Initial Plan: IOT Data Trading User Study Platform

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CM3203: One Semester Individual Project - 40 Credits

Project Description

The Internet of Things (IoT) describes the network of physical objects embedded with sensors, software and other technologies these objects now have the ability to communicate over a network without needing human-to-human or human-to-computer interaction (Rosencrance 2019). There are many IoT solutions such as wearables, contactless cards or animal trackers. These solutions all store data independently, however, a significant amount of knowledge can be gained by analysing these stores together hence improving our lives through increased consumer knowledge, reduced resource wastage etc. By giving a user the ability to trade data about themselves they could gain the benefit of having greater control over their data and rewards for sharing that data (i.e. monetary, loyalty points, gifts etc) in turn organisations gain the benefit of an increased number of different data points so they can understand users better, have a better idea of where to invest and make more informed product or services decisions (Charith 2017).

However, there is a conflict between what types of data an organisation may want and what data a user may be willing to give up and equally what types of organisation they may be willing to share this data with. Therefore, there needs to be some understanding between an organisation and user about what kind of benefit a user would need to see for a certain piece of data i.e. the sidedness of the trade.

The project is based on developing an application where people can create user studies to understand the willingness of their users to trade different types of data collected by IoT devices. The application then allows users to participate in the study in a simple and interactive way (for diagram explaining exemplar user study see appendix 1). The project also involves taking the response data and creating tools which enable people to be able to analyse the data from those who have participated in the study in a meaningful way giving organisations an insight on what types of data users would be willing to trade.

Project Aims and Objectives

Aims

Develop an application which allows people to create user studies about IoT data trading and allow people to participate in those studies in a simple, self explanatory manner (for diagram explaining exemplar user study see appendix 1). The application will then represent the data from studies to the creators of the studies for the purpose of understanding how the participants wish their data to be traded

Objectives

- Research
  - Research of existing solutions design and implementation.
  - Find technologies which would be applicable to given requirements of the project.
  - Learning of required technologies to implement application.
- Gather requirements of application
  - Create both functional and non-functional requirements of the application.
- Design UI of application
  - Create user personas of the application and use cases of the application.
  - Create state transition networks of the application.
- Implement the application
  - Create backend of the application that fits the requirements of the application (see main feature objectives below).
  - Create front-end of the application which aids the usability of the application & fits the requirements of the application.
- Test application
  - Test physical application based upon different measures such as whether it meets the requirements, it's performance under load, it's compatibility with different devices and it's security.
  - Test the usability of the application using user based evaluation.
- Evaluate the application
  - Evaluate the application based upon outcomes of the physical tests above.
  - Evaluate the application based upon the user based evaluation.

Main Feature Objectives

Features and constraints needed in order to meet the objectives of the software include but are not limited to:

- Allow any admin to create any number of user studies, for each user study creating 2 sets of "cards" to specify the different types of data and organisations, a measure of each set of cards by which a user must rank and the number and types of field the user must fill out for each intersection of the two sets of cards (for diagram explaining exemplar user study see appendix 1).
- Allow an admin to create & add users to a study.
- Give an authenticated study participant the ability rank the cards in order depending on the measure used and fill out fields pertaining to their ranking in an interactive way (for diagram explaining exemplar user study see appendix 1).
- Allow an admin of a study to analyse responses to their studies using visualisations such as graphs and tables that allow meaningful interpretation of data given the measures provided in that specific user study.

- Allow an admin to retrieve their study data using some common standards to request, send, encode data or to download data in some common format so they are then able to process the data themselves.

- Ensure study data and the study itself can only be accessed by those permitted to and cannot be modified by anybody.
- Ensure application is easy to use for both admin and user study participants.
- Ensure applications can be used across many platforms.
- Ensure data is presented in a meaningful way depending on the measures used.
- Ensure data can be exported in a universal representation which can be used and interpreted by other applications.
- Ensure application is secure from any unauthorised access, modification or action.

Work Plan

Week 1 (27/1/20-2/2/20)
- Research surrounding the topic of IoT and data trading.
- Write up project description, project aims and objectives, work plan and risk assessment for initial plan.
- Complete initial plan.

Deliverable: Initial Plan (3/2/20)

Week 2 (3/2/20-9/2/20)
- Research of existing solutions design and implementation.
- Research and write up of functional and non-functional requirements.
- Write up the personas of users of the application.
- Write up of use cases of application.
- Research and select technologies applicable for application given the requirements.
- Complete development course(s) necessary relevant to the selected technologies.

Milestone: Research completed on the technology needed to implement application.
Milestone: Development course(s) completed on the respective technology.

Week 3 (10/2/20-16/2/20)
- Creation of state transition networks for user interface.
- Complete research integrity module for user research on SIMS.
- Development of the admin functionality of creation of user studies & associated front-end.
- Testing of the developed functionality.

Week 4 (17/2/20-23/2/20)

- Review meeting 1 of current state of development, adjusting already completed development and future development as appropriate.
- Creation of participant information form and consent form for ethics approval.
- Submit documentation for ethics approval.
- Development of user participation in studies: authentication of users, ranking of cards interactively & associated front-end.
- Testing of developed functionality.

Week 5 (24/2/20-1/3/20)

- Creation of tools for admin to analyse responses to the studies either through visualisation on application or access of raw data & associated front-end.
- Testing of developed functionality.

Week 6 (2/3/20-8/3/20)

- Functionality testing against test cases to check requirements have been met.
- Compatibility testing of application on different platforms.
- Security testing of application.

Week 7 (9/3/20-15/3/20)

- Load testing of application to test responsiveness and correctness of application.
- Perform modifications to application where necessary to improve application after testing.
- Perform experiments on the performance of the application under different loads for use in evaluation of project.

Week 8 (16/3/20-22/3/20)

- Review meeting 2 to review final elements of implementation, testing and upcoming data collection & make adjustments to application/testing/ study where needed.

- Perform experiments measuring the security, compatibility and functionality of application.
- Preparation for and begin data collection on users responses to an example study.
- Preparation for and begin user interface research.

Week 9 (23/3/20-29/3/20)

- Finish data collection on users responses to an example study.
- Finish user interface research and interpret results.

Week 10 (30/3/20-5/4/20) (Easter)

- Writeup of introduction & background of report.
- Description of static architecture of application.
- Justification of the design of the application given the constraints.
- Description of any intermediate states of application.

Week 11(6/4/20-12/4/20) (Easter)

- Writeup of implementation of application,
    - choosing critical parts of the application to describe
    - Discussion of problems encountered when implementing application
- Writeup of results and evaluation judging how well the application performs under use, whether it meets all the requirements, it's compatibility, security of the application and a justification of these tests.

Week 12 (13/4/20-19/4/20) (Easter)

- Writeup of future work, expressing what could be done beyond what I have achieved.
- Writeup of conclusions of main findings.
- Writeup of reflection on learning.

Week 13 (20/4/20-26/4/20)

- Collation of all support material for each section.
- Final checking of report contents, structure, spelling, grammar, correct support material.
- Create screen capture video explaining and walking through main features in application.
- Create screen capture video explaining application source code included in the deliverable to aid understanding.

Week 14 (27/4/20-3/5/20)

Week 15 (4/5/20-10/5/20)

Deliverable: Final Report (7/5/20)
Deliverable: application source code. (7/5/20)
Deliverable: video explaining source code. (7/5/20)
Deliverable: video explaining functionality of application (7/5/20)

Ethics

I will be collecting data from students through my application and conducting user interface research in order to evaluate my application. Therefore I will need to ascertain ethics approval from the university. I have factored this into my time plan, giving me enough time to obtain approval before any research takes place.

Risk Management

Risk	Worst Case Scenario	Likelihood	Impact	Strategies to minimise disruption
Incomplete Project	Submission with major omissions in the deliverables of the project	Low	Large	1. Regular meetings with supervisor to check progress. 2. Follow the work plan closely to meet deadlines. 3. Adapt work plan to meet changing requirements.
Project data loss	All/ large amount of data for the development and/ or report is lost by being overwritten or deleted	Low	Large	1. For development use versioning software i.e. GitHub to ensure software can be rolled back in the event of mistake to the latest working version. 2. Use cloud storage solutions when doing any work to ensure work is regularly backed up and

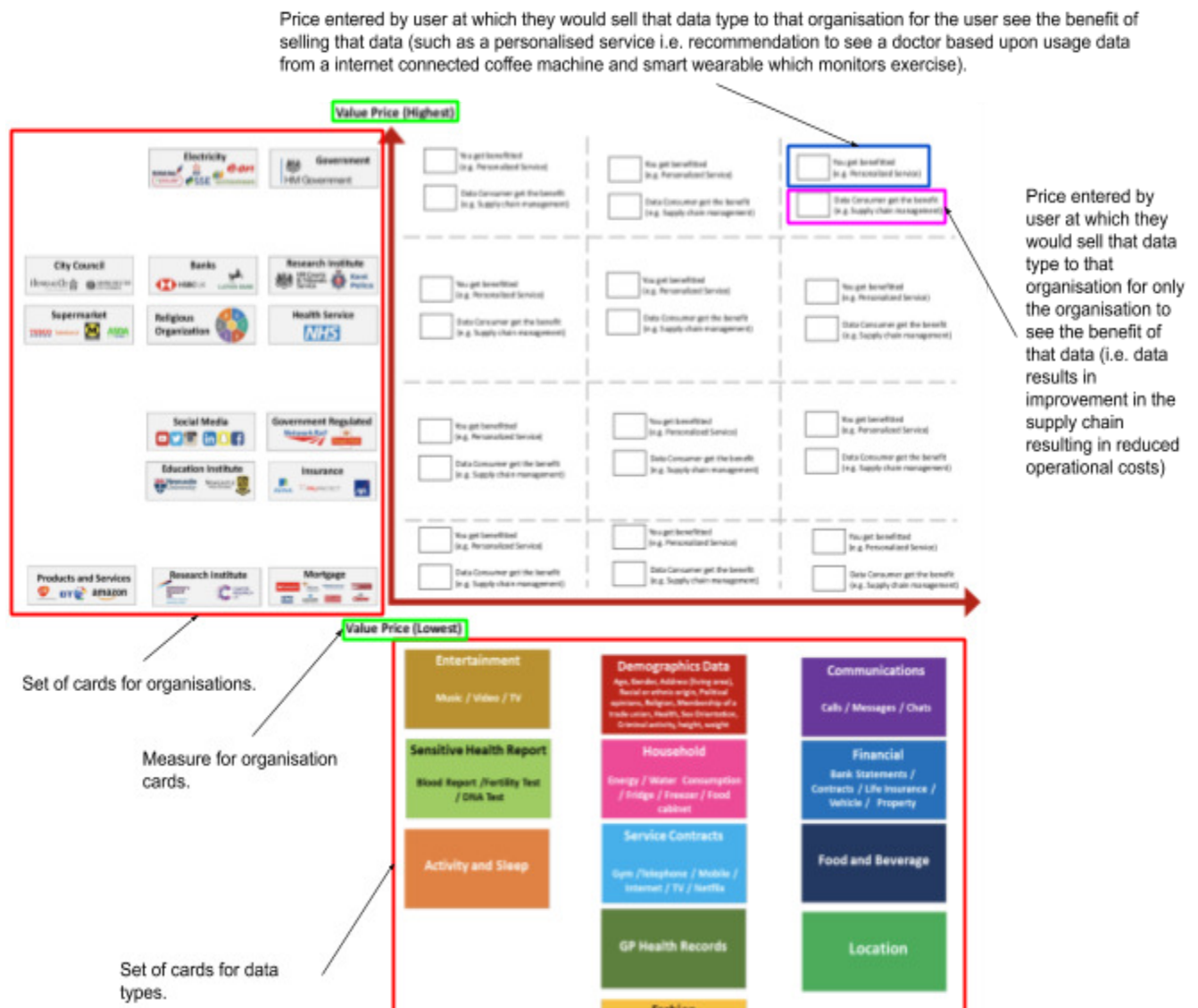|				
				previous versions are retrievable in the event of accidental deletion or corruption. 3. Save project regularly.
Illness/ Unexpected circumstances	Results in delays to the research/implementation/ report, having an incomplete report by the final report deadline	Low	Medium	1. Significant buffers have been left near easter and at the end of report to account for unexpected circumstances to allow for feasible changes in the work plan. 2. Follow extenuating circumstances procedure if necessary.
Insufficient user participation in data collection or user interface research	A minimal set of participants means results cannot be relied upon in report for true evaluation of application	Medium	Medium	1. Ensure that a surplus of users are contacted to participate in study. 2. Follow up on participants who have not yet completed tasks.

Appendix 1

Figure 1: User study ranking example (Adapted from Charith, P. 2020)

References

Charith, P. 2017. *Sensing as a Service (S2aaS): Buying and Selling IoT Data.* Available at: https://arxiv.org/pdf/1702.02380.pdf [Accessed: 2 February 2020]

Rosencrance, L. et al. 2019. *internet of things (IoT)*. Available at:https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT [Accessed: 2 February 2020]