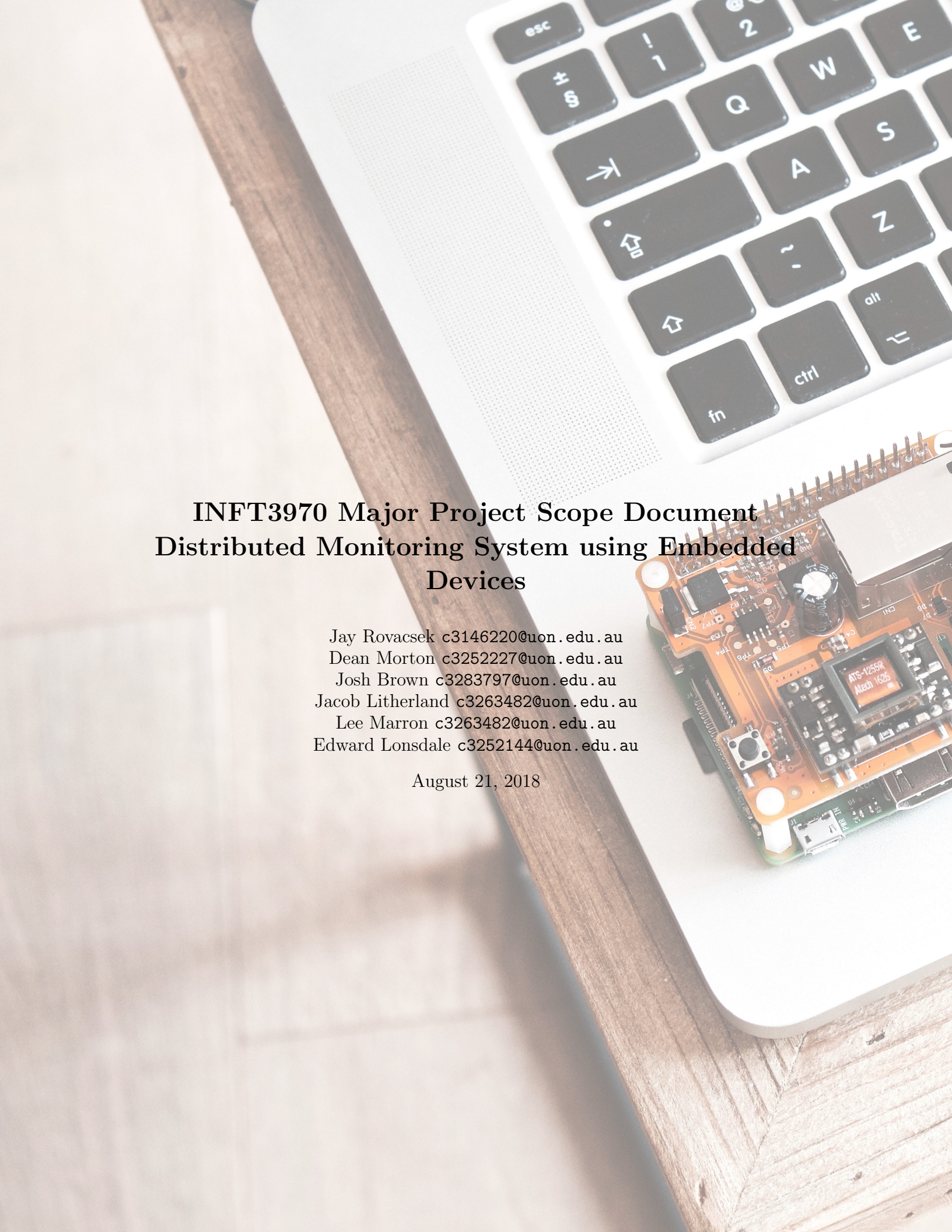

INFT3970 Major Project Scope Document
Distributed Monitoring System using Embedded Devices

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Contents

Executive Summary

0.1 Background

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 and therefore optimisation of such measurables.

0.2 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.
In this document we intend

0.2.1 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.

1 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 ain 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
- ESP8266 boards
- DHT11 Temperature and Humidity sensors [6]
- XC-4444 PIR Motion sensors [5]
- Various required breadboards / generic electronics items

1.1 Deliverables

Included deliverables for the project will include a large span of items crossing a number of percieved IT-sub-disciplines:

- Raw data be stored in an online database including:
  - Temperature
  - Humidity
  - Motion
  - Associated timestamps for datapoints
  - User information including:
    - Name
    - Address
    - Postcode

The user interface will be developed to allow the users to access their stored infomation and optionally remove sections of data. Each user will be able to customise their own homepage in order to display to their needs. The user interface will deliever:

- Login page
- Registration
- Home Page (Where all data is displayed)
- Graphs based on the user's data
- Analytic results
- Suggestions
- Logout

1.2 Milestones

Major milestones for the project include are split into a number of concurrently developed sub-sections:

1. Sensors:
    1.1. Sensor proof of concept implementation (serial to USB)
    1.2. Testing of POC
    1.3. Sensor and Wifi Implementation
    1.4. Testing of Sensor and Wifi implementation
    1.5. Sensor to API communication including:
        1.5.1. Implementation and testing of Temperature logging
        1.5.2. Implementation and testing of Humidity logging
        1.5.3. Implementation and testing of Motion logging
        1.5.4. Testing of Sensor to API communication
2. Database:
    2.1. Database Pilot
    2.2. Review and Testing of Database
    2.3. Optimisation of datatypes used in each table
    2.4. Implementation of indexing and other optimisations to avoid big O issues.
    2.5. Final database implementation.
3. Backend:
    3.1. Decision of framework to be used
    3.2. Initial POC on framework
    3.3. Feature implementations:
        3.3.1. Implementation of PING GET endpoint to avoid sending of data unnecessarily
        3.3.2. Implementation and testing of POST endpoints:
            3.3.2.1. Temperature
            3.3.2.2. Humidity
            3.3.2.3. Motion
        3.3.3. Implementation and testing of application helpers to aid front-end data sourcing
    3.4. Refactor existing code
        3.4.1. Peer review of code, implementation of required changes
4. Front End:
    4.1. Initial implementation of POC dashboard
    4.2. Initial POC of authentication using a login page
    4.3. Review of code by peers
    4.4. Migrate dashboard behind successful login page
    4.5. Improvements and refactoring of dashboarding code
    4.6. Review and refactor to suit all devices commonly used to browse websites.
    4.7. Implement required bootstrap/css framework to handle display of data.
    4.8. Final peer review and refactor

5. Documentation

    5.1. Generate POC documentation from project

    5.2. Generate scope document

    5.3. Comment code extensively for readability

    5.4. Document APIs

    5.5. Document database design, with considerations of optimisation and required modifications

    5.6. Generate user guide for final product

    5.7. Generate final report

2 Technical 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 datageneration via ajax queries of similar methods.
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.

Functioning network connectivity, all of the sensors will be connected to a local network which will then send all the data to the API. Having the local network is vital part to the success of the system as the sensors will not be able to communicate with the database.

Meet system requirements to run the users preference of web browser, the user will have to login into the system through a local web browser to view their sensor information on their network.

Azure to run 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].

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 end of the web application. The development of the web application will be written in visual studio then pushed to azure for final deployment. Arduino boards and sensors. ESP8266 boards will be used with a variety of compatible sensor to create a home monitoring system. These sensors include temperature, humidity and motion.
Arduino IDE software for editing/flashing the boards in C/C++

Majority of product/service has the “requirements”
More details than deliverables.

3 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.

“Limitation” of the project
Managing expectation, not over-promising

References

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

[2] https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world

[3] http://sunnewsonline.com/china-is-worlds-largest-renewable-energy-producer-consumer/

[4] http://esp8266.net/

[5] https://www.jaycar.com.au/medias/sys_master/images/9105858396190/XC4444-dataSheetMain.pdf

[6] https://www.jaycar.com.au/medias/sys_master/images/9091897786398/XC4520-dataSheetMain.zip

[7] https://www.microsoft.com/net/download

[8] https://docs.microsoft.com/en-us/sql/t-sql/language-reference?view=sql-server-2017

[9] https://azure.microsoft.com/en-au/support/legal/sla/app-service/v1_4/