |

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