

MapMyNotes

Report Name	Outline Project Specification
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1 Project description

My project is called MapMyNotes and it aims to produce a web application which will allow the user to upload an image of their handwritten notes.

Lots of people still handwrite their notes often leading to ridiculous amounts of paper to search through to find their notes. Modern applications have come around such as One Note, which aid this, but people still like to write their notes.

The project aims to produce a web application to aid the digitalisation of their notes. At its very basic level, the user will interact with a web application and upload an image of their handwritten notes. It will use very simple OCR techniques (most likely from the Tesseract OCR engine) to read the title of the notes, who lectured, the module code and the time at a very basic level of the author's handwriting.

The application can be manually tagged by the user. Additionally, it will then store the notes and the metadata into a database, where a user can search for the tags for a module code and find all associated notes for that user. The database choice for the notes has not been decided, but it will need to consider binary data and metadata, so the choices of a NoSQL and SQL database needs to be considered. Once the notes have been collated they will be added to some form of calendar; OAuth with Google Calendar is a possibility but more research with this needs to be conducted.

If there is sufficient time with the project the application will give the option to do full OCR recognition on the text and produce the entire image as text. This will also incorporate extraction of diagrams and graphs from the image and conduct automatic rotation of the note prior to analysing it. Additionally, they will be able to edit the content of their note and the text associated with it. An additional stretch would be to look at analysing any user's handwriting. Finally, you should be able to link to other notes in the archive.

The methodology that the project will follow will be an adapted Extreme Programming. There needs to be investigatory work on how this can be applied to this project, but during the development stage then CRC cards could be beneficial when thinking about the design stage.

2 Proposed tasks

The following tasks are ones which should be completed on the project:

- **Investigation of how to extract handwriting from images.** This task will involve looking and investigating OCR tools such as Tesseract to see how well handwriting data can be interpreted. The tool will need to be trained for the authors handwriting so it can interpret it with a high accuracy rate.
- **Investigation into server configuration.** Look into how to host a web application with external dependencies such as Tesseract and Open CV libraries. It will also need to investigate how to store images and metadata into the database reliably as well as deciding on an appropriate library to be able to interact with these.
- **Configuration of local work environment.** Configuration of the local environment of my machines to be as similar as the server configuration would be needed to reduce the errors when deploying. Will need to set up a private repository with git, most likely with GitHub [CITE].
- **Development**
 - **Produce a front end application to input a note.** The front end features must allow a user to upload an image and see the image on the screen. They can add appropriate tags for the module code. The user can then search for the module code, and it will list all the links to the corresponding notes.

- **Back end parsing the images.** The core business logic should do basic OCR recognition of text at the top of the notes. The other logic could interact with OpenCV's libraries to extract the images from the notes. Finally, the backend module should integrate with some kind of calendar to archive the notes in a calendar for someones use.
- **Produce a list of constraints that the notes must follow.** As notes are varying from person to person, then a constraint should be attached to the notes to ensure the notes follow a similar format. This should be a small set of rules that can be added to the application which represent a structure for a given upload on the notes.
- **Investigation of how to extract diagrams and graphs from images.** There will be research conducted to identify an efficient way to identify images, graphs and diagrams from an image given the user has followed a set of constraints. If they have followed a set of constraints then they should be able to extract an image into the application.
- **Continuous project meetings and diaries.** The project will consist of weekly meetings with the supervisor. There shall be one group meeting and another individual meeting to show and share concerns and progress. A weekly diary will be kept to keep track of how the project is progressing and will be referenced to in the end report.
- **Preparation for the demonstrations.** The project will consist of a mid project demonstration and an end demonstration. The mid project demonstration will need to be prepared to show minimal character recognition of notes and the ability to upload a note. The final project demonstration should show the ability to search for a note by tagging it and uploading it to a calendar.

3 Project deliverables

The following are deliverables which are expected to be completed on the project:

- **The MapMyNotes software.** There should be a web application which at the minimum will take an image and save it to the database and input it into a calendar. This should be well tested and well structured with appropriate comments where necessary.
- **A collection of user acceptance and model tests.** Due to this being a web application then user acceptance and integration tests should be provided for all the front end applications. Additionally, the models which control the logic should also be provided in the testing sections.
- **Story Card, CRC cards, burndown charts and backlog items.** As the author intends to use an Extreme Programming methodology for their project, then providing CRC cards and story cards would be useful for the Final report deliverable to show how they accomplished the design phase. Additionally, burndown charts show progress and how well estimations have got over the 15 week period. Backlog items could also be aided in discussion of what could be achieved if we had more time.
- **A series of training data.** The OCR will need be learned on at least the authors handwriting so training data will need to be provided to show how the OCR tool has been trained to recognise handwriting for the application.
- **Mid-project Demonstration.** There will be a mid project demonstration which should show current progress on the project.

- **Final report** - The report will discuss the work that has been carried out, the process that I have followed any libraries or frameworks which have been used throughout the project. It will discuss the project, the design undertaken and evaluating the end outcome and any changes that would be made.
- **Final Demonstration** - The demonstration has been added as it is a milestone in the application and should be considered when identifying work to complete.

Annotated Bibliography

- [1] R. Agarwal and D. Umphress, "Extreme Programming for a Single Person Team," in *Proceedings of the 46th Annual Southeast Regional Conference on XX*, ser. ACM-SE 46. New York, NY, USA: ACM, 2008, pp. 82–87. [Online]. Available: <http://dx.doi.org/10.1145/1593105.1593127>

This paper was useful on how Extreme Programming can be modified to a single person project. It provided thought on the methodology which should be undertaken on the project and how different aspects of Extreme Programming can be used.

- [2] L. A. Fletcher and R. Kasturi, "A robust algorithm for text string separation from mixed text/graphics images," *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, vol. 10, no. 6, pp. 910–918, Nov. 1988. [Online]. Available: <http://dx.doi.org/10.1109/34.9112>

This paper was not as useful as I first thought it would be. I soon realised I would not be needing to extract the text from an diagram in the image, instead the image as a whole. This paper may be revisited if I was to filter out the text, though.

- [3] B. M. Gonzalez, "Iris : a solution for executing handwritten code," Master's thesis, University of Agder, 2012. [Online]. Available: <http://brage.bibsys.no/xmlui/handle/11250/137557>

This thesis was a great reference material for handwriting recognition. The used the Tesseract OCR engine to analyse human handwriting and convert the code written on the paper to the actual output. The most interesting part of this thesis, for me, was when the author described the training process for handwriting recognition, which I will look to follow a similar approach.

- [4] C. Patel, A. Patel, and D. Patel, "Optical Character Recognition by Open source OCR Tool Tesseract: A Case Study," *International Journal of Computer Applications*, vol. 55, no. 10, pp. 50–56, Oct. 2012. [Online]. Available: <http://dx.doi.org/10.5120/8794-2784>

This paper analyses how Tesseract compares to other commercially available OCR software. Although this paper doesn't complete the study on handwriting data it was useful to see the comparisons and the accuracy and success of Tesseract compared to other tools.

- [5] S. Rakshit and S. Basu, "Recognition of Handwritten Roman Script Using Tesseract Open source OCR Engine," Mar. 2010. [Online]. Available: <http://arxiv.org/abs/1003.5891>

This paper covers how the Tesseract OCR engine was able to indentify Roman handwriting from scripts. Although this uses an older version of the Tesseract engine, it was useful to know that the Tesseract engine can be used on human handwriting recognition as well as yielding a fairly high accuracy.

- [6] Y. P. Zhou and C. L. Tan, "Hough technique for bar charts detection and recognition in document images," in *Image Processing, 2000. Proceedings. 2000 International Conference on*, vol. 2. IEEE, 2000, pp. 605–608 vol.2. [Online]. Available: <http://dx.doi.org/10.1109/icip.2000.899506>

The paper provided a useful and key algorithm in detecting bar charts in images. The paper was interesting as it used a modified Hough transform to group together the collection of lines and bar charts to extract the diagrams from the images. It also showed a way in which I could potentially do this in my application.