

Welcome Page

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University of Wales Trinity Saint David



Assignment 1: Innovation & Research

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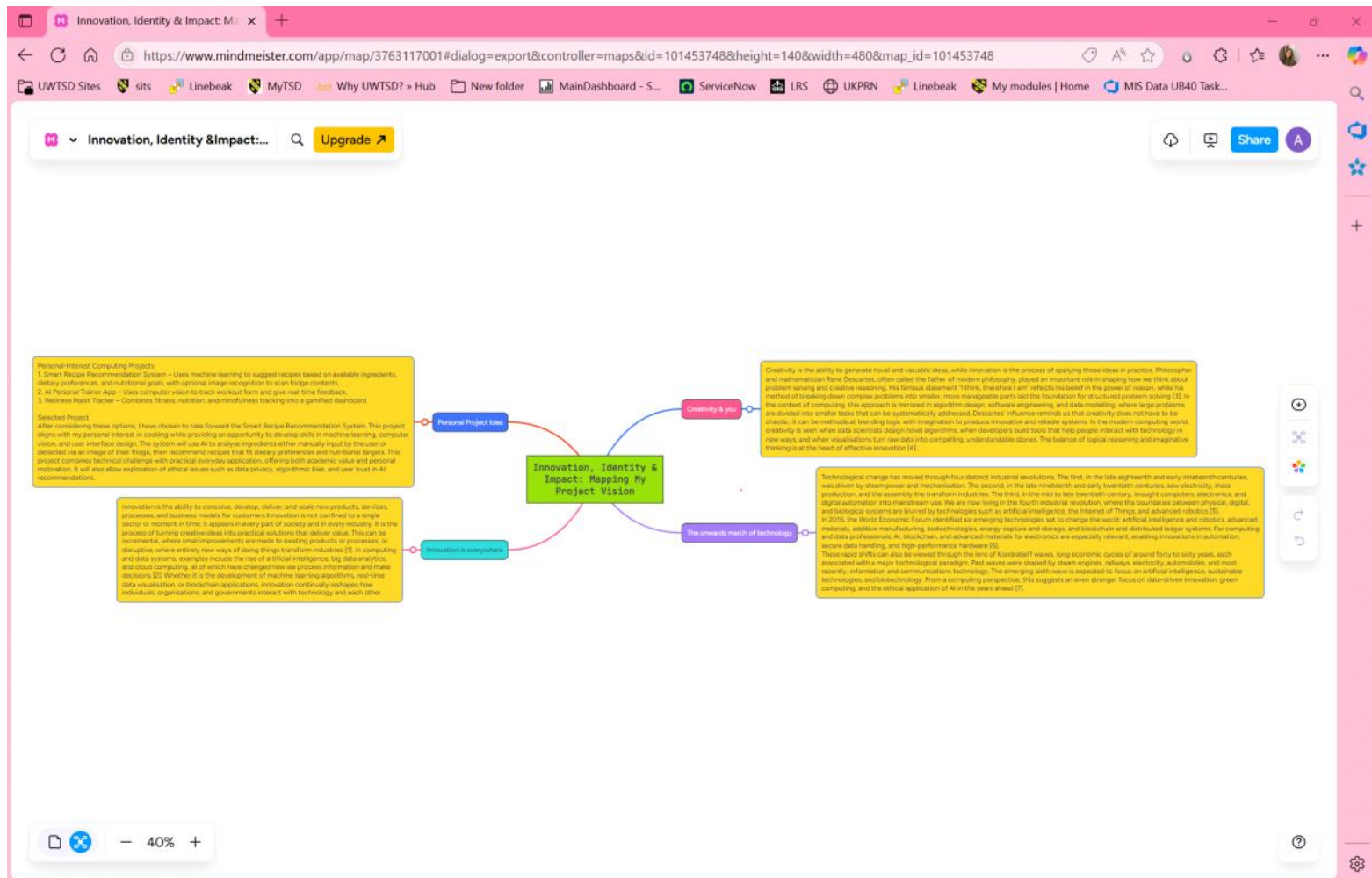
Student Number: 2237650

Module: ACCA5033 – Computing, Data & Information Systems

A Smart Recipe Recommendation System Project Proposal

Mind Map

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Reference List

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Task 2: Aim, Objectives & Research Area

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Q1: Aim and Objectives

The aim of this project is to design and develop a smart recipe recommendation system that uses machine learning and image recognition to suggest personalised recipes based on ingredients available at home, dietary preferences and nutritional goals. The system will provide users with tailored cooking suggestions through a user-friendly interface, enhancing convenience, reducing food waste and supporting healthier eating habits.

To achieve this aim, the following objectives are proposed:

1. Investigate existing recipe recommendation systems, their algorithms and limitations, with a focus on machine learning and image recognition techniques.
2. Collect and prepare a dataset of recipes, ingredients, nutritional values and labelled fridge or food cupboard images for training and testing the model.
3. Develop a computer vision module capable of identifying ingredients from images with high accuracy.
4. Implement a recommendation engine that matches detected or manually entered ingredients to recipes while considering dietary preferences and nutritional requirements.
5. Design and evaluate a user interface that presents personalised recipe suggestions in an intuitive and accessible way.
6. Test and validate the system's accuracy, usability and performance through user trials and feedback.

Q2: Appropriate Research Philosophy

This project will adopt a pragmatist research philosophy, as the focus is on applying the most effective methods to address a practical, real-world problem. Pragmatism does not commit to a single philosophical stance but instead values approaches that best solve the problem at hand [1].

From an epistemological perspective, the project will take a practical, problem-solving approach that acknowledges multiple ways of generating knowledge [2]. It will recognise that both quantitative and qualitative data can provide valid insights, and that the best understanding emerges from integrating empirical evidence with user perspectives. In this context, knowledge is viewed as something that is constructed through the interaction between technical performance data and user experiences, rather than being fixed or absolute.

The research will therefore combine quantitative methods such as accuracy testing of ingredient recognition and evaluation of recommendation precision with qualitative feedback from user trials on usability and satisfaction. For example, while model accuracy is essential, understanding whether users trust and enjoy the recipe suggestions is equally important. This philosophical and epistemological alignment supports the dual goals of technological performance and positive user experience, ensuring the final system is both functional and desirable [2].

Q3: Search Tools, Databases and Strategies

To ensure the system is grounded in the latest research, a range of academic databases, grey literature sources and strategic search techniques will be used.

Databases – accessible through my UK university account:

- **IEEE Xplore:** peer-reviewed papers on computer vision, machine learning models and AI-based recommendation engines.[3]
- **ACM Digital Library:** conference proceedings and technical case studies on recommender systems.[3]
- **ScienceDirect:** journal articles on AI in food technology, nutritional science and human–computer interaction.[3]
- **Google Scholar:** cross-disciplinary literature, including open-access studies on dietary and

nutrition-based AI applications.

Grey Literature Sources – freely accessible in the UK:

- **GitHub:** open-source projects related to recipe recommendation and food image recognition. [4]
- **Industry Blogs and Reports:** such as Google AI and NVIDIA, showcasing innovative applications in visual recognition and recommendation.

Search Strategies will include:

- Keyword-based searching, for example “recipe recommendation system”, “machine learning food recognition”, “computer vision ingredient detection”, “AI personalised nutrition”.
- Boolean operators, for example (“recipe recommendation” AND “machine learning”) OR (“ingredient recognition” AND “computer vision”).
- Citation chaining, reviewing references from key papers and tracking later studies citing them.
- Date filtering, focusing on research from the past five years to ensure up-to-date methods are used.

By combining peer-reviewed academic sources accessed through my university account with freely available grey literature, the project will remain both academically rigorous and practically relevant. This dual approach is consistent with the pragmatist philosophy, ensuring the final system reflects the latest innovations in AI-driven recommendation systems.

Conclusion

By adopting a pragmatist philosophy and leveraging both university-access academic databases and openly available research sources, this project will be informed by robust theoretical and practical insights. The Smart Recipe Recommendation System aims not only to demonstrate technical proficiency in AI and computer vision but also to provide tangible benefits to everyday users. The outlined objectives will bridge the gap between advanced computing technologies and real-world culinary experiences, creating a tool that supports convenience, sustainability and healthy eating.

References

- [1] “Pragmatism Research Philosophy,” *Research-Methodology*, 2025. [Online]. Available: <https://research-methodology.net/research-philosophy/pragmatism-research-philosophy/>. [Accessed: 14-Aug-2025].
- [2] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. Thousand Oaks, CA, USA: Sage Publications, 2017.
- [3] “Welch Medical Library Guides: Expert Searching – Which Databases to Use,” *Johns Hopkins University*, 2025. [Online]. Available: <https://browse.welch.jhmi.edu/searching/databases-by-subject>. [Accessed: 14-Aug-2025].
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Task 3: Research Strategies

Q1: Validity, Reliability, Generalisability, and Ethical Considerations

Ensuring validity means the Smart Recipe Recommendation System must accurately deliver relevant, personalised and feasible recipe suggestions. To strengthen content validity, recipe datasets will be drawn from reputable sources such as WHO healthy eating guidelines [1] and verified nutrition databases. Construct validity will be supported by using well-defined dietary categories (e.g., vegetarian, vegan, gluten-free) consistent with recognised UK nutritional frameworks.

Reliability will be addressed by maintaining consistent model training and evaluation pipelines. For example, the image recognition module will be tested repeatedly on the same labelled dataset, while automated unit testing and version control will prevent accidental code drift. A potential limitation is that retraining the model on new data could affect reproducibility; this will be mitigated by fixing random seeds and storing configuration files for replication [3].

Generalisability is critical since users will have diverse dietary backgrounds. To achieve this, datasets will include a wide range of ingredients and cuisines, and testing will involve participants with different cultural and dietary preferences [3]. A risk here is that certain groups may still be underrepresented; this will be addressed by deliberately sourcing balanced datasets and piloting with varied users.

Ethical considerations are central to UK-based projects. Under the UK GDPR, user data must be collected with explicit consent, minimised to what is necessary, anonymised where possible, and securely stored [2]. The system will follow ICO guidelines on AI and data protection, ensuring lawful processing of sensitive data. Bias in AI models will be mitigated by balancing training datasets and allowing users to exclude allergens or unwanted ingredients. Transparency will also be prioritised by providing users with plain-language explanations of how recommendations are generated [2].

Q2: Research Strategies, Data Collection, and Pilot Study Design

A mixed-methods research strategy will be adopted to capture both technical performance and user perspectives [3].

- **Quantitative data:** Controlled experiments will test ingredient recognition accuracy (precision, recall, F1-score), recommendation success rate, and processing speed.
- **Qualitative data:** Interviews and surveys will capture user satisfaction, ease of use, and suggestions for improvement [4].

Data Collection Methods:

- Image datasets: Participants will provide labelled photographs of fridge/cupboard contents for ML model training.
- Surveys: Gather data on dietary restrictions, cooking habits, and feature preferences.
- User testing: Participants interact with the prototype and provide structured feedback.

Pilot Study:

A small group (5–10 participants) will trial the prototype by uploading ingredient photos, receiving recipe suggestions, and completing a short survey. Feedback will highlight usability issues (e.g., if ingredient detection misses items) and inform refinements before scaling.

(See Appendix B for pilot survey template.)

Q3: Quantitative and Qualitative Analysis Approaches

Quantitative analysis will assess technical performance and user trends. For example:

- Confusion matrices can visualise how well the model recognises ingredients [3].
- Bar charts can compare accuracy rates across different food categories (e.g., fruits vs grains).
- Line charts can track system accuracy improvements across development iterations.

Descriptive statistics (mean, median, standard deviation) will summarise survey data, while inferential tests (paired t-tests) will assess improvements between versions.

Qualitative analysis will apply thematic coding to interview responses, grouping comments into categories such as “ease of use”, “accuracy of recognition”, and “recipe variety” [4]. Data visualisation tools like word clouds can highlight frequently mentioned themes.

Integrating both approaches ensures a well-rounded evaluation: quantitative methods verify technical robustness, while qualitative insights capture real-world usability. Together, they strengthen the project’s reliability, user-centred design, and alignment with practical needs.

References

[1] World Health Organization (WHO). *Healthy Diet Factsheet*. WHO, 2023. [Online]. Available: <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>

[2] Information Commissioner’s Office (ICO). *Guidance on AI and Data Protection*. ICO, 2023. [Online]. Available: <https://ico.org.uk/for-organisations/uk-gdpr-guidance-and-resources/artificial-intelligence/guidance-on-ai-and-data-protection/>

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[4] V. Braun and V. Clarke, “Using thematic analysis in psychology,” *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, 2006.

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✔ You have completed Section 3!

After completing this section, you should

- Think of yourself as someone capable of being creative (if you don't already)
- Identify personal passions as sources for idea generation.

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Unit 1 topic 2
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✔ Unit 1 Topic 2 completed!

You should now:

- recognise the link between creativity and feelings of wellbeing and understand how to strengthen that link in your own life;
- define your research philosophy using the new terms Ontology, Epistemology and Axiology and understand how these philosophies can impact your investigation;
- define your research philosophy as one of five constructs.

If you have taken notes using the in-built notebook, you can now export them.

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Unit 4 topic 1

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✓ Unit 4 Topic 1 completed!

You should now:

- Be able to imply a numerical precision to arguments in a casual way that brings a lack of precision to our work.
- Be able to analyse data using different examples of graphs and charts and present data using a variety of methods.
- Have a deeper understanding of creating charts that communicate in the best way possible.

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Unit 2 topic 2

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✓ Unit 2 Topic 2 completed!

You should now:

- Be familiar with different methods for collecting and analysing qualitative data including data sampling.
- Be able to consider how the acquisition of your data will impact your research.
- Understand your approach to collecting data for your research.

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Appendix A: Pilot Study Design and Feedback Form

Pilot Study Overview

Purpose

The pilot study aims to test an early prototype of the Smart Recipe Recommendation System to assess ingredient recognition accuracy, relevance of recipe suggestions, and user satisfaction. The findings will inform design refinements before a larger-scale trial.

Participants

A small convenience sample of 5-10 participants will be recruited from friends, family, and classmates. Participants will have varied cooking habits and dietary preferences to ensure diverse feedback.

Procedure

1. Onboarding - Participants receive a short introduction to the system, including its intended purpose and how to use it.

2. Ingredient Input - Participants take one or more photos of their fridge/Cupboard contents using their phone and upload them to the prototype system.

3. Recipe Suggestions - The system processes the images, identifies ingredients, and generates a set of 3-5 recipe suggestions.

4. User Feedback - Participants complete a short feedback form evaluating:

- Accuracy of ingredient recognition

- Relevance of recipe suggestions

- Ease of use and interface clarity

- Suggestions for improvement.

Data Collected

- Quantitative: Accuracy scores for ingredient recognition, user ratings for recipe relevance (scale of 1-5), time taken to generate suggestions.

- Qualitative: Open-ended feedback on usability, missing features, and recipe variety.

Ethics & Consent

All participants will provide informed consent. No personally identifiable information will be stored. Photos will be anonymised and deleted after analysis to comply with GDPR.

Pilot Study Feedback Form

Section 1 - Basic Information

Date: _____

Participant ID: _____

Dietary preference:

☐ Omnivore ☐ Vegetarian ☐ Vegan ☐ Other: _____

Section 2 - Quantitative Ratings

(Please rate each from 1 = Poor to 5 = Excellent)

1. Accuracy of ingredient recognition: ☐1 ☐2 ☐3 ☐4 ☐5

2. Relevance of recipe suggestions: ☐1 ☐2 ☐3 ☐4 ☐5

3. Ease of using the interface: ☐1 ☐2 ☐3 ☐4 ☐5

4. Variety of recipe suggestions: ☐1 ☐2 ☐3 ☐4 ☐5

5. Speed of recipe generation: ☐1 ☐2 ☐3 ☐4 ☐5

Section 3 - Open-ended Questions

Which feature did you find most useful and why?

Were there any ingredients missed or incorrectly identified?

How could the recipe suggestions be made more relevant to your needs?

Any additional features you would like to see?

Section 4 - Consent

☐ I consent to my anonymised responses being used for research purposes in this project.

Signature: _____ Date: _____

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