INFT3970 Major Project Scope Document
Distributed Monitoring System using Embedded Devices

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1 Executive Summary

1.1 Background

As technology is integrated further into society, a knowledge of sensor technology will be seminal for the IT professional. Computation devices are becoming extensions of our senses and in this vein becoming indispensable. Starting in the health services industry black box solutions have run medical devices for over a decade. In the contemporary setting we can observe mining trucks that are driverless, driverless car incubation projects and robots that perform operations like the davinci [19] [20]. One thing these devices all have in common is the extensive use

of sensor technology. Furthermore, these sensors are extending our sense-making ability into areas that the human race has never experienced before, infrared and ultraviolet sensors in remote controls give us the ability to control devices without physical intervention. Phones with accelerometers can be combined with a gyroscopes for games and movement tracking. Barometric sensors are implemented to measure atmospheric pressure and forecast short term changes in the weather. Sensors can now measure heart rate and health telemetry which will be a trillion dollar industry in the future. Even simple sensors such as temperature, humidity, motion can be employed to create analytics for the home. Riding the wave of "IoT Revolution" [1], this project will develop a low cost, easily

deployable IoT product in any setting.
IoT or *The Internet of Things* has proven to be an explosive trend within the consumer electronics markets. Never before have such small versatile devices been available for general consumption, leading to an estimated combined business and consumer spending value in excess of $6 *trillion* dollars globally in 2018 [1].
For the vast majority of consumers, both corporate and end-customer [2], a large movement toward both minimisation of waste and optimisation of spending is occuring on a global scale in the developed world, with the developing world rapidly following this trend also [3].
Citing this movement, it would only be logical to create a simple to use set of devices that allow for the monitoring of such measurables.

1.2 Overview and Purpose

The concept of this project is to create a distributed system in which small devices are used to monitor, log and analyse a number of select metrics from a multitude of potential data points.
The purpose of the project is to deliver a viable product that could be replicated for a reasonable price for both end-user and business alike. We believe the market to be on a precipice of further explosive growth, with the consumer market partially realised, but far from tapped by curent offerings.

1.2.1 Metrics

The metrics measured included will be:

- Temperature
- Humidity
- Motion

We anticipate further development on the project to be viable post submission date, however realise the limitations of the current timeframe.

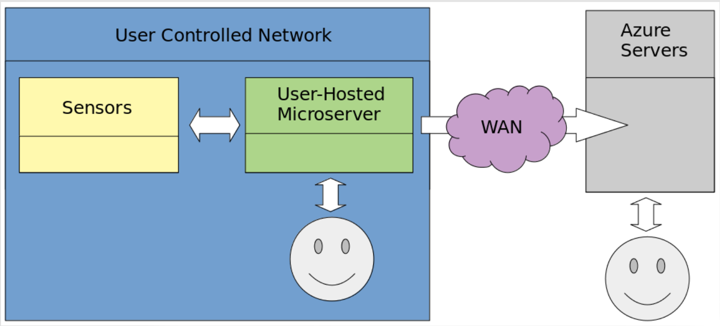
Metrics measured would be viewable on a users dashboard, with data being able to be scoped to multiple filter requirements such as time, select edge cases or specific locations.
The end-goal being an ability for users to better determine inefficient or bad decisions they may make unwittingly in regards to home or business heating, coupled with the impact of room utilisation.

2 Business Needs/Problems

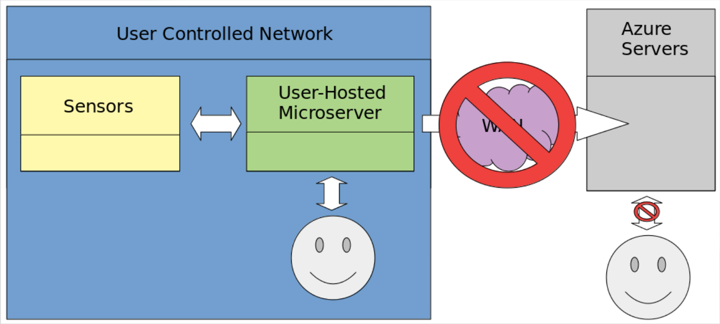
As suggested in the executive summary and project background, the IoT market is expected to rapidly grow in not only the current year but a number of future years to come. Accessibility and ease of use being major factors spurring the market into the current state.
This project aims to fill some of the gaps that exist within the expanding world of IoT by allowing end users irrespective of technological capability to easily partake in the current market at a price position that doesn't reflect excessive or overly expensive alternatives that exist.
As individuals within the project, we recognise the hurdles that would need to be jumped in order to prove this potentially to be a business viable product, so instead we elect to suggest that this project instead could allow a level of federation for the maker-space and allow the product instead to be documented for open-sourcing into the future potentially or to accept donations as a labour of love.

2.1 Azure Hosting

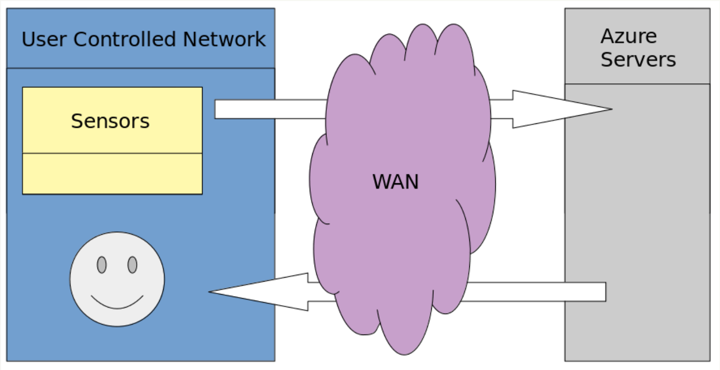
Currently without extenuating circumstances against hosting within the cloud the decision to host in Azure applications seems to be the path of least resistance for the project in order to enable a globalised access to a single database to host data.
We recognise the flaws with hosting in the cloud also, such as data breach potential (traditional methods or emerging threats [15]), however also recognise with a limited span of time allowable for the project a more suitable system design such as below is not suitable in the timeframe:



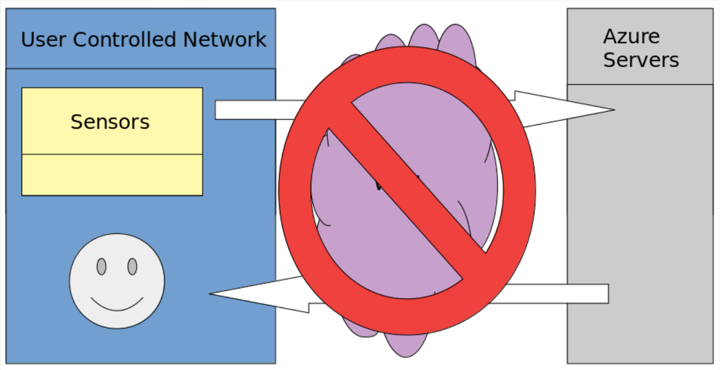
Such a design would allow for users to maintain connectivity from their own LAN:



Given time constraints we need to accept that the design of centralised servers hosted within Azure achieves the same ability to serve the user information and maintain connectivity as required, but is more failable:



In a network failure situation:



Optimally the scope of the project would be expanded to development of the user hosted microservers that would act as middleware between the hosted servers and the sensors, this is a highly viable goal given technologies such as the RaspberryPi [13] which under $50AUD can a number of Linux distributions or Windows IoT Core platform however time will likely limit ability for us to consider this route, and therefore we have decided against including the concept in this project.

2.2 Wi-Fi vs Zigbee

Considerations to implement the network of devices was considered however given the requirement to purchase and implement a module to enable use of Zigbee, conventional WEP/WPA/WPA2 network options were perfered. Both conventional Wi-Fi networks and Zigbee would allow meshability between devices, however Zigbee would prove less of an impact on the user's network in the form of mixture of DHCP leases and wireless network congestion avoided.

2.3 Privacy Issues

We recognise the collection of such personal data not only increases the attack surface for privacy conscious individuals, but erodes privacy barriers that should be upheld. GDPR [21] compliance will be attempted to be upheld in this project, breach notification, right to access, right to be forgotten and data portability (in the form of a user being able to download their own data) will be offered where possible. Furthermore to avoid various attacks against privacy such as Record linkage, attribute linkage or table linkage (less severe in this case) data that is related to multiple parties will be anonymised where possible and not a hinderance to the project's scoped objectives. [18]

3 Project Objectives

Within the timeframe still available to this project, we aim to develop and deploy a number of IoT devices [4] to a home enviroment or two and to track heat, humidity and motion of the dwelling to better understand the potential correlations of room use, heating and potential inefficiencies created in areas such as 'High Traffic' spots (loungerooms and hallways). Optimally we aim to couple this with a mapping of the dwelling, allowing a more intuitive expression of the data collected.

We intend on using student subscriptions to leverage Azure for both website hosting and databasing coupled with a small budget of roughly $100-$200 to purchase all required equipment which currently is expected to be:

- Arduino UNO3 Microcontroller [10]
- ESP8266 boards [4]
- DHT11 Temperature and Humidity sensors [6]
- XC-4444 PIR Motion sensors [5]
- Various required breadboards / generic electronics items

The overall goals of the project is to enhance our knowledge of IOT sensor technology in the scope of exploratoring what this technology can achieve and expanding the paradigm of this technologies implementations.

Secondarily the group seeks to develop our ability to interface with middleware using a number of appropriate languages to create a frontend user interface for users to monitor/operate and perform data analytics on the system and a backend for data management system that interfaces with an SQL server implementation.

4 Deliverables

The deliverables that are expected to be produced throughout the distributed monitoring system are broken into Four sections; Sensors, Database, UI and analytics.

4.1 Sensors

- Sensors are created to read temperature.
- Sensors are created to read humidity.
- Sensors are created to read motion.
- Sensors can be reprogrammed with different modules (Or have all modules avilable).
- Sensor ownership can be modified.
- Sensors cav connect to any 2.4gHz home network.

4.2 Database

- A new user account can be created.
- A new sensor can be registered.
- A newly registered sensor can create data on first boot.
- An admin can access user's information (password hashed + salted).
- A user record can be edited.
- A sensor can be assigned to a user account.
- A sensor can be deleted from a user's account.
- A sensor's details can be edited.
- An admin can view raw data from all tables (Depersonalised data).
- An admin can edit data from tables.
- Password can be changed.
- Email will be sent for resetting a forgotten password.
- Email verification upon account creation.
- Procedures and triggers for data analysis and querying.

A full prototype EER diagram can be found in the Appendix

4.3 User Interface

- Login page for users.
- Registration page for users.
- Home page (Displaying an overview).
- Tabbed pages for:
  - Temperature page.
  - Humidity page.
  - Motion page.
- User able to access associated data.
- Graphs based on the user data.
- User able to customise graphs and home page layout.
- Custom Analytic results.
- Email Suggestions section.
- Password reset section.
- Logout Page.

4.4 Data Analytics

- Administration able to view user data that has been depersonalised.
- Display Recommendations to the user based on trends.
- Showing different trends around a user's home using the different modules.
- Visibility of outlier data.
- Make recommendations on when to use heating or cooling in rooms.
- Determine if applicances may have been left on or utilised when not required and prompt user.
- Meta-Analytics including:
  - Average temperature/humidity.
  - Average events for motion sensors.
  - Determine localised trends
- Determine expected trends and flag or notify of extreme outliers.

Having a Data Analytics major within our group we expect the data collected may contain interesting information. An analytic module will be used to parse data for each user and display recommendations and habits from the data.

4.4.1 Temperature Module

The analytic module will be able to tell the users how different the temperature is around their house and see trends on room temperatures. This will also be able to be used to give recommendations on what rooms need heating/cooling and what rooms do not benefit from heating or cooling.

4.4.2 Humidity Module

The analytic module will be able search through the data and view what rooms and areas of the house are the most humid. This allows the user to keep an eye on the moisture that is in their homes like a wardrobe or kitchen pantry. Another use for the humidity module is alongside the temperature module to give suggestions to the user if they should turn on/off Air-conditioning units.

4.4.3 Motion Module

The analytic module will be able to see trends and habits on behaviour as they move through their home. By using this information the user will be able to see what rooms are high traffic areas and at what times of the day this high concentration of movement occurs. Through this it can also be used to tell when outliers occur for security purposes. Such as late night movement in a shed could be an intruder and the user will be notified with this uncommon event.

4.5 Milestones

A number of highly important milestones have been already scheduled as below;

Milestone	Date
Brainstormed viable projects, finalised project choice	12th August
Project broken down into milestones, assigned initial work to members	14th August
Initial database and sensors created	19th August
Sensors connecting to the database	20th August
Finished Scope Document	22nd August
Working User interface prototype	14th September
Programming complete for all sensors	20th September
Completion of Database and scripts	14th October
Finished User Interface	14th October
Testing completed	20th October
Project Completed for Exhibition	25th October
Exhibition Presentation	3rd November

An extended list of milestones on expected completion times for tasks is included in the proceeding pages. For a full gantt chart, please refer to the Appendix

ID	Task Name	Duration	Start	Finish
1	Brainstormed viable projects, finalised project choice	11 days	Wed 1/08/18	Sun 12/08/18
2	Project broken down into milestones, assigned initial work to members	2 days	Sun 12/08/18	Tue 14/08/18
3	**1. Sensors Research**	**11 days**	**Tue 14/08/18**	**Sat 25/08/18**
4	1.1. Sensor proof of concept implementation (serial to USB)	1 day	Tue 14/08/18	Wed 15/08/18
5	1.2. Testing of POC	1 day	Wed 15/08/18	Thu 16/08/18
6	1.3. Sensor and Wifi Implementation	2 days	Thu 16/08/18	Sat 18/08/18
7	1.4. Testing of Sensor and Wifi implementation	1 day	Sat 18/08/18	Sun 19/08/18
8	**1.5. Sensor to API Communication**	**6 days**	**Sun 19/08/18**	**Sat 25/08/18**
9	1.5.1. Implementation and testing of Temperature logging	4 days	Sun 19/08/18	Thu 23/08/18
10	1.5.2. Implementation and testing of Humidity logging	4 days	Sun 19/08/18	Thu 23/08/18
11	1.5.3. Implementation and testing of Motion logging	4 days	Sun 19/08/18	Thu 23/08/18
12	1.5.4. Testing of Sensor to API communication	1 day	Thu 23/08/18	Fri 24/08/18
13	**2. Database pilot**	**48 days**	**Tue 14/08/18**	**Mon 1/10/18**
14	2.1. Create Basic Database and table	14 days	Tue 14/08/18	Tue 28/08/18
15	2.2. Testing of database	3 days	Tue 28/08/18	Fri 31/08/18
16	2.3. Optimisation of data types used in each table	10 days	Fri 31/08/18	Mon 10/09/18
17	2.4. Implementation of Indexing and other optimisations to avoid Big O issues.	6 days	Mon 10/09/18	Sun 16/09/18
18	2.5. Final Database implementation	14 days	Sun 16/09/18	Sun 30/09/18
19	**3. BackEnd**	**56 days**	**Sun 19/08/18**	**Sun 14/10/18**
20	3.1. Decision on framework to be used	7 days	Sun 19/08/18	Sun 26/08/18
21	3.2. Initial POC on framework	4 days	Sun 26/08/18	Thu 30/08/18
22	**3.3. Feature implementations**	**38 days**	**Thu 30/08/18**	**Sun 7/10/18**
23	3.3.1. Implementation of PING GET endpoint to avoid sending of data unnecessarily	5 days	Thu 30/08/18	Tue 4/09/18
24	**3.3.2. Implementation and testing of POST endpoints:**	**28 days**	**Tue 4/09/18**	**Tue 2/10/18**
25	3.3.2.1. Tempature	28 days	Tue 4/09/18	Tue 2/10/18
26	3.3.2.2. Humidity	28 days	Tue 4/09/18	Tue 2/10/18
27	3.3.2.3. Motion	28 days	Tue 4/09/18	Tue 2/10/18
28	3.3.3. Implementation and testing of application helpers to aid front-end data sourcing	5 days	Tue 2/10/18	Sun 7/10/18
29	**3.4. Refactor existing code**	**6 days**	**Sun 7/10/18**	**Sat 13/10/18**
30	3.4.1. Peer review safety of code, implement required changes	6 days	Sun 7/10/18	Sat 13/10/18
31	**4. FrontEnd**	**56 days**	**Sun 19/08/18**	**Sun 14/10/18**
32	4.1. Initial implementation of POC dashboard	15 days	Sun 19/08/18	Mon 3/09/18
33	4.2. Initial POC of authentication using a login page	10 days	Mon 3/09/18	Thu 13/09/18
34	4.3. Review of code by peers	5 days	Thu 13/09/18	Tue 18/09/18
35	4.4. Migrate dashboard behind successful login page	5 days	Tue 18/09/18	Sun 23/09/18

ID	Task Name	Duration	Start	Finish
36	4.5. Improvements and refactoring of dashboarding code	5 days	Sun 23/09/18	Fri 28/09/18
37	4.6. Review and refactor to suit all devices commonly used to browse websites.	5 days	Fri 28/09/18	Wed 3/10/18
38	4.7. Implement required bootstrap/css framework to handle display of data.	6 days	Wed 3/10/18	Tue 9/10/18
39	4.8. Final peer review and refactor	5 days	Tue 9/10/18	Sun 14/10/18
40	**5. Pilot/monitoring and testing**	**27 days**	**Sun 14/10/18**	**Sat 10/11/18**
41	5.1. Implement and test system-wide exception logging to DB	27 days	Sun 14/10/18	Sat 10/11/18
42	5.2. Implement and test system-wide logging of authentication	27 days	Sun 14/10/18	Sat 10/11/18
43	5.3. Fuzzing/toolset assisted testing of website	27 days	Sun 14/10/18	Sat 10/11/18
44	**6. Sensors**	**26 days**	**Sat 25/08/18**	**Thu 20/09/18**
45	**6.1. Pilot testing of potential boards (UNO3 / ESP / RPI / OPI)**	**6 days**	**Wed 22/08/18**	**Tue 28/08/18**
46	6.1.1. Code feasability report on each board, considerations on support from community and team ability	3 days	Wed 22/08/18	Sat 25/08/18
47	6.1.2. Review of boards and decision on main boards to use	3 days	Sat 25/08/18	Tue 28/08/18
48	**6.2. Implement monitoring for chosen metrics:**	**10 days**	**Tue 28/08/18**	**Fri 7/09/18**
49	6.2.1. Temperature	10 days	Tue 28/08/18	Fri 7/09/18
50	6.2.2. Humidity	10 days	Tue 28/08/18	Fri 7/09/18
51	6.2.3. Motion	10 days	Tue 28/08/18	Fri 7/09/18
52	**6.3. Implement networking on boards**	**2 days**	**Fri 7/09/18**	**Sun 9/09/18**
53	6.3.1. Determine viability of WPA-2E connectivity	2 days	Fri 7/09/18	Sun 9/09/18
54	6.4. Implement json generation on boards	2 days	Sun 9/09/18	Tue 11/09/18
55	6.5. Implement PING request functionality to check web server is up or not	2 days	Sat 11/08/18	Mon 13/08/18
56	6.6. Test API communication	4 days	Thu 13/09/18	Mon 17/09/18
57	6.7. Design and print 3D case for boards	2 days	Mon 17/09/18	Wed 19/09/18
58	6.8. Deploy boards to various locations	1 day	Wed 19/09/18	Thu 20/09/18
59	**7. Documentation**	**71 days**	**Tue 14/08/18**	**Wed 24/10/18**
60	7.1. Generate POC documentation from project	2 days	Tue 14/08/18	Thu 16/08/18
61	7.2. Generate scope document	8 days	Thu 16/08/18	Fri 24/08/18
62	7.3. Comment code extensively for readability	14 days	Fri 24/08/18	Fri 7/09/18
63	7.4. Document APIs	50 days	Fri 24/08/18	Sat 13/10/18
64	7.5. Document database design, with considerations of optimisation and required modifications	50 days	Fri 24/08/18	Sat 13/10/18
65	7.6. Generate user guide for final product	20 days	Wed 26/09/18	Tue 16/10/18
66	7.7. Generate final report	8 days	Tue 16/10/18	Wed 24/10/18

5 Key Roles in Project

Key roles defined for the project include the below:

Task	Task Manager	Support
Brainstormed viable projects, finalised project choice	Whole Team	Whole Team
Project broken down into milestones, assigned initial work to members	Jay	Whole Team
Initial database and sensors created	Lee	Whole Team
Azure set-up and management	Dean	Josh
Sensors connecting to the database	Jay	Dean, Lee
Finished Scope Document	Jay, Lee	Whole Team
Working User interface prototype	Ed	Jacob, Lee, Josh
Back End programming	Dean	Jay, Ed, Jacob
Data Analytics	Jacob	Ed
Programming complete for all sensors	Jay	Dean, Lee
Completion of Database and scripts	Josh	Ed, Jacob
Finished User Interface	Ed	Jacob, Lee, Josh
Testing complete	Dean	Whole Team
Project completed for Exhibition	Whole Team	Whole Team

6 Technical Requirements

6.1 Generalised Requirements

The team collaboratively have agreed on a few generalised requirements of the project including:

- Ease of use: The devices must be able to used by a nontechnical user, they must be supplied in such a way that an ability to place the device in place, and connect power are the largest difficulties that the end user encounters.
- Abstraction of underlying technologies: as a byproduct of the requirement of ease-of-use the devices and web application should not require the end user to have any knowledge of the underlying technolgies used.

6.2 Data Requirements

Requirements for raw data be stored in an online database are only access for the development resources to be able to access any suitable cloud account, self-host on a local machine or debug required functions in the application with localised data generation via ajax [17] queries of similar methods.

6.2.1 Azure

Azure is a likely candidate for the Database and website hosting, The database will be used to store all the data that is sent from the sensors. The uptime of the database the web application is vital to the user experience and the success of the project. Azure provides this security with 99.95% uptime [9].

6.3 Hosting Enviroment

Pages for the site itself will require a suitable host either cloud or local which supports .NETcore 2.0 [7] and suitable network access to reach a required TSQL [8] database hosted by the team.

6.4 Network Connectivity

Functioning network connectivity will be heavily depended on by the project, all of the sensors will be connected to a local network wirelessly which will enable the boards to post data at the API endpoint at either `https://www.inft3970.com` (Parked domain) or `https://inft3970.azurewebsites.net` (Currently functioning endpoint)

Requirements for the user to maintain a 2.4gHz enviroment will exist, as without this an expansion board or alternate boards will be required instead of the proposed ESP8266 [4] and UNO3 [10].

6.5 User Requirements

The users of the system will need to be confident in browsing webpages and accessing them. Generally we recognise any device with browser functionality will suit the purpose, and development will use a mixture of Firefox [11] or Chromium [12] based browsers to find all possible bugs within the project span.
The lack of an adblocker or similar addons for the chosen browsing enviroment would be suggested also, third party javascript libraries are likely to be used and cannot be assured to function under such enviroments including modification or blocking of traffic/assets.

6.6 Development Requirements [22]

A number of softwares will be required by the development team in order to complete the project, these softwares may include:

- SQL management studio to manage the database. Azure is using TSQL which can be managed by SQL management studio on the developers local machine.
- Visual studio to develop the front and back-ends of the web application.
- Visual Studio Code to develop elements of the front-end
- Arduino IDE software for editing/flashing the boards in C/C++.

7 Limitations

It is important to acknowledge the limitations of this project, given that this project is taking place in a compressed format it will primarily be an exploratory exercise in IOT sensor technology and its ability to interface with middleware, frontend/backend and an SQL server implementation. In order to managing expectations we are primary focused on heat,humidity and motion, this proof of concept implementation reduces the risk of under delivering on expectations.

7.1 Device Limitations

The ESP8266 is limited to the 2.4gHz wireless spectrum, and therefore a number of modern wireless networks may prove incompatible with the device. This is only a small hinderence to the device as most modern networks will use both 2.4 and 5.1gHz spectrums. Furthermore the 2.4gHz spectrum is better suited to longer distance connections than the 5.1gHz range, and even in the most heavily congested of wireless areas it would be reasonable to expect the payload from the ESP would have no issues at a measly 200bytes on average.

7.1.1 Security Concerns

Issues related to security on the publicly open API endpoints hosted in Azure prove to be hindered by the limitations of the devices. We are currently investigating potential fixes for the current implementation in which requests over https connections should ensure a level of security over current use of plain http.
Implementation of a method that would allow access to a preflashed public key to be used for encryption purposes of sensitive json data before it even leaves the device would be an excellent addition to the project, however both scope and inefficiencies of pub/private key encryption are reasons against this idea.

7.2 Development Limitations

Limitations of development experience may exist within the group with only 2 software engineering majors present. We expect that these members will be able to assist the other members in potential problem areas and expect the use of code versioning will alleviate any potential miscommunications in code modification and submission.
Factors potentially negating this issue include a base level of programming knowledge being shared across all members of the team, with a heavy level of experience in C# programming.

7.2.1 Framework Limitations

We may experience some level of difficulties with the chosen framework of .NETCore 2.0 in development as only a limited number of the team have experienced .NETCore MVC application programming or .NETCore API programming.
We expect however the time required for upskilling and learning the framework will provide a positive time return if not purely allowing team members a new skill in which to take to potential employment opportunities into the future.

References

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[20] https://www.forbes.com/sites/danielnewman/2017/12/19/the-top-8-iot-trends-for-2018/

[21] Information page: GDPR https://www.eugdpr.org

[22] Development resources:

Software/Hardware/Equipment	Description/Purpose
Visual Studio	Backend development
Visual Studio Code	Embedded Programming / Frontend development / Latex Typesetting
SQL Server 2016 Management Studio	Design and implementation of database
Microsoft Project	Gantt Chart Generation
GIMP	General Image Manipulation
Arduino IDE	Embedded programming
Azure Virtual Machine	Web Application Live Deployment
Slack	Team collaboration
GitHub	Code Repository

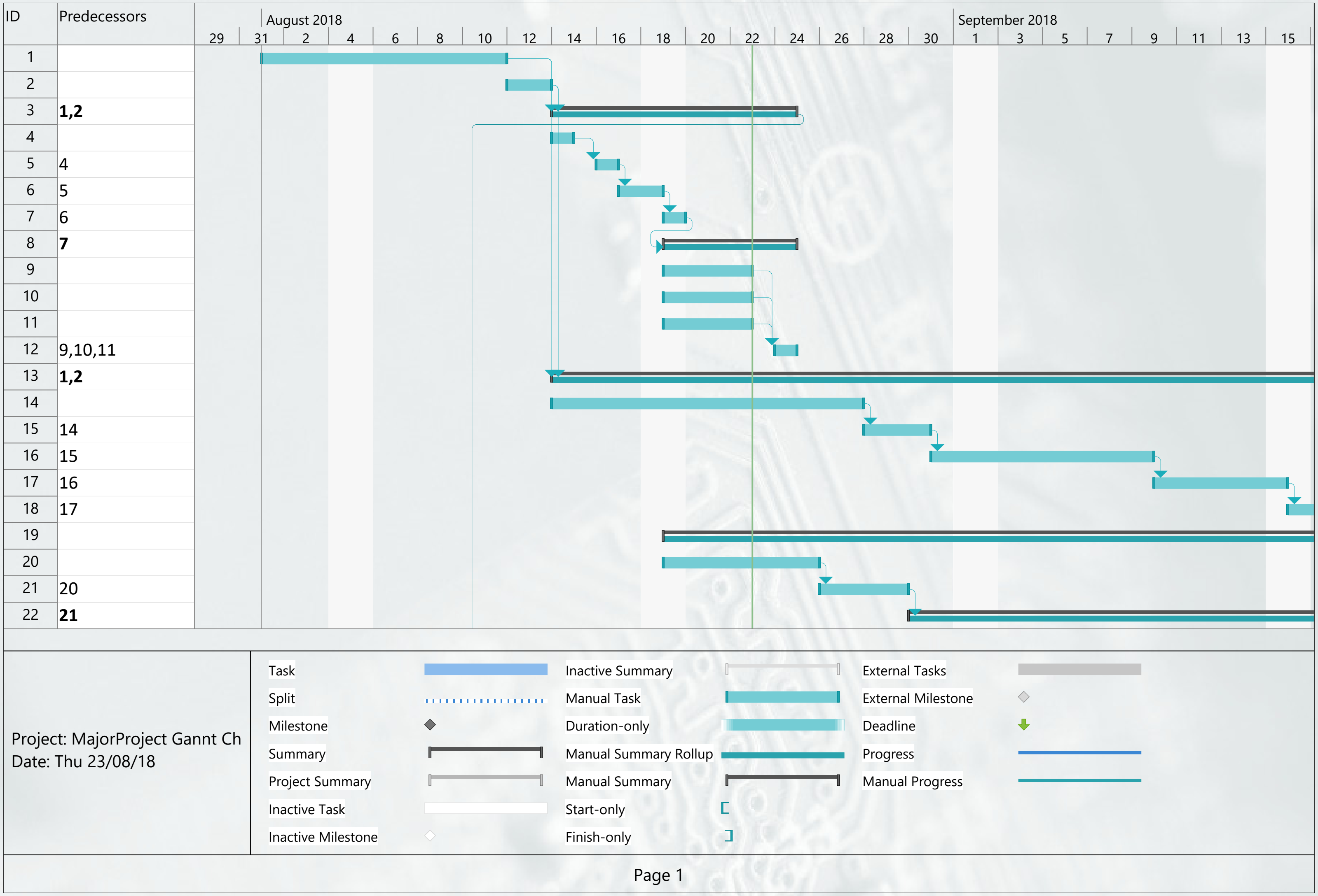
All image backgrounds are images from Unsplash, a provider of free and openly licensed images [16] All code hosted

both locally and an origin repository maintained in Github:

- Web Application code: https://github.com/JayRovacsek/INFT3970
- Database code: https://github.com/JayRovacsek/INFT3970-DB
- Sensor code: https://github.com/JayRovacsek/INFT3970-Sensors

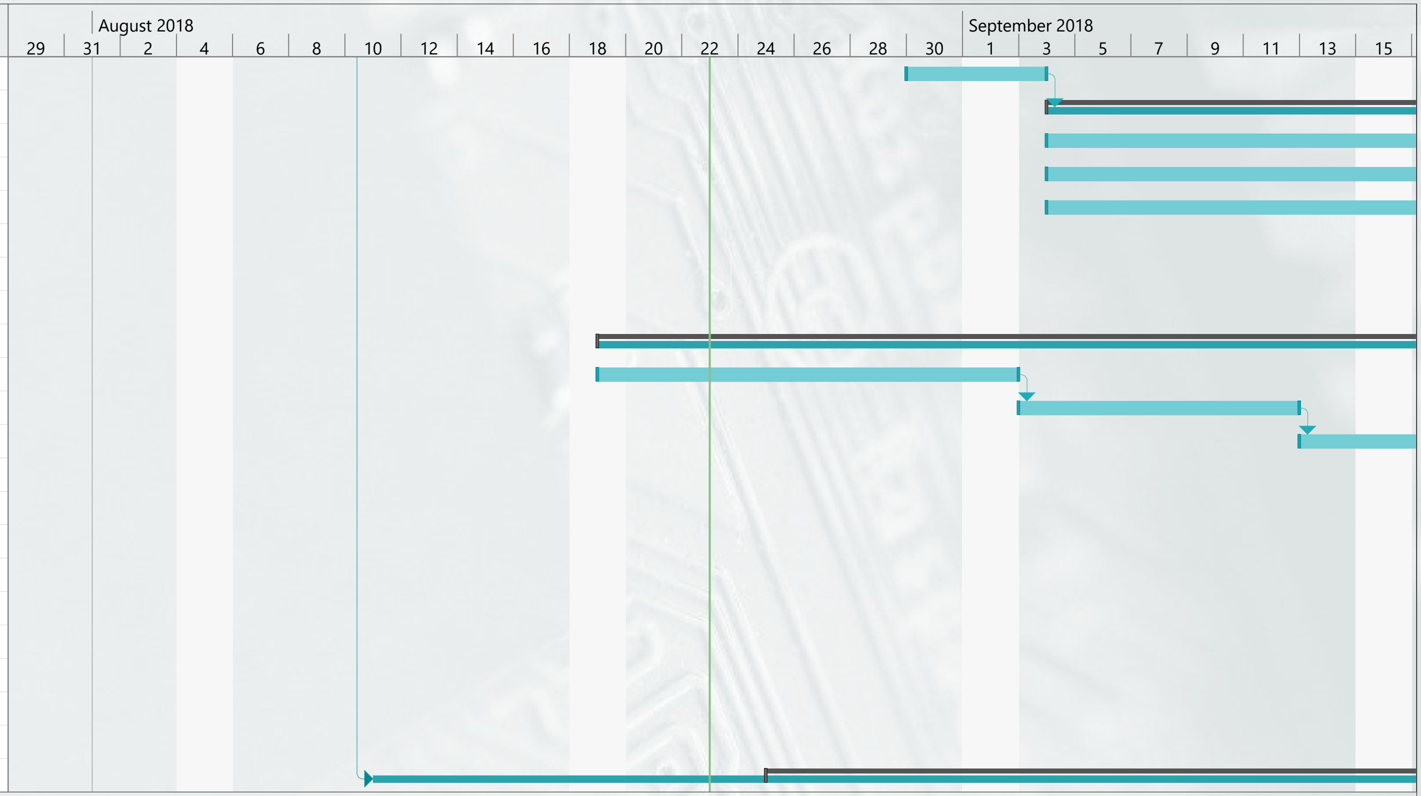
Access to the private repositories can be organised, at the completion of the course if no members object we will move the repositories to an open status.

8 Appendix



ID
Predecessors
August 2018
September 2018
29 31 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 1 3 5 7 9 11 13 15
1
2
3 1,2
4
5 4
6 5
7 6
8 7
9
10
11
12 9,10,11
13 1,2
14
15 14
16 15
17 16
18 17
19
20
21 20
22 21
Project: MajorProject Gannt Ch
Date: Thu 23/08/18
Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress
Page 1

ID	Predecessors
23	
24	**23**
25	
26	
27	
28	24
29	
30	
31	
32	
33	32
34	33
35	34
36	35
37	36
38	37
39	38
40	**19,31**
41	
42	
43	
44	**3**



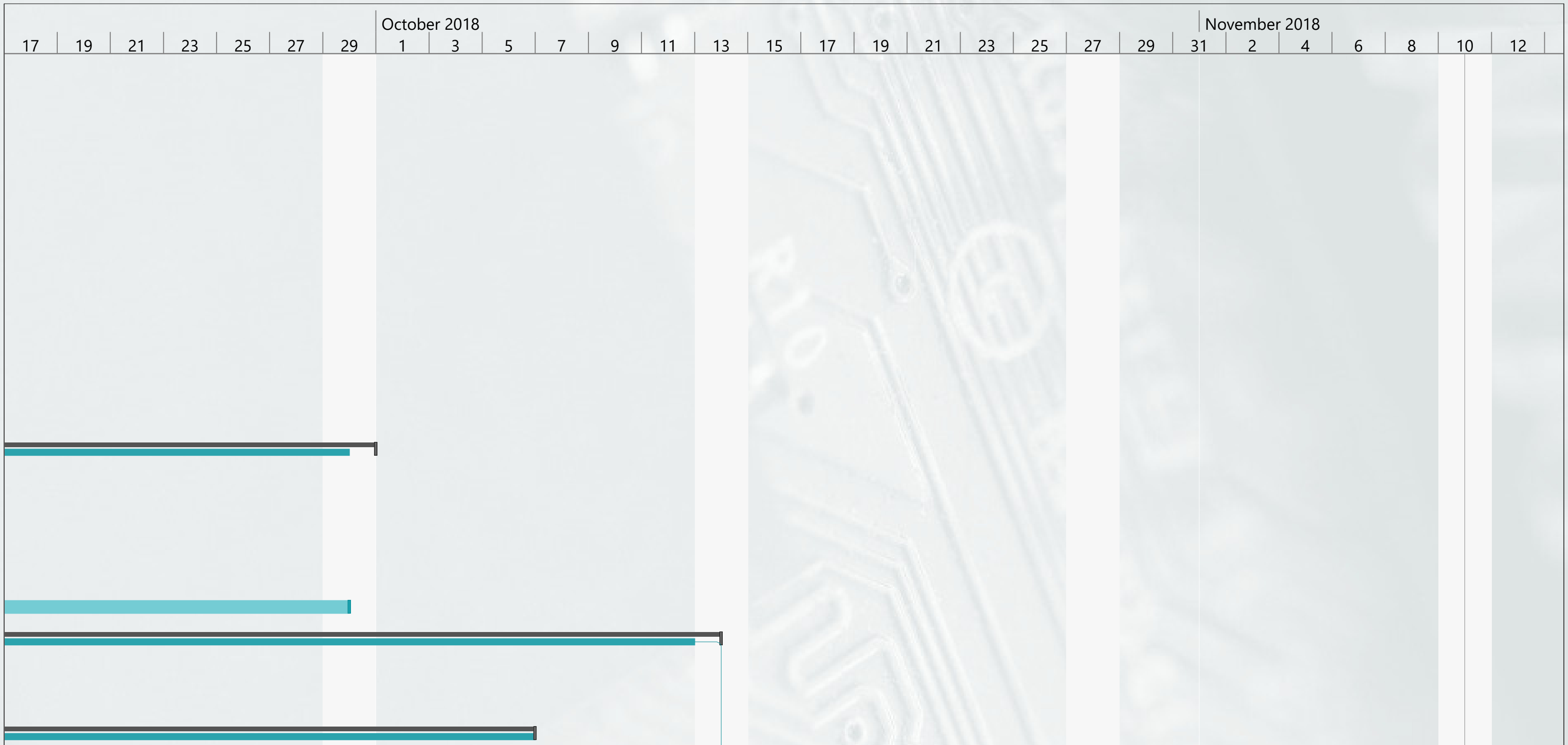
Project: MajorProject Gannt Ch
Date: Thu 23/08/18

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	

ID	Predecessors
45	
46	
47	46
48	**47**
49	
50	
51	
52	
53	
54	
55	
56	52,54,55
57	
58	
59	
60	
61	60
62	
63	
64	
65	
66	60,61,62,63,64,65

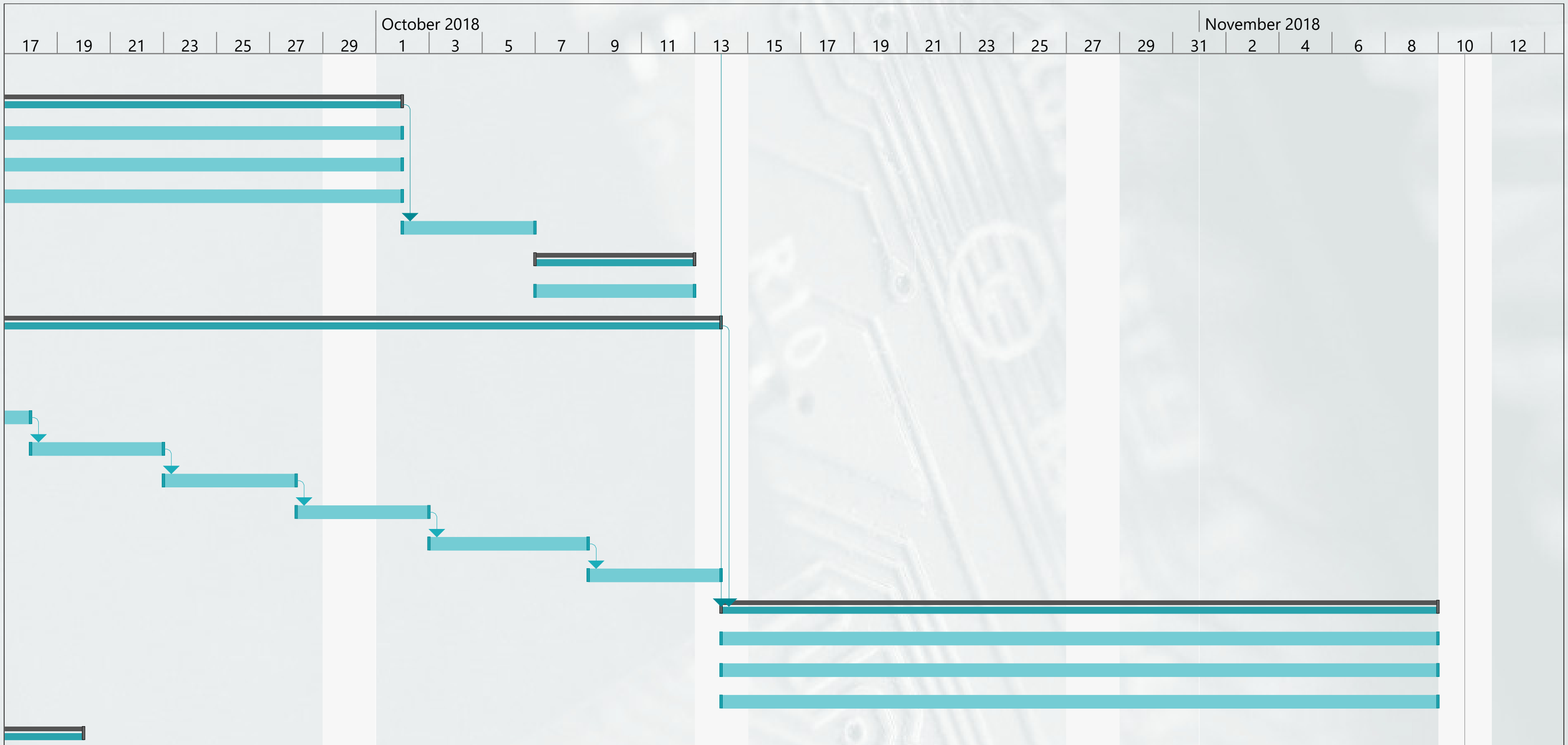
Project: MajorProject Gannt Ch
Date: Thu 23/08/18

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	



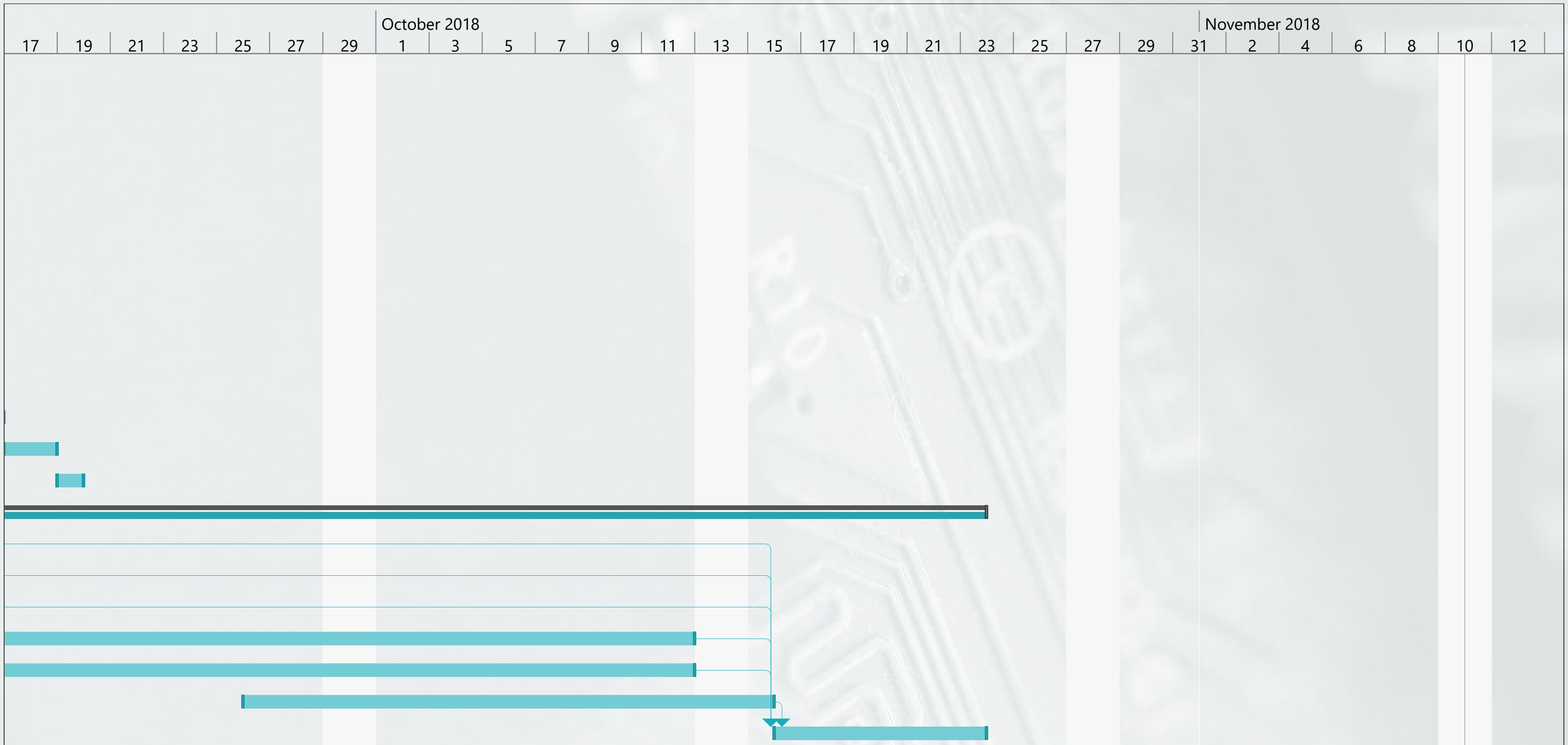
Project: MajorProject Gannt Ch
Date: Thu 23/08/18

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	



Project: MajorProject Gannt Ch
Date: Thu 23/08/18

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	



Project: MajorProject Gannt Ch
Date: Thu 23/08/18

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	