UNIVERSITY OF CAMBRIDGE

Report on the Product Design Assignment

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1 INTRODUCTION

The task was set to identify a specific problem with a mode of public transport and to devise a way to improve this situation by designing or redesigning a product, system or service.

The problem that was identified was relating to the fact that commuters will often miss their train due to not leaving to walk to the station on time as they do not correctly judge how long it will take to get there.

The solution was to design and build an android app that would determine the train that the commuter would catch and then notify the commuter of an appropriate time to leave their location in order to arrive at the station in time for their train.

An additional feature that was developed into the application was a live map display of the current locations of trains in the UK.

2 Problem Identification

The initial task in the design process was to identify a suitable problem with a mode of public transport. To accomplish this, the problem space was widened and abstracted in order to allow for a range of problems to be made present. Below are listed a number of problems that were considered to be solved:

- Train related problems
  - Train stops at many stops before your required stop, even if no passengers enter/leave the train
  - Many journeys have the same fare, despite them being different distances
  - Trains can only take you to locations where a station is available
  - Some trains run with very few passengers
  - Other trains run over capacity
  - Trains run slowly around tight corners
  - Many commuters miss their train and must either catch a later train or forfeit their fare
  - Tickets are not always checked on the train for validity
  - Trains require a large number of staff to operate
- Bus related problems
  - Buses experience traffic
  - Buses that have a low demand have very high fares

3 Task Clarification

The problem that was selected was that commuters often miss their trains and thus will be late to arrive at their destination and can sometimes have to pay more for a later train.

The need for a solution to this problem is great as it causes for the trains that are missed to be under capacity and for the trains that are caught late are over capacity. It also means that commuters can be late to arrive to their destination and spend additional money on fares unnecersarily.

This problem was abstracted in order to cause for the widest range of possible solutions to be discovered and explored. After this abstraction process, the problem statement was as follows:

Devise a way to reduce the number of people who miss their train during a commute

Then, in order to realise the solution, a requirements list was drawn up:

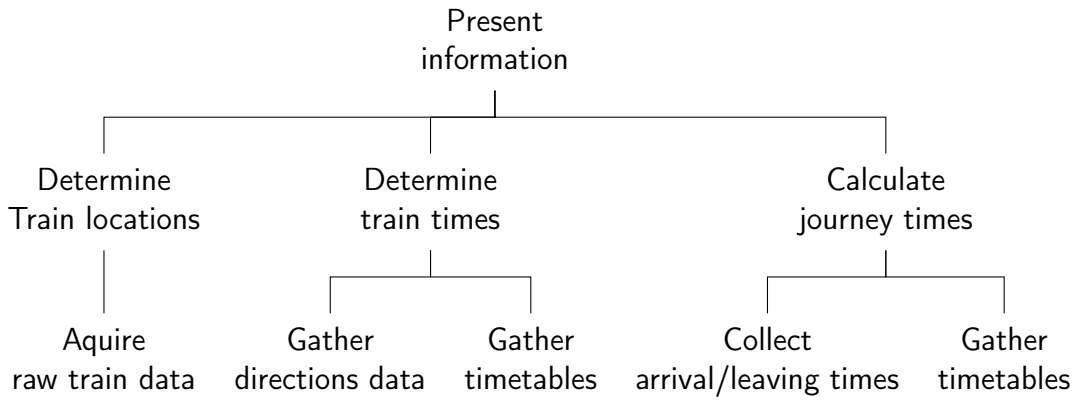
[Key: D/W = Demand/Wish; Wt = Weight (wish importance) between 1 and 3]

D/W	Wt	Requirements	Keyword
		Functionality	
D		The system must determine train operating times	Timings
D		The system must determine live train locations	Locations
D		The system must determine User location and destination	Directions
D		The system must determine required train for journey	Journey
D		The system must calculate an appropriate time for the user to travel to station	Leaving
W	3	The system sets an alarm for when the user should begin journey	Alarm
W	2	The user can select trains on live map and get details of selected train	Details
W	2	The user can review directions for their selected journey	Review
		Efficiency	
D		The system must minimise calls to data APIs thus minimising required bandwidth	Bandwidth
D		The system must minimise calculations on device	Battery
W	3	The device should store minimal information	Size
W	2	The device should make minimal API calls that are general/uniform	API
		Useablilty	
D		The application must have minimal bugs so as to minimise crashes	Bugs
W	3	The user should make as few interactions as possible to recieve the required response	Interaction
W	2	The system should be user-friendly and clear to navigate	Navigation
W	1	The system should be intergrated with other systems to provide a seamless operation experience (e.g Google directions/maps intergration)	Integration
		Aesthetics	
W	2	The application should have a clean and user-friendly design	Design
W	1	The application design should follow Google Material Design requirements	Material
		Timescales	
D		Product and work deadline: 25 April 2017	Work
D		Presentation date: 26 April 2017	Presentation

4 Conceptual Design

In order to begin designing a concept to solve the problem, the overall function of the solution must be determined. The overall function of the solution must be to provide the user with useful information and notification of train locations with respect to them in order for them to have the best chance of avoiding missing their train.

This overall function was then decomposed into smaller sub-functions as detailed below:



Next, solution priciples were determined and combinations of these principles were identified:

Function	**Solution Priciples**			
Present information	Graphically	As Text	On a map layout	Spoken
Aquire raw train data	From GPS devices on trains	From public APIs		
Gather Directions data	Design bespoke directions system	Use Google directions API		
Gather Timetables	Use Public Rail API			
Collect Arrival/Leaving Times	Request user input			
Determine Train Locations	Translate GPS data into latitude longitude	Analyse data from API		

Three combinations concepts were identified:

Function	**Combnation**		
	Combination 1	Combination 2	Combination 3
Present information	As Text	On a map layout	Spoken
Aquire raw train data	From public APIs	From public APIs	From GPS devices on trains
Gather Directions data	Use Google directions API	Use Google directions API	Design bespoke directions system
Gather Timetables	Use Public Rail API	Use Public Rail API	Use Public Rail API
Collect Arrival/Leaving Times	Request user input	Request user input	Request user input
Determine Train Locations	Analyse data from API	Analyse data from API	Translate GPS data into latitude longitude

To identify the best solution, a concept evaluation was set up:

		Concept 1		Concept 2		Concept 3	
Criteria	Wt.	value	score	value	score	value	score
Alarm	3	-	-	0	0	+2	+6
Details	2	-	-	+2	+4	-2	-4
Review	2	-	-	+1	+2	-1	- 2
Size	3	-	-	-2	-6	-2	-6
API	2	-	-	-1	-2	0	0
Interaction	3	-	-	+2	+6	+2	+6
Navigation	2	-	-	+1	+2	+2	+4
Integration	1	-	-	+1	+1	-2	-2
Design	2	-	-	+2	+4	+2	+4
Material	1	-	-	0	0	0	0
total score			0		+11		+6

Thus, the chosen concept was concept 2.

5 Embodiment Design

5.1 Redundancy

This system will be built to function under the circumstances of sub-system failure. It will be capable of this by causing the sub-systems to be built upon the primary functionality. That primary functionality will be the system's ability to aquire appropriate direction data from the Google directions API. Any sub-system failure, such as the map view or the live train data capture, will not cause the directions API to fail. This will be achieved by coding the sub-systems as proprietary, with the base function able to operate without the sub-systems being available.

5.2 Tolerance

This system will be highly tolerant to unexpected or uncertain situations by the implementation of appropriate input analysis. This will revolve around a well structured user and API data input flow that is based on the principals of GIGO (Garbage In Garbage Out). This mean that the input flow will be properly designed to identify usefull and properly structured data coming in and to disregaurd data that is innapropriate. If the user input is innapropriate, the system will warn the user of the fact and will require the input to be repeated until the data is acceptable. If the innapropriate data comes from the API, the system will simply disreguard the data and will continue to request the data from the API until the correct data is received.

5.3 Safety

This system will be entirely safe as it is not a physical product. The primary safety concerns surrounding the use of this product are covered by the safety systems of the hardware being used to run it. Other than this, the user may pay attention to the appllication over the surroundings of the user, putting them in potentially hazourdous situations. This will be minimised by providing the user with appropriate warnings of this fact and to caution them to keep their attention in the proper places.

6 Design for People

6.1 Stakeholder Analysis

Production - This application would be produced by a team of programmers, engineers and designers. To streamline the process for this team, appropriate workloads and deadlines must be applied to them in order to reduce their chances of over stressing.

Distribution - This application would be distributed by the appropriate app stores and thus, once the application is uploaded, no human interaction is involved.

Installation - This application is installed by the user, to minimise inconvinience, the application should be properly optimised to reduce download and installation time.

Use - This application must be optimised and designed properly to simplify the user experience. This can be accomplished by minimising the number of button presses the user must execute in order to accomplish any given task. In addition to this, clear labelling of buttons and other points of interest with clear text or with simple graphics can be utilised.

Maintenance - The programmers that produced the code for this application will also have to maintain it by removing any bugs that surface during the product lifetime. To make this process as simple as possible, code will have to be clearly commented. This will include breif descriptions of how functions operate and the purpose of classes and other system modules.

6.2 Diversity Analysis

To allow this product to be accesible to a diverse population, the following considerations have been taken into account:

- The product should be adapted to offer a variety of languages, to alllow access to those whose first language is not english
- The product should be built to work in many countries to allow people to access the product for a wide variety of places
- The product should be as simple to use as possible to allow the use by a wide range of ages and learning ablility
- The product should include large buttons and interfaces to allow access by those with impared vision

6.3 TASK ANALYSIS

Below is detailed the operation flow of the application:

6.3.1 SUB-TASK ANALYIS

- Input of locations
  - The user must be able to easily navigate to the desired locations. This can be achieved by utilising the simple touch gestures offered by the Google Maps API
  - The user can also enter this information though a text interface, this gives the user the chance to enter the data by their prefered method
- User gets further information on their desired route
  - This is simplified for the user as it is achieved by simply performing a click operation on the displayed route
- User alarm
  - This operation requires the user to check the option for an alarm to be set in the application options
  - This operation makes the application more accesible as it will warn the user to begin their journey without any further user cognition