

UNIVERSITY OF BRIGHTON

COMPUTER SCIENCE (GAMES)

INDIVIDUAL PROJECT - CI301

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# Final Year Project Report

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# 1 Methodology

A methodology is a set of methods, rules and restrictions combined to form a procedure or discipline.

By adhering to a development methodology it is possible to set development goals and a way to identify trouble areas during a project allowing for plans and contingencies to be allocated to improve the likelihood of success.

## 1.1 Overview of types of methodology

There are many forms of methodologies, below are a few of the most popular and an overview of each.

### 1.1.1 Rapid Applications Development (RAD)

By producing prototypes of the software quickly customers are able to test and provide feedback as the software is developed. This is useful as often requirements change and it's common for developers to produce software that isn't actually what the customer wanted.

### 1.1.2 Agile

Originally project management was slow to adapt to changes with user review coming in late stages of development. Agile however aims for incremental development with regular feedback. (Admin 2008)

The most popular form of agile development is the Scrum (Admin 2008) scrum is suited towards small teams and requires close involvement by the product owner to provide regular feedback and review.

### **1.1.3 Lean**

Much like scrum and other agile methodologies aims to produce software quickly and involves close coordination with the product owner, where lean varies is that it wants to reduce waste by selecting the most valuable features required. (*What Is Agile Methodology?*).

### **1.1.4 Waterfall**

Focuses on phases such as; requirement gathering, analyses, development and testing. Each phase is completed entirely before moving onto the next phase and is often depicted by the phases flowing steadily downwards resembling a waterfall.

### **1.1.5 Spiral**

The spiral model is based on the incremental model and consists of four phases; Planning, risk analysis, engineering and evaluation (*What is Spiral model- advantages, disadvantages and when to use it?*). A project will go through each phase multiple times in an iterative process or spirals. This is very well illustrated in the figure below.

### **1.1.6 Time Boxing**

Involves strict deadlines rather than goals. By developing up to the agreed upon time and evaluating progress this can allow for steadier development and a set time in mind which provides a deadline for development.

Evaluating at the end of the time frame can show struggles in the development process and provides the ability to address them rather than simply spending more time to complete the goal.

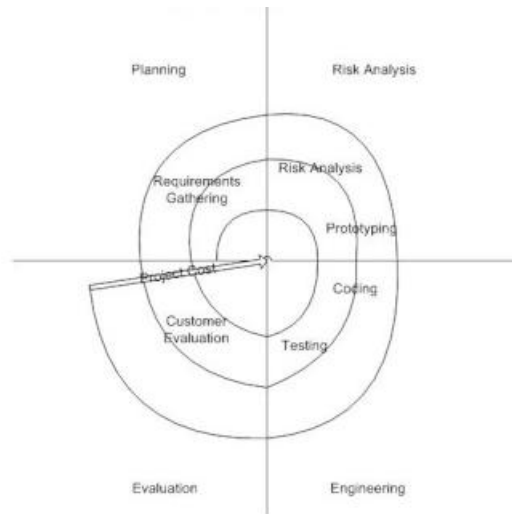


Figure 1: Spiral model diagram (*What is Spiral model- advantages, disadvantages and when to use it?*)

## 1.2 Choice of methodology

After assessing the various forms of project methodologies I have decided to use an agile methodology most notably the Lean methodology as this will provide me the ability to develop core functionality in a fast pace and add other features time permitting. To assist my development I will also be using time boxing to allocate time for my applications functions and allow me to perform regular performance reviews so I can identify time sinks and other issues to allow me to manage them.

## 1.3 Project Time line

Below is a Gantt chart of the overall plan for my project. A Gantt chart doesn't suit my development methodology very well and so is fairly high-level overview.



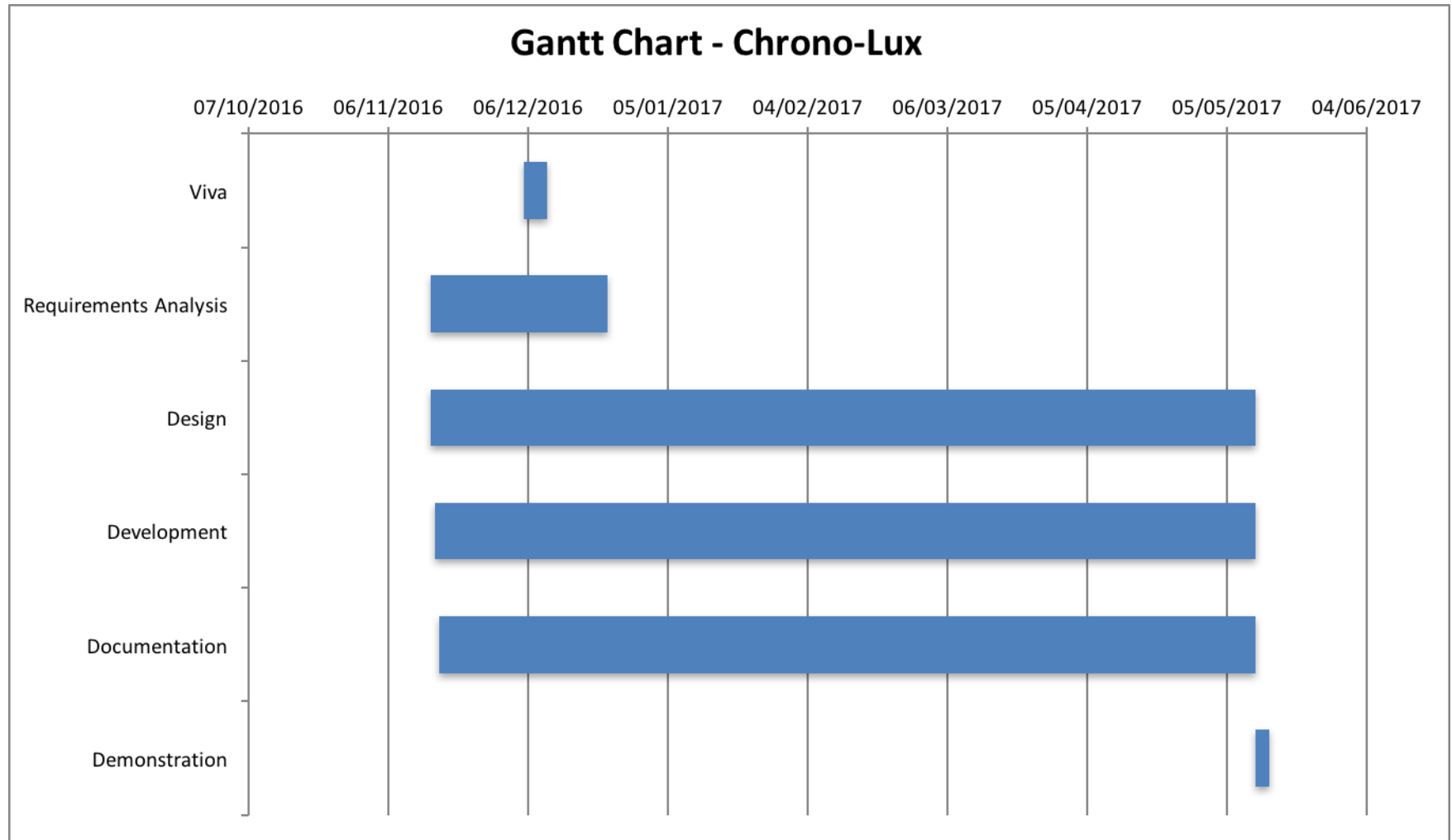


Figure 2: Project Gantt Chart

## 2 Stages of Development

For a complete project there are fundamental stages that need to be addressed, failure to address these stages can result in project drift resulting in the end result not fulfilling expectations or failing to achieve the requirements of the project.

It must be mentioned that although the term stages has been used, in many methodologies especially those that involve rapid development many of these stages will occur in either parallel or in quick succession; for example testing will often happen throughout development to ensure aspects of the code and design work as expected before extending the software further.

### 2.1 Analysis

The first stage of development is analysis, failing to analyse the problem or obtain customer requirements renders development practically impossible as the project scope can not be defined. Analysis often requires the assessment of the problem or product to be developed and rendering it down into more fundamental pieces such as how to implement a RESTful API or store any data required. During this stage it is common to perform competitor analysis by finding similar existing solutions to challenges that may be faced and to implement improvements over the competition and produce something objectively better to improve usability, experience, performance and any combination of aspects that can be deemed desirable.

#### 2.1.1 Problem Analysis

#### 2.1.2 Competitors

**Sleep as Android** This is the most feature packed alarm app available on Android that I could find.

**Cuckuu** Cuckuu doesn't have the same level of integration with reminders, appointments or weather as what I intend and it doesn't include any smart bulb integration.

## **Appearance**

## **Features**

**Wakie** Wakie is very different in how it intends to wake a user up and besides being an alarm has little to what my app will consist of. Wakie does have a very interesting perms though, that a stranger from around the world will be able to call you when you would like to be woken and talk about a topic you would like to discuss.

**Appearance** With a very simple and clean design this app definitely looks nice and allows itself to easily be ported into the varying mobile platforms.

## **Features**

## **2.2 Design**

During the design stage the User Interface (UI) and various aspects of the code are planned for development. By critically thinking about certain design aspects with regards to the requirements outlined from the analysis stage, designs of the software can be produced, this includes both the visual designs of the user interface and some of the software solutions that may be required such as certain tooling and frameworks that are available for development to produce more stable software faster by removing the need to produce custom solutions to aspects that have been solved and are found throughout programming.

### **2.2.1 Designs**

APPENDIX?

## **2.3 Development**

Throughout development everything that has been produced from both the analysis and design stages are implemented through creation and utilisation of software and assets such as images and sounds to produce the goal of the project, in the instance of a mobile application this would consist of producing and application that can run on the required platforms such as Android, iOS or Windows Phone and for the application to perform the tasks required such as sending and receiving messages and displaying them to the user in the case of a communications application.

### **2.3.1 Platform**

### **2.3.2 Target Market**

## **2.4 Testing**

Often testing is an ongoing aspect of the development life cycle so that as aspects of the application are developed tests and unit testing classes are produced to allow the automation of testing. Performing ongoing testing is useful to indicate that code is working correctly and if during development if the automated testing indicates any issues these can be resolved as they occur instead of during feedback or after deployment, both of which increase development cost through having to hunt down bugs and maintain the application during the life time of the application.

### 2.4.1 Tests

## 2.5 Feedback

Feedback is crucial for assessing the success of a project, by obtaining feedback from testers or trial users changes can be made to improve the experience of the application. Feedback can be obtained during development by having people use certain aspects of the application as it's being developed. If during feedback multiple users raise complaints about the same aspects this is a key indicator to change that aspect of the application before full deployment to ensure a higher level of polish and maintain a higher level of respect and image.

### 2.5.1 User Trials

## 3 Specification

Through performing the initial development stages the following project specification has been developed. Due to my chosen methodology various aspects of my specification can be slightly flexible though many are fundamental aspects the project.

### 3.1 Deliverables

My project has multiple deliverables that I will assign a level of priority to using the must, should, could concept.

The deliverables for my project will be as follows;

Activity	Priority	Deliverable
Writing final report	Must	The final report for the project is crucial and will be undertaken through out the development of my application.

Activity	Priority	Deliverable
Developing a basic alarm	Must	The application, an alarm app is what my project is based upon and so I will need to develop this before I can develop any further.
Developing a better alarm	Should	The application, a basic alarm will work but I would like this to be an alarm app that has all the features found in any alarm app such as repeat alarms, multiple alarms, etc. . .
Smart bulb integration	Must	The application, the Smart bulb integration is a main bases of my project and so I will need to include this into my application.
Develop for smart bulbs	Should	The practicality of demonstrating smart bulb integration could be a challenge, by setting up a test platform using an Arduino or raspberry pi would allow me more control than external APIs.
Calendar Integration	Should	The application would be improved with calendar integration providing an agenda for the user in the morning.
Text to speech	Could	The application, text to speech is a part of the Android platform and can be used relatively easy and so doesn't contain much of a challenge to it's implementation.

### 3.1.1 Stages

It would be nave for me to provide a detailed schedule of the activities and stages for my project, however I can identify what I will need to do and in which order as well as estimate a time frame for when I intend to begin the activity.

Activity	Time Frame
Writing the report	Writing the report will be on going throughout the development of my application to allow me to assess my work, identify my challenges and to provide the technical research I undertake.
Design	First week will be spent on this. I don't intend to spend much time of the visual design of my application as it should be fairly simple and can be modified easily.
Prototypes	Will occur prior to new visual changes to my application. I will provide a dummy function to the visual elements that involve interactions to test the look and feel before implementing fully.
Basic Alarm	First four weeks, the basic alarm will be the foundation of my application and as such will need to be developed well using the principles I have learnt.
A test platform	Two weeks following the alarm development, this will take some time to develop

### 3.1.2 Risk Analysis

There are many risks present with any kind of project, I will be identifying the most relevant and predictable risks and assessing the impact that could be caused. By identifying the risks posed I can attempt to avoid and mitigate these risks and plan for those that I can't control.

Table 3: List of risks.

Risks	Impact level	Reaction
Sickness	Low	Avoid getting ill.
Data loss	Low	Mitigate risk with multiple backups and version control.
Project complexity	Medium	Avoid making it too complex, or too simple.

Risks	Impact level	Reaction
Scope creep	Low	Avoid implementing features not outlined.
Communication with supervisor	Low	Mitigate by keeping in regular contact.

## 4 Research

There are aspects of my project that my research before and during development influenced my app from what I had initially planned.

### 4.1 Philips Hue API

My project utilises the Philips Hue connected light bulbs, the Philips 2016 system uses the ZigBee Alliance 2016 standard, though all of this is transparent as the method of interfacing with the devices is to use ‘GET’, ‘PUSH’, ‘POST’ and ‘PUT’ URL requests and provide JSON formatted commands in the body to interact.

The state of a specific light can be received using ‘GET’ and providing the URL `/api/devID/lights/1` or all of the lights by not specifying the number.

The state can be changed using ‘PUT’ instead and providing attributes and their values that you would like to change, for example:

```
1 {"on":true, "bri":255}
```

A few useful attributes for my application are: `on` = true/false `bri` = Brightness between 0 and 254

Colour settings include: `sat` = Saturation between 0 and 254 `hue` = The hue of the light (hue runs from 0 to 65535)



Through researching into the Hue API further there existed a Hue Software Development Kit (SDK), by using implementation of the Hue SDK most interactions with the lighting that would require the use of the RESTful API are now able to be accessed using Java methods. The Hue SDK exists alongside a very basic example Android application that allows the connection to the Hue bridge used for interfacing with the lights and a button to randomly adjust the hue values of the lights connected to the bridge.

#### **4.1.1 Influence**

The implementation example of the bridge connection and the storage of the API key required to authenticate a connected device/application included was very useful for the initial set-up for interfacing with the Hue lighting platform and as such a direct use of the RESTful API has not been implemented within my application to interface with the Hue lighting but instead the Hue SDK.

## **4.2 Design Considerations**

Through my research I have found that it has been shown bright lighting, blue light in particular can affect the circadian rhythm of the body which is used to regulate sleep patterns Oh et al. 2015. There are applications used to reduce the amount of blue light displayed in the evening and through the night, applications such as flux (*F.lux - software to make your life better*) and features included within mobile operating systems such as iOS (Swider 2016) and Android platforms (Diaz 2016).

#### **4.2.1 Influence**

My application will often be used within a low-light or dark scenario and as such I will design the application to use a dark colour scheme.

A light colour scheme could be quite energising to the user and could potentially make them more alert which is not ideal before going to sleep and could

extend the duration it takes to fall asleep, resulting in restlessness and a poor nights sleeps.

## 4.3 Human Perception of Light

Many human senses are based on a logarithmic scale, this is to say we are far more able to distinguish changes in light or sound in the lower band of the senses compared to higher, as such a small increase in volume of a whisper will be a more distinguishable change in volume than two jet engines roaring and increasing by their volume by a small amount.

The same applies to sight, it is more important to distinguish details in low light such as that from the moon compared to the light change of daylight at varying times of the day. We do this to normalise our senses to best suit our environment.

This kind of stimulus perception is defined as the just-noticeable difference (JND). First summarised by Ernst Weber in 1834 his equation was called Weber's Law and simply stated that response intensity increases as stimulus intensity increases (Salkind 2010, p. 1613-1615). Further refined by Gustav Fechner who proposed the use of a constant to provide a curve to the stimulus/-perception relationship. Fechners' law was a much better fit, however some stimulus did not fit well, such as that of electric shock.

Most recently in the 60's an American psychologist S. S. Stevens produced a formula that worked for all forms of stimulus, even for electric shocks (Stevens 1957). He proposed an exponential function raising the data to a power rather than using a simple constant. This essentially stated that to get a linear increase in perception of various stimuli, the stimulus would need to increase in an exponential form.

### 4.3.1 Influence

Due to this perception of light I feel increasing the brightness of the lighting in the room in a logarithmic fashion will produce a perceptibly more natural

and linear increase in brightness over increasing the value directly from 0 to the maximum value.

## **5 Assessment of Progress**

an assessment of the progress you made, problems encountered, their solutions and the lessons learned

### **5.1 Progress Made**

### **5.2 Problems Encountered**

#### **5.2.1 Alarm creation**

**Solution**

#### **5.2.2 Storing Objects**

**Solution**

### **5.3 Lessons Learned**

## **6 Accomplishments**

aspects of your work you are particularly proud of;

## 7 Success and Failure

assessment of the success or failure of the project as a whole.

### 7.1 Successes

### 7.2 Failures

## 8 Original Project Plan

Include your original project plan, together with any later versions or a discussion of any necessary changes to the plan. We recommend a count of 5000 words. This report is an assessable component of the project and is one the examiners will pay close attention to. Please hand in one copy by 18th May 2017. All reports MUST contain a first page with student name, student number, exit award for which you are registered and a short title.

### 8.1 Aims and objectives

What I will be developing over the upcoming months is an app to help users get out of bed easier in the morning in a useful and information rich way.

My aims are:

- Produce an alarm app with all the functionality users are used to.
- Integrate Smart bulb functionality into the app to turn the light on in the morning with the alarm.
- To turn off the lights at night without having to get out of bed.
- Provide weather information for the day.
- Inform the user of their schedule for the day and upcoming events.
- Publish the application to the play store for download and use by others.

## 8.2 Stakeholders

I have identified the following stakeholders:

- Myself - Not only am I developing the application making me a stakeholder, I am also very interested in home automation and waking up happy.
- My supervisor, Marcus Winter - By accepting to be my supervisor Marcus is also a stakeholder for my application.
- The second reader - Will also be involved and will be grading my project.
- An expanding user base of smart bulbs - Although the market currently is small the cost of smart bulbs is decreasing making them more available to users.
- Anyone that uses an alarm - The largest stakeholder I have is anyone that uses an alarm on the Android platform. More specifically those who own smart bulbs or other connected devices.

## 8.3 Communications

I will maintain contact with my project supervisor with monthly meetings where I intend to measure my progress against deadlines and goals, reflect on what progress has been made and address issues, challenges and for development advice to assist me successfully complete my project as planned.

Regular emails will also be used between meetings to keep in contact and keep my supervisor informed of what I intend to talk about and on my progress made.

## 8.4 Installation Process

I would like to publish my application to the Play store once developed to a satisfactory level. To install an app from the Play store you can simply

select the option to install the app and it will be downloaded and installed seamlessly.

I will be ensuring to develop to a high standard and ensure there are no issues, bugs or flaws with my application.

## **8.5 Quality checks**

During development I will ensure to maintain my code and follow the principles that have been taught to me and that I have learned and will learn, in doing so my code should be easily maintainable, readable and extendable for possible extensions and stretch goals.

I will develop a test plan as I continue to develop my application to allow me to note issues and ensure previous functionality has not been effected by further developments.

## **8.6 How will I measure success?**

My key performance indicators are outlined below:

- Alarm functionality
- Smart bulb integration
- Weather functionality
- Calendar Integration (Stretch)
- Text to speech (Stretch)

If I am unable to produce a working alarm app with smart bulb functionality I will have failed to achieve what I intended to develop and so these are my highest priority.

## 8.7 Challenges

There are many challenges I will face during my project these include the following:

- Making my application extensible to other home automation systems such as the *Belkin Wemo*. This would allow for greater flexibility and a larger target audience.
- Handling various devices, there are now many various appliances that are connected to home automation, from washing machines and fridges to door locks and CCTV. Many devices could be useful for morning and night automation, such as closing the curtains at night or turning the kettle on in the morning. Each of these devices will have different functions and are very different from one another. To be able to add several and include them within a scene/scenario to perform multiple actions would be a very powerful inclusion within the app.
- Providing a good level of home automation without making the app cumbersome or difficult to use. My target audience is average users who would like to wake up easier and more refreshed and have their days information available straight away. They don't want to spend ages setting up the light bulbs or struggling to find settings as they will get fed up and stop using and potentially uninstall the app.

## **9 Further Areas of Investigation and Enhancements**

### **9.1 Further Investigation**

### **9.2 Enhancements**

## **10 Evaluation**

A critical evaluation of every significant area of your project work, including your choice of project and how it fits in with the modules you have studied;

### **10.1 Choice of Project**

### **10.2 Course Relation**



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All links were last followed on the 9<sup>th</sup> of November, 2016