Project Proposal

Project Title: Exploring the world with NFC, Android and augmented reality

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Introduction and Rationale

Work in progress application name

Points of Interest.

Topic Area

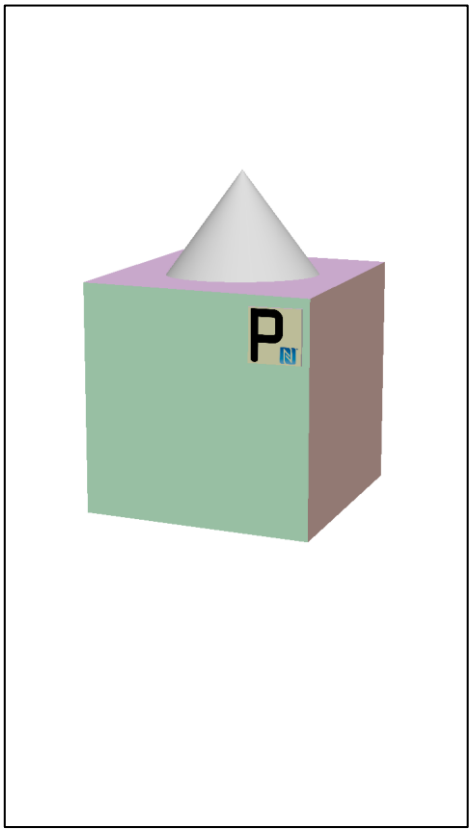
- NFC
- Android
- Augmented Reality
- Geo-location

Aim

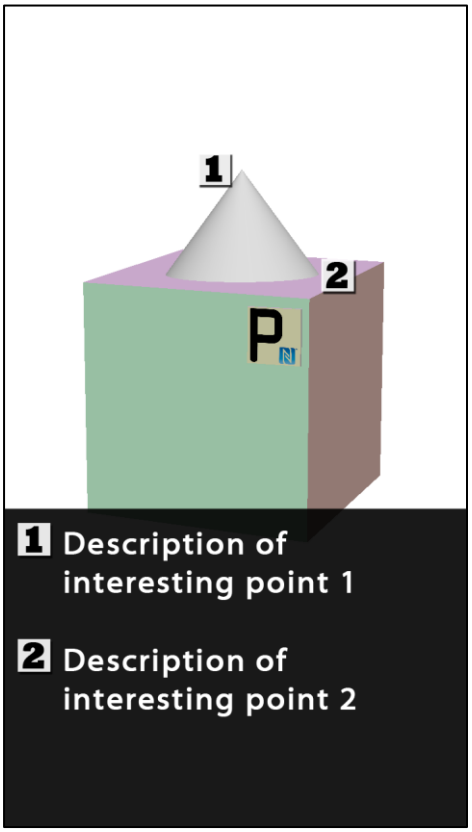
In this project I aim to produce an Android application that utilises combined NFC and augmented reality tags to produce information on an object. These tags would be placed at points of interest across the world (in zoos, national landmarks, across a city). When scanned with the user's device, the tag would download that objects data into the app. It would then start the camera and overlay numbers onto the object which would correspond to snippets of information about that object.

Below is a simple mock-up example of how the application could look:

In this case we are using the app to look at a particularly interesting cone.



Without Augmented Reality - *fig.1*



With Augmented Reality - *fig.2*

In *fig.2* we can see the augmented reality in action. The location of the numbers would be based off of the position of the tag (the P with the NFC logo).

There will also be a server application that the Android app would connect to in order to download the object information and upload new information.

Objectives

The application should be able to:

1. Look up object information by NFC tag
2. Work without NFC (using geo-location to find objects)
3. Allow for the creation, deletion and updating of tags
4. Show numbers on screen in 3D space using augmented reality technology
5. Give a fluid user experience
6. Be easy to use (usable without instruction)

The server should be able to:

1. Take insert requests
2. Take delete requests
3. Take select requests
4. Take update requests
5. Only allow logged in users to make changes to their objects
6. Have a minimal admin GUI

Practical Applications

The project itself is to create something to be used in the real world. The app could be used by anyone who would like to bring something interesting to the public's attention. It could be used by companies to promote their attractions.

It could also be used on excursions, where the group would have to find a set amount of objects and information about them.

Dissertation Originality

As far as I can find, the idea of combining NFC and augmented reality into a service that gives users detailed information about an object quickly by just tapping your phone on the tag has not been done before.

McDonalds Restaurant have an NFC/augmented reality game called "Happy Table"[1], that tracks the users phone across multiple tags. The apps are similar in the sense that the augmented reality element uses the tags to know what information the application should load (in Happy Table, the track pieces. In **Points of Interest**, the object information).

Relation to Course

This project is related to:

Object-Orientated Modules

This project uses object orientation heavily which is the main focus of the course.

U08971 - Advanced Mobile Software Development

The project uses the following skills learnt in this module

- Android development
- Using the input/output of mobile devices

U08054 - Web Technology

This project uses web technologies

Intended Deliverables

At the end of the project I intend to deliver:

- An Android Application (client)
- A PHP based server – most likely using Amazon's web services so that the server would be able to handle increased app usage over time

Who is undertaking the Work

I will be doing all of the work. I will use the documentation provided by Google, and other third parties to assist me. I will ask for help from my supervisor if it is needed.

Career Interests

I have under taken this project as in the future I would like to pursue mobile app development as well as web technologies.

Background Review

NFC

NFC stands for Near Field Communication, it is used to send and receive information from within a few centimetres.[2] Many phones have this technology built in and it is becoming increasingly more common.

RFID

RFID's are similar to NFC, though they can only send data. They can be encoded with a URL or any data as long as it is not greater than the tags memory.

Android Programming

Android applications are programmed in Java, which is an object orientated language.

Android and NFC

The Android SDK has support for using NFC. With NFC you can use a URI to open an app with an intent (e.g. An ID).

The minimum SDK version that can be used for NFC programming is 10. [3]

Augmented Reality

A paper entitled 'Mobile Augmented Reality for Enhancing E-Learning and E-Business'[4] makes a good point about the use of augmented reality markers being a disadvantage when looking at an object. It states that what if the marker is obscured even though object is clearly visible? The counter argument to this point is that by removing the AR (augmented reality) marker you then have to start processing from the cloud in order to match the image seen through to camera with one from the

database, which increases data traffic massively. Another point to make is that without the AR marker, how would a user know that they can use their AR app with that object?

I have conducted a small amount of research into android augmented reality SDK's and have concluded that the Vuforia SDK[5] would fulfil the needs of the planned application.

Methodology and Resources

I will design the initial system using UML diagrams.

I will then use "Sublime Text"[6] to program the PHP web server.

Then I will use "Eclipse"[7] or "Android Studio"[8] to program the Android application. I will need to use third-party SDK's for the augmented reality as I will not have time to develop my own solution.

The server will probably be run on Amazon's Web Services.

I will split development between two computers. Most of the work will be done on my desktop PC running Microsoft Windows 8; this has access to Adobe Photoshop for graphics work and the Eclipse IDE. If I am not at home, for example: I am working at university, I will use a laptop running Debian. This computer has access to both Eclipse and Android Studio.

I will use GIT to control my source code and documents/other resources. The repository will be hosted on github.com and be private. I will use it to backup code and track issues. Because I only have a limited number of private repositories available to me, I will keep both the client and server in the same one. Access to this repository can be given upon request.

Costs

I will need to purchase some RFID stickers, total costs should be no more than £15.

The server may incur some costs; Amazon does have a free tier though any database activity/storage is charged.

I already have the rest of the required equipment.

Risks

The risks involved in this project are fairly minimal. When developing the project, the main risk is getting stuck on a problem – though this can be rectified by asking for help from my supervisor.

When the application is released, security must be used in order to stop other people from editing a user's tags. No personal information about a user will be stored apart from a provided username and password, as people who wish to add tags will need to apply for a special account.

Specification

The following table is an early specification for the application and server.

#	Priority	Deliverable
1	High	App uses NFC to recognise object
2	High	App uses an external server to get data of object
3	Medium	App is a fluid experience throughout
4	Medium	Server is “RESTful”
5	Medium	Server uses authentication such as OAuth2
6	High	App uses augmented reality to show information about object
7	Medium	App uses geo-location as NFC back-up
8	Medium	App can be used to manage tags

Testing

A test plan will be created based off of a more detailed specification that will be included in my interim report. The project will use black box testing.

Project Plan

I have used a PERT chart to indicate when I will be doing tasks in my project.

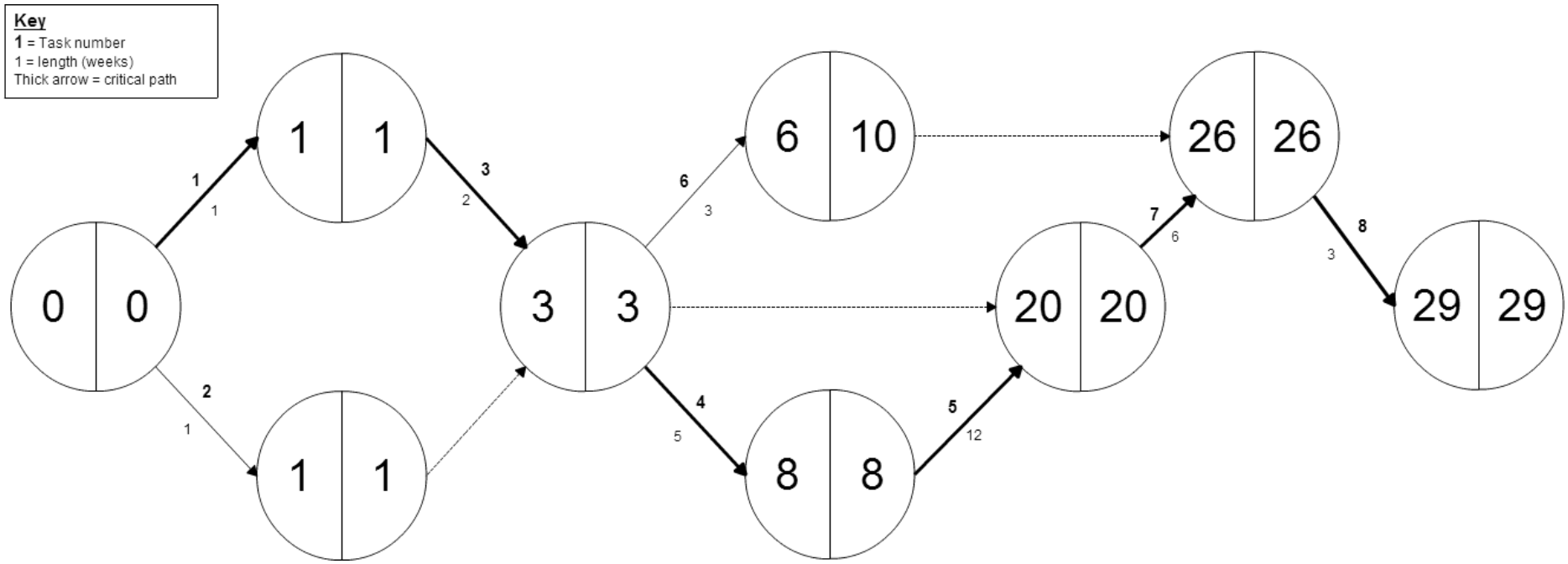
Pert Chart

The following times are fairly flexible; I have left myself plenty of time to finish the project off at the end. The reports will be written in line with the work, but here I have shown what must be finished in order to finish that specific report.

Tasks

#	Length of time to complete (weeks)	dependencies	Task
1	1	-	Research of augmented reality solutions
2	1	-	Research of NFC technology
3	2	1,2	UML Diagrams
4	5	3	Programming of Server
5	12	3,4	Programming of App
6	3	3	Interim report
7	6	5,6	Final report
8	3	7	Presentation

Chart


Key
1 = Task number
1 = length (weeks)
Thick arrow = critical path
0 0
1 1
1 1
3 3
6 10
8 8
20 20
26 26
29 29
1
1
2
1
3
2
6
3
4
5
5
12
7
6
8
3

References and Bibliography

[1] McDonalds “Happy Table”, URL: http://youtu.be/c6ATOgEcR1U

[2] NFC Forum – About NFC, URL: http://www.nfc-forum.org/resources/faqs#headTechnology

[3] Android Developer Site on NFC, URL: http://developer.android.com/guide/topics/connectivity/nfc/nfc.html

[4] Suya You, Ulrich Neumann, “Mobile Augmented Reality for Enhancing E-Learning and E-Business”, 2010, E-ISBN : 978-1-4244-5143-2, Print ISBN: 978-1-4244-5142-5

[5] Vuforia, URL: https://www.vuforia.com/

[6] Sublime Text, URL: http://www.sublimetext.com/

[7] Eclipse, URL: http://www.eclipse.org/

[8] Android Studio, URL: http://developer.android.com/sdk/installing/studio.html