

## **Initial Plan: Object Recognition on Mobile Devices**

*Author: Allan Lainchbury  
Supervisor: Dave Marshall  
Moderator: Alia I Abdelmoty  
Module Number: CM3203  
Module Title: One Semester Individual Project  
Credits: 40*

### **Description**

The project focuses on developing software for Android mobile devices that can recognise user defined objects in an environment full of other entities through the phone camera. This will then lead to applications such as helping individuals find objects that they commonly lose, by using the camera to effectively scan a room and track the object location if visible to the camera. Or in other cases help those with poorer sight be able to distinguish common items they may encounter in their household, by identifying what they see when the camera is directed at an item they have previously defined.

The project will need to be able to allow users to add objects they wish to distinguish. This will be done by creating a repository of images at multiple angles for added objects via steadily rotating the camera around the entity at certain points. The added entity must then be uniquely identified to the user by allowing them to attach a user defined name. Then using this repository, the application must be able to highlight the object and its name in a given environment (such as a room full of other physical articles) when the camera is in view of it. This will be achieved by having positive matches in terms of shape, colour, texture, etc. between the object to be recognised in view of the camera and the images of it in the repository, with enough of a strong match the highlighting should occur.

How the project aims to achieve this is by using existing computer vision libraries such as VLFeat or OpenCV that currently have methods of object classification using techniques such as SIFT, SURF or MSER. These libraries work through common operating systems like Windows, Linux and Mac as well as programs like MATLAB. The key is to create the core functionality of the project using the libraries in their designed environment such as with a MATLAB interface, so that it may for instance recognise objects in images, then to be able to port these functionalities to Android Java applications to transfer for mobile use.

Android devices were chosen over other devices such as iPhones specifically due to Android's reliance on Java. Given the familiarity with Java as a programming language as well as its relatively safer and less complex usability when compared to languages such as C++ that iProducts function on, it seemed with time constraints considered to be the choice of highest value when choosing what language and therefore what devices to port to.

### **General aims and objectives**

- . Create a system to recognise select objects through a phone camera
- . Highlight recognised objects in the camera view to distinguish them
- . Include functionality to add new objects to the select objects pile
- . Produce a user tested GUI optimised in ease of use and aesthetic appeal
- . Test system functionality from both white and black box perspectives to remove errors and evaluate performance
- . Research into additional and more complex functions or theories that could improve the system
- . Document system design, implementation and evaluation processes for both its front and back end

## **Work plan: Aims and objectives**

Below describes a detailed breakdown of the aims and objectives to be worked on throughout the project in order to achieve a complete system and all its relevant documentation. Following is also a Gantt chart to give an approximate time scale that a work plan aim or its objectives are to be completed by, which if adhered to should end in a completed system and documentation by the end of the project deadline. The Gantt chart also includes a body of time dedicated to supervisor meetings. Supervisor meetings have been scheduled to occur in that body of time once every Friday starting from the 30/01/2015 to discuss project progress in accordance to the work plan and any issues that have arisen

**Aim:** Comprehend and run image recognition on a supported platform

**Objectives:**

- Download and install VLFeat library using the MACLAB interface
  - Setup relevant directories and paths
  - Analyse the source code and outputs, record how VLFeat works using different techniques such as SIFT and MSER on the pre-set images and repositories included in the download
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**Aim:** Investigate porting image recognition techniques to mobile devices

**Objectives:**

- Research into currently available techniques when using SIFT, MSER or SURF in Java
  - Research converting MATLAB code into Java applications
  - Research methods of using VLFeat or OpenCV in Java
  - Investigate how to import java applications onto Android devices
  - Decide on the library and technique to use when porting, accounting for; code complexity, ease of converting to Java/porting to phone, run times and how much processing is needed to function
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**Aim:** Implement porting to mobile devices

**Objectives:**

- Convert library code using the chosen technique into Java, such that it may classify objects in images from the pre-downloaded repositories on a Windows or Mac computer
  - Create a basic and minimal mobile UI for the application
  - Import the Java files onto a mobile device so that it too can perform the same functionality
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**Aim:** Research and implement object classification in real time image processing

**Objectives:**

- Research how the chosen technique and library can be used to recognise objects in videos or cameras from the pre-downloaded repositories
  - Implement this technique on the Windows or Mac computer
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**Aim:** Implement object recognition using a camera from a mobile device

**Objectives:**

- Modify previous code so that it may use the phone's camera as the real time sequence of images in which to recognise objects in
- Port the code to the phone such that this functionality remains true

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**Aim:** Implement user defined object repositories

**Objectives:**

- Implement functionality to focus on a selected distinct object through a camera
  - Implement creating a new repository on command
  - Implement filling this repository with images of the focused object from a camera, accounting for images at different angles
  - Update UI to initiate adding a new object, signify when and what object is in focus and instruct how long to hold the camera at a certain angle before moving to the next
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**Aim:** Design and prototype an improved UI

**Objectives:**

- Sketch and note improvements to the current UI in order to improve ease of use, system notifications and aesthetics from a developers perspective, referring to heuristics such as Neilson's heuristics for additional guidance
  - Implement a prototype of the improved UI using Balsamiq or similar tools
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**Aim:** Testing UI prototype

**Objectives:**

- Using the Balsamiq prototype, test user responses to navigating set tasks through the UI
  - Record initial user reactions to the UI
  - In a post interview, record measurable user opinions on the improved UI's aesthetics and efficiency
  - Make any significant improvements to the prototype from user testing
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**Aim:** Implement improved UI

**Objectives:**

- Modify and add to existing UI such that it matches the prototype, hence integrating UI with the functions of the system
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**Aim:** Test the completed system

**Objectives:**

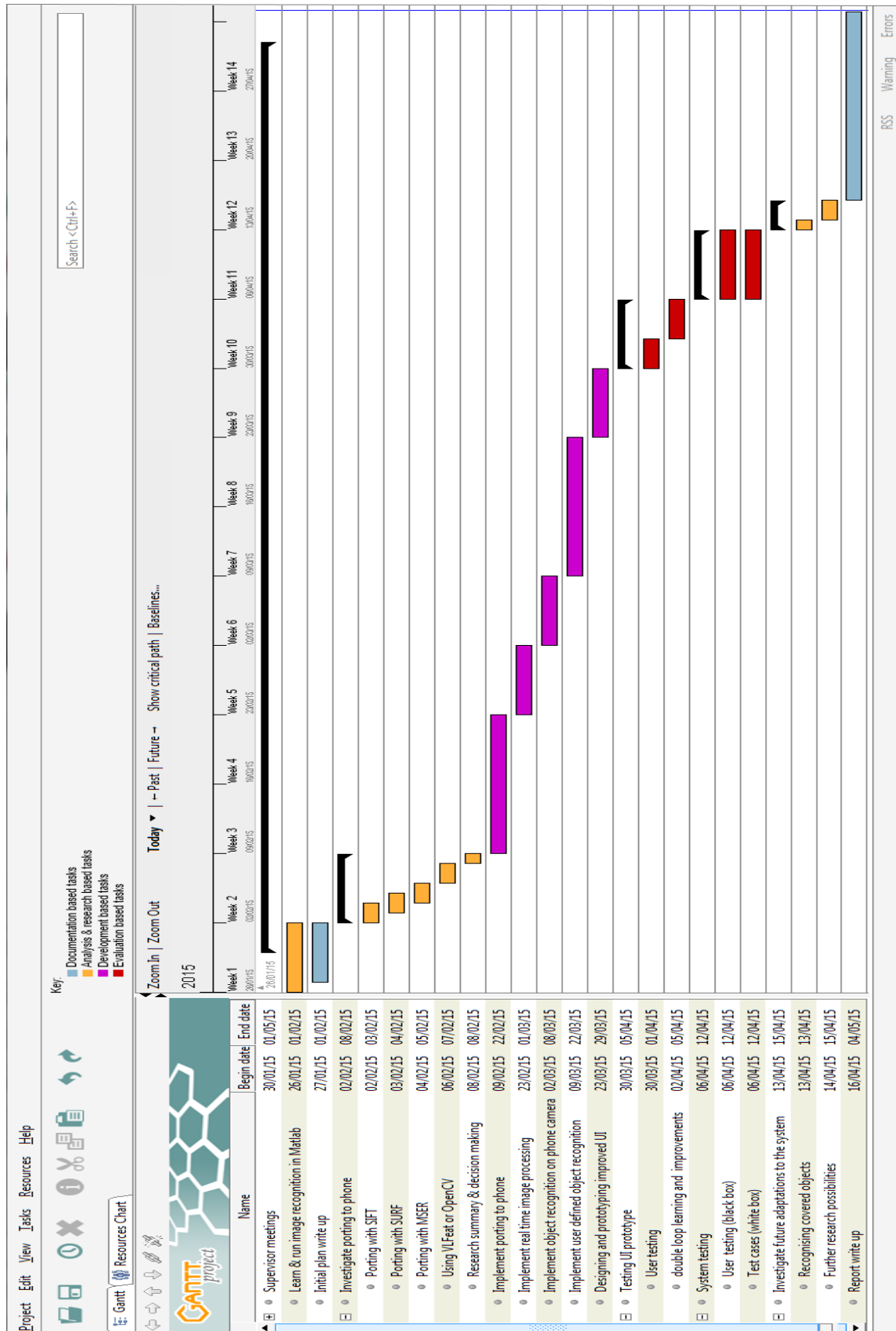
- Create use cases for each system functionality
  - Use a nominated tester to fill in the use cases, noting when steps of a function have been completed successfully and if any errors have occurred during any stage
  - Analyse use cases and record errors if necessary
  - Create a user test such that a possible user has to use the system to complete tasks under monitored conditions, with no prior knowledge of the system
  - Record any points of interest, such as errors and notable user reactions
  - Analyse results to identify potential weaknesses in the system, improve existing code if necessary or log weaknesses for future use
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**Aim:** Investigate future prospects for the system

**Objectives:**

- Research techniques or theories that may help recognise objects that are partially hidden or covered (for use in finding lost object applications)
- Research techniques to incorporate text to speech with the application, such that the system will not just highlight and show the name of the recognised object in text but also speak its name (for use in helping to identify objects for those with poorer sight)

### Work Plan: Gantt chart



**Work Plan: Final report details**

The following is a list of contents currently aimed to be included in the final report:

- . Introduction
- . Prior research: existing technologies, possible methods of implementation, research conclusions and implementation method chosen
- . System architecture and designs
- . Functionality breakdown: description of code and justification of methods or technologies used
- . UI breakdown: design choices and justifications
- . Testing the system and UI: process explanations, results and conclusions
- . Conclusion: system's ability to solve initial problem, documentation on any delivery failures with justifications
- . The future of the system: research results and possible adaptations
- . Reflection of the project processes