Appendix 4 – Requirements Specification

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1. Requirements Specification

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1.1 External Interface requirements

1.1.1 User Interfaces

ID no	FR-UI01	Category		Functional – User Interfaces	
Description	Interfaces will be able to read fingerprints when touched in order to validate user credentials.				
Justification	Due to the nature of pervasion, as little human input as possible is required. This allows the system to store information, understand patterns and perform tasks autonomously, that are tailored to the user. For example, automatically register a user and display possible tasks which are relevant to its permissions.				
Reference	Main Report 6.2.3				
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A				
Testing Criteria	'Log-in' occurs with a single touch. Users will not have to hold finger on the screen for more than 1 second to verify identity.				

ID no	NF-UI01	Category		Non-Functional - User Interfaces	
Description	Interfaces will be embedded into kitchen surfaces and eye-level storage spaces.				
Justification	Detachable interfaces pose a security risk. Ubiquitous/pervasive computing defines computing as being 'merged into our daily lives'. External, visible interfaces contradict this.				
Reference	N/A				
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A				
Testing Criteria	The cavity between any interfaces and surface will be less than 1 millimetre in diameter. Any cavity will be filled with waterproof filling.				

ID no	NF-UI02	Category		Non-Functional - User Interfaces	
Description	Storage spaces will have a key slot to enable manual unlocking with a key				
Justification	In the event of software failure or power cuts it is important that Storage spaces can still be opened. Follow up research stated that students do not trust software to work 100% of the time.				
Reference	Appendix 3 – Interview 2				
Timestamp	12/04/2014	Importance	5	Version	2
Change information	After follow up research on requirements specification it appeared that students did not trust software to work properly every time. Justification of requirement was edited to reflect this.				
Testing Criteria	Manual key can unlock cupboard in the absence of input from the scanner, without electricity or due to software failure. The key opens every cupboard in the kitchen.				

ID no	NF-UI02	Category		Non-Functional - User Interfaces	
Description	All interfaces must be 100% waterproof, scratchproof and heat proof.				
Justification	With water, heat, steam and surfaces being used to cut ingredients in the kitchen it is imperative that the interfaces can't be damaged as it would be very costly to fix.				
Reference	N/A				
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A				
Testing Criteria	Electronics unaffected by water or steam despite the level of exposure. Hardware/Interfaces unaffected by heat up to 200^{o}C Interface shows no scratches despite contact with sharp items. E.g. knives.				

ID no	NF-UI02	Category		Non-Functional - User Interfaces	
Description	Kitchen surfaces are a large fully responsive touch screen interface.				
Justification	Coinciding with the nature of ubiquitous computing, embedding computing systems in everyday life.				
Reference	Main Document 6.2.6				
Timestamp	08/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	All interfaces' have a 0 second lag time between stimulus and response. Completely scratch proof Heat proof up to 200^{o}C				

1.1.2 Hardware interfaces

ID no	NF-HI01	Category		Non-Functional - Hardware Interfaces	
Description	Any storage space handle will have thumbprint scanners embedded into them.				
Justification	In research only 9.9% of people stated that food never goes missing whereas 32% of people stated that food goes missing at least 'fairly often'. A further quarter of all people asked, stated that food goes 'sometimes' goes missing. Storage spaces with thumbprint locks will counter this problem in a student house.				
Reference	Main Document 6.2.1				
Timestamp	06/04/2048	Importance	5	Version	1
Change information	N/A				
Testing Criteria	Area of scanner must be less than 200mm^{2}				

ID no	NF-HI02	Category		Functional - Hardware Interfaces	
Description	The system will include a fire safety alarm that can override control of applications.				
Justification	An issue highlighted in original research was the tendency for smoke alarms to be set off incorrectly. Although this is uncommon as the norm for student houses is to have heat sensors rather than smoke detectors, a smart fire safety tool. It can double as smoke/heat detectors while having the ability to turn on or off appliances, such as increasing the power in smoke detectors.				
Reference	Main Document – 6.3.6				
Timestamp	07/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Zero false positive fire readings. Zero false negative fire readings. There must be a maximum of a two second time lapse between a fire of any size breaking out and the alarm sounding.				

ID no	NF-SS01	Category		Non-Functional – Hardware Interfaces	
Description	Shelving in all storage spaces will have inbuilt scales in them.				
Justification	A barcode or RFID is essentially a ‘look-up code’ to view information of a product. The weight is stored with this product. When an item is removed from storage and replaced lighter, the system will register how much is left of that product. It can be cross referenced with a recipe to more accurately calculate the how much food is being used, should the user be using a recipe.				
Reference	Main Document – 6.2.7				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Scales must be sensitive to <1gram. The approximation of food in storage must be accurate for 99% of items.				

ID no	NF-SS02	Category	Non-Functional – Hardware Interfaces
Description	There will be a RFID and Barcode Scanner around frame of all storage spaces.		
Justification	This will allow a list of food in storage to be compiled to create an inventory record that can be used to create shopping lists or find recipes by registering food inputted and removed to/from storage.		
Reference	Main Document – 6.2.7		
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A		
Testing Criteria	The system must register every barcoded/RFID tagged item of food in storage as it is inputted or removed from storage.		

1.1.3 Software Interfaces

ID no	NF-SI01	Category	Non-Functional - Software Interfaces
Description	The system will have a secure connection to wireless connected devices.		
Justification	Should an external device gain control of the appliances in the kitchen it has the potential to be extremely problematic and potentially dangerous.		
Reference	Appendix 3 – Interview 1		
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A		
Testing Criteria	TCP ‘Handshaking’ will ensure information sent between device and interface cannot be intercepted by any external device. Unauthorised external devices cannot access any of the kitchens systems.		

ID no	NF-SI02	Category		Non-Functional - Software Interfaces	
Description	Up to 15 users' thumbprints can be registered on the central database for each storage space.				
Justification	Multiple users may need access to Storage spaces; Housemates, Landlords, letting agents etc.				
Reference	Appendix 3 – Interview 10				
Timestamp	10/04/2014	Importance	4	Version	2
Change information	Was originally set to '10 users', from feedback with users it became apparent that 10 wouldn't suffice with houses sometimes containing up to ten students. Changed to 15 users.				
Testing Criteria	Time taken to unlock the storage space will not vary for any of the 15 people registered to open a cupboard. Duplication of fingerprints must be recognised, i.e. one person cannot have two 'accounts'.				

ID no	NF-SI03	Category		Non-Functional - Software Interfaces	
Description	The database for users and Storage spaces will be stored in a central database.				
Justification	This will allow fast edits of permissions for specific Storage spaces and an easy overview of whom is permitted to enter Storage spaces to highlight redundant users.				
Reference	N/A				
Timestamp	06/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	All information can be accessed from any interface without any replication of stored information.				

1.1.4 Communication Interfaces

ID no	NF-CI01	Category	Non - Functional – Communication Interfaces
Description	The system will be connected to the house Wi-Fi at all times.		
Justification	This will allow remote access through a smart device. It will also allow interfaces to use their internet capabilities. It can also provide a method for unconnected appliances added into the kitchen to communicate with the rest of the appliances.		
Reference	N/A		
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A		
Testing Criteria	The system is always on-line when the house Wi-Fi is operational.		

1.2 Functional Requirements

1.2.1 Stimulus 1 - Storage Systems

The following is a set of functional requirements of the system in relation to the storage and security of food.

1.2.1.1 Functional requirement 1.1

ID no	FR-SS01	Category	Functional – Storage Systems
Description	The system will force Storage spaces to self-close when released.		
Justification	This is to stop others from using an already opened cupboard.		
Reference	N/A		
Timestamp	06/04/2014	Importance	4	Version	1
Change information	N/A		
Testing Criteria	Storage space door closes as soon as pressure is released. Storage space door close softly so no digits get trapped.		

1.2.1.2 Functional requirement 1.2

ID no	FR-SS02	Category		Functional – Storage Systems	
Description	The system will provide a list of what is in storage for each individual person.				
Justification	This will save the user time by making the need to physically look through the shelves to find an item redundant.				
Reference	Appendix 3 – Interview 1				
Timestamp	08/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	No items in storage are omitted from the list. Unspecified items in storage must still register on the list. There are no items on the list that are not in shelves.				

1.2.1.3 Functional requirement 1.3

ID no	FR-SS03	Category		Functional – Storage Systems	
Description	The system will provide information on the perishing dates of food.				
Justification	60% of students say it is not uncommon for them to throw out food that has perished, while only 11% say it has never happened.				
Reference	Appendix 1 - 1.7				
Timestamp	07/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Gives notifications of what food has expired Gives notifications of what will expire in the next 2 days.				

1.2.1.4 Functional requirement 1.4

ID no	FR-SS04	Category		Functional – Storage Systems	
Description	The system will provide a timestamp for the last 20 storage openings and information of the changes in each storage device.				
Justification	Only 16% of students have never had food stolen from them. This will further increase the security of possessions as it will have a log as to who has opened what, and what have been removed and used.				
Reference	Appendix 1 – 1.2				
Timestamp	08/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	20 timestamps per storage compartment. Information of who accessed the cupboard stored next to each timestamp. Information of what was altered in the accessed Storage spaces stored next to each timestamp.				

1.2.1.5 Functional requirement 1.5

ID no	FR-SS05	Category		Functional – Storage Systems	
Description	The system will provide notification to both the interface and the 'victim's' mobile device if a user is removing an item of food that doesn't belong to them.				
Justification	This will act as a deterrent to stealing food. It will also allow shelves to be shared, meaning there will be more storage space for everybody. Almost half (48%) of students do not have enough storage space and would like more.				
Reference	Appendix 1 – 1.4				
Timestamp	08/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	Items must be completely removed from the storage space with a variation on weight. If two of the same items exist within the storage space, the owner is not notified. Warnings must be dismissed with one click.				

1.2.1.6 Functional requirement 1.6

ID no	FR-SS06	Category		Functional – Storage Systems	
Description	The system will provide the option to leave all storage spaces unlocked.				
Justification	Having locked storage spaces could prove an annoyance to users.				
Reference	Appendix 3 – Interview 3				
Timestamp	11/04/2014	Importance	2	Version	1
Change information	Requirement highlighted through future research.				
Testing Criteria	Storage spaces do not lock unless expressly told to.				

1.2.1.7 Functional requirement 1.7

ID no	FR-SS07	Category		Functional – Storage Systems	
Description	The system will be have the ability to read barcodes on receipts to know what items to 'expect' that are going to be placed in storage.				
Justification	Receipts have information stored on them that state what has been purchased. If this has been read the system can know what to expect. This adds further accuracy to the record of stored items.				
Reference	N/A				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	The system processes will not alter from the norm if expected items are not entered into storage. The system must allow unexpected items entered into storage.				

1.2.1.8 Functional requirement 1.8

ID no	FR-SS08	Category		Functional – Storage Systems	
Description	The system will detect food that has been placed from the freezer to the fridge to defrost to provide notification when it has been defrosted.				
Justification	Some foods, such as white meat, need to be consumed within a few hours after defrosting. There are also rules for how long it takes to defrost certain things which can be programmed into the system.				
Reference	N/A				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Notifications can be pushed smart devices. Food must be 100% defrosted when notifying the user. Provides a notification only for food types where defrosting rules are recognised.				

1.2.2 Stimulus 2 - Cooking Control

The following is a set of functional requirements of the system in relation to the processes the system can undertake with the semi-automatic preparation of food.

1.2.2.1 Functional requirement 2.1

ID no	FR-CC01	Category		Functional – Cooking Control	
Description	The system must have the capability to pre-program timings and heat strength to control appliances.				
Justification	85% of students said they would like to make cooking easier. Only 13% of students stated they never have issues with timings, where almost a third of students (32%) stated they have issues with timings at least fairly often.				
Reference	Appendix 1 – 1.14 & 1.15				
Timestamp	06/04/2014	Importance	5	Version	1
Change information	N/A				
Testing Criteria	The actual times food is cooked for will not vary for more than 10 seconds from the programmed times.				

1.2.2.2 Functional requirement 2.2

ID no	FR-CC02	Category		Functional – Cooking Control	
Description	The system must provide the option to turn off all automatic systems, to manually cook.				
Justification	Follow up research highlighted the fact that users may not fully trust the automation of the system, or have their own unique preference of how to cook specific items.				
Reference	Appendix 3 – Interview 13				
Timestamp	10/04/2014	Importance	5	Version	1
Change information	Requirement added after follow-up research.				
Testing Criteria	No process will be undertaken by the system that hasn't been immediately instructed.				

1.2.2.3 Functional requirement 2.3

ID no	FR-CC03	Category		Functional – Cooking Control	
Description	The system must finish cooking on every appliance at the same time.				
Justification	Should the user be cooking on multiple hobs or appliances (e.g. oven) it is important that the food is ready at the same time. 87% of students have had problems with timings when cooking.				
Reference	Appendix 1 – 1.14				
Timestamp	06/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Stand times are accounted for. Each food item prepared must be ready to serve at the same time, every time with the automatic cooking system				

1.2.2.4 Functional requirement 2.4

ID no	FR-CC04	Category		Functional – Cooking Control	
Description	The system will have capabilities to 'understand' recipes found on the internet.				
Justification	89% of students asked have used recipes when cooking during their time at university. Follow up research highlighted the use for this requirement as students do not always know timings when they cook; instead they assess the readiness of food by look and taste.				
Reference	Appendix 1 – 1.13				
Timestamp	10/04/2014	Importance	4	Version	2
Change information	Extra justification added through follow up research.				
Testing Criteria	100% of the instructions must be recognised to accept programming.				

1.2.2.5 Functional requirement 2.5

ID no	FR-CC05	Category		Functional – Cooking Control	
Description	The system will automatically program appliances in accordance to the 'understood' cooking instructions found on recipes.				
Justification	Maintaining the pervasive/automatic nature of the cooking system.				
Reference	N/A				
Timestamp	10/04/2014	Importance	4	Version	1
Change information	Requirement Split into separate requirements from *FR-CC04*				
Testing Criteria	Instructions programmed in must exactly correspond with that of the recipe 99% of the time.				

1.2.2.6 Functional requirement 2.6

ID no	FR-CC06	Category		Functional – Cooking Control	
Description	Sensors on hobs detect boiling over and adjust heat accordingly to prevent further spillage.				
Justification	Prevents the need for the user to supervise the cooking therefore increases the ease of cooking. 85% of students would like to make cooking easier. It also will affect the cleanliness of the hobs. 90% of students stated that they found mess interfering.				
Reference	Appendix 1 - 1.10 & 1.15				
Timestamp	06/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Correctly differentiate between 'splashes' and pans boiling over 95% of the time. Cooking outcome is not affected by the changes in heat.				

1.2.2.7 Functional requirement 2.7

ID no	FR-CC07	Category		Functional – Cooking Control	
Description	The oven will power off and send notification to smart device once it detects burning.				
Justification	Only 13% of students have never had issues with timings in cooking.				
Reference	Appendix 1 – 1.14				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Oven will automatically start to cool Detection will be successful at least 95% of the time At most, 5 in every 100 notifications will be false positives. At most, 5 of every 100 burnt items will be false negatives.				

1.2.2.8 Functional requirement 2.8

ID no	FR-CC08	Category		Functional – Cooking Control	
Description	The system will send a push notification to a registered portable device when automatic cooking is completed.				
Justification	Allows the users to detach themselves from the cooking and only return to the kitchen when it is completed.				
Reference	N/A				
Timestamp	06/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Notification must be correct 100% of the time. Notification will only be sent if user is not in the room.				

1.2.2.9 Functional requirement 2.9

ID no	FR-CC09	Category		Functional – Cooking Control	
Description	The system has the capability to find possible recipes for meals, based on items in storage.				
Justification	29% of students do not consider themselves a good cook. A capability that can analyse the stored food by a user and automatically find recipes online was confirmed as a useful tool by follow up research.				
Reference	Appendix 3 – Interview 8				
Timestamp	11/04/2014	Importance	3	Version	2
Change information	Confirmation of requirement usefulness in follow up research. Justification altered.				
Testing Criteria	Up to 10 possible recipes based on ingredients the user owns will be shown. Provide a list in <5 seconds.				

1.2.2.10 Functional requirement 2.10

ID no	FR-CC10	Category		Functional – Cooking Control	
Description	The system will provide the option to record processes of previously made meals.				
Justification	This can allow the system to be 'programmed' to create meals that are tailored to the users' preference.				
Reference	N/A				
Timestamp	08/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	Up to 10 meals can be recorded.				

1.2.2.11 Functional requirement 2.11

ID no	FR-CC11	Category		Functional – Cooking Control	
Description	The oven will have the capability for the user to select meat, and its weight for automatic cooking.				
Justification	Meat is not always easy to determine if it has been cooked thoroughly enough. There are rules with regards to heat and timings of meat which can be codified. This will save a user effort, by eliminating the need to look up information or continuously check the food.				
Reference	N/A				
Timestamp	07/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	User must be able to select meat, and weight within 6 touches of the interface. Assuming correct parameters, meat will be undercooked 0% of the time.				

1.2.3 Stimulus 3 - Interface Management

The following is a set of functional requirements of the system in relation to methods and capabilities of the system with regards to its input and output through the interfaces.

1.2.3.1 Functional requirement 3.1

ID no	FR-IM01	Category		Functional – Interface Management	
Description	Each and every interface can run a different process for each and every user who is using the system simultaneously.				
Justification	Only 8% of students state they have had to never wait for appliances to become free where 20% of students say it happens very often. If more than one student can use an interface, the system can calculate processes to utilise more time-efficient ways of cooking, reducing the time needed for people to wait before cooking.				
Reference	Appendix 1 – 1.5				
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A				
Testing Criteria	There is a 0% change of speed in processing time between 1 and 10 simultaneous users of the system.				

1.2.3.2 Functional requirement 3.2

ID no	FR-IM02	Category		Functional – Interface Management	
Description	The system will remember a user's 'current state' on any interface that is being used.				
Justification	A need for this requirement was made obvious through future research. This gives the users the capability to use multiple different interfaces when navigating the kitchen, and allows other users to use any interface without interfering with the first users processes.				
Reference	Appendix 3 – Interview 7				
Timestamp	11/04/2014	Importance	4	Version	1
Change information	Added after follow up research.				
Testing Criteria	0 second time delay between changes on display of any inputs.				

1.2.3.3 Functional requirement 3.3

ID no	FR-IM03	Category	Functional – Interface Management		
Description	The system will have the capability to re-scale the surface-interfaces so they can cover as much, or as little of the surface space as necessary.				
Justification	Gives the user control over how much they wish to utilise the interactive surface.				
Reference	N/A				
Timestamp	08/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Touch control accuracy and image quality is not affected by the size of the interface. Maximum size is up to 2mm from the surface edge.				

1.2.3.4 Functional requirement 3.4

ID no	FR-IM04	Category	Functional – Interface Management		
Description	Interfaces will have full internet connectivity and browsing capabilities.				
Justification	Only 11% of students have not used recipes when cooking. Internet would provide a capability to find recipes, instructional videos, and anything else available online.				
Reference	Appendix 1 – 1.3				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Must have capabilities to install and run any commercial internet security package. Must not lack any functionality that can be found on any device-equivalent internet browser.				

1.2.4 Stimulus 4 - System Control

The following is a set of functional requirements of the system in relation to the different platforms and methods a user can interface with the system with.

1.2.4.1 Functional requirement 4.1

ID no	FR-SC01	Category		Functional – System Control	
Description	Interfaces have full control over all in-built kitchen appliances.				
Justification	Acts as a 'control panel' for appliances. All inputs are computed by the interfaces (touch, voice, smart device) which in turn control the appliances.				
Reference	N/A				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Any single interface has control over every built-in appliance in the kitchen.				

1.2.4.2 Functional requirement 4.2

ID no	FR-SC02	Category		Functional – System Control	
Description	All appliances and interfaces are voice activated.				
Justification	Voice activation provides less interaction between the user and the machine, making the system as whole more ubiquitous. Advanced voice activation is also faster and easier than touch screen interfaces.				
Reference	N/A				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Every function that can be performed on each interface can be programmed in through voice commands. Works regardless of accents. The processing delay is identical to the touch screen interface processing delay. Conversations and instructions to the system must be differentiated from one another 100% of the time.				

1.2.4.3 Functional requirement 4.3

ID no	FR-SC03	Category		Functional – System Control	
Description	Any individual automatic or non-automatic kitchen function can be turned off.				
Justification	There is no 'Silver Bullet' for fixing kitchen processes and people may have preferences over what functions to use with the system.				
Reference	Appendix 3 - Interview 14				
Timestamp	09/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	If an automated function is disabled, the functionality of all other functions or systems is not affected. The kitchen can still be operated manually with the same effectiveness regardless of disabled automated functions.				

1.2.4.4 Functional requirement 4.4

ID no	FR-SC04	Category		Functional – System Control	
Description	The system will allow contactless scrolling through pages.				
Justification	In the kitchen it is likely that hands will get messy with cooking, to ensure the cleanliness and sanitation of the interfaces contactless scrolling is a solution.				
Reference	Appendix 3 – Interview 1				
Timestamp	12/04/2014	Importance	4	Version	1
Change information	Requirement added after follow-up research				
Testing Criteria	The speed in which the pages will scroll will be directly related to the speed of the hand movement. The display will not scroll by errant hand or arm movements.				

1.2.4.4 Functional requirement 4.4

ID no	FR-SC05	Category		Functional – System Control	
Description	The system will provide information on the status of all appliances.				
Justification	This help with maintenance and usage. Users can easily see if an appliance has an issue, or cannot be used due to cleaning etc.				
Reference	N/A				
Timestamp	09/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Information about the appliances must be 99% accurate. Store information on warranty expiration dates for appliances that can be viewed.				

ID no	FR-SC06	Category		Functional – System Control	
Description	The entire kitchen can be controlled remotely through ‘smart’ devices.				
Justification	This allows an authorised user to remotely control an interface through their smart device. Follow up research highlighted an issue of users having to wait for an oven to pre-heat once they had just entered the house. This would enable users to control a kitchen on their way home, or even have pre-prepared food cooked for when they arrive. It will also allow for control of entertainment such as music.				
Reference	Main Report 6.3.7				
Timestamp	11/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	No functionality available on the built in interfaces will not be available on external connected devices.				

1.2.5 Stimulus 5 - Appliance Cleanliness

The following is a set of functional requirements of the system in relation to the processes the system can undertake with maintaining and ensuring the cleanliness of the kitchen.

1.2.5.1 Functional requirement 5.1

ID no	FR-AC01	Category		Functional – Appliance Cleanliness	
Description	The system will include a dishwasher that cleans its load in up to 2 minutes.				
Justification	90% of students find mess interfering. It was also highlighted in research that people struggle to cook as a result of people not washing up. A dishwasher that washed dishes to a high standard in a matter of minutes would solve this problem as it would only mean waiting 2 minutes. It would also save energy by not having a long rinse and soak cycle.				
Reference	Appendix 3 - Interviews 5,7,10,11,12				
Timestamp	12/04/2014	Importance	4	Version	1
Change information	Requirement added after further research.				
Testing Criteria	Performs identically to high-end commercial dishwashers. Wash completed in 120 seconds every time.				

1.2.5.2 Functional requirement 5.2

ID no	FR-AC02	Category		Functional – Appliance Cleanliness	
Description	The oven will have the capability to detect differing levels of dirt inside the oven.				
Justification	90% of students find mess interfering. Every student interviewed in follow up research stated that the kitchen wasn't cleaned as often as they would like. Based on an average cost of 17.2 pence per Kilowatt Hour (kWh)[1] and an energy consumption of approximately 8kWh it costs approximately £1.40 in electricity every time the oven cleans. This could prove very costly should the oven be set to automatically clean every 'x' uses, especially with a student house with a lot of tenants.				
Reference	[1] CompareMySolar.co.uk (2013) –*Comparison of E.ON, EDF, nPower, British Gas, Scottish and SSE* Blog. [ONLINE] Available at:http://blog.comparemysolar.co.uk/electricity-price-per-kwh-2013-comparison-of-e-on-edf-npower-british-gas-scottish-and-sse/. [Accessed 05 May 2014]. [2] Panasonic. 2014. *Panasonic Dirt Sensors*. [ONLINE] Available at: http://www.vdta.com/Magazines/DEC08/fc-PanasonicDec08.html. [Accessed 05 May 2014]. Appendix 1 – 1.10 Main Report - 5.3				
Timestamp	20/04/2014	Importance	3	Version	3
Change information	Research into further technology highlighted the costs to self-cleaning ovens. Updated Justification and testing criteria section.				
Testing Criteria	Sensors must be heat-proofed up to 900°F.				

1.2.5.3 Functional requirement 5.3

ID no	FR-AC03	Category		Functional – Appliance Cleanliness	
Description	The oven will self-clean when the mess in the oven reaches unacceptable levels.				
Justification	The automation of this requirement re-enforces the pervasiveness of the kitchen.				
Reference	N/A				
Timestamp	07/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	The oven will never reach a level of dirt above that of acceptable levels, set by the testers. Cleaning will happen when the appliance isn't due to be used 95% of the time.				

1.2.5.4 Functional requirement 5.4

ID no	FR-AC04	Category		Functional – Appliance Cleanliness	
Description	Provide inbuilt housekeeping rota into the system.				
Justification	90% of students find mess interfering with their cleaning purposes. A cleaning rota would help to reduce the mess in the kitchen.				
Reference	Appendix 1 – 1.10				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Inbuilt housekeeping rota is available to view or edit at all times.				

1.2.5.5 Functional requirement 5.5

ID no	FR-AC05	Category		Functional – Appliance Cleanliness	
Description	Sensors on bins will provide a notification when they are full.				
Justification	It was highlighted in the research that bins are an issue in a student kitchen, not being disposed of correctly or replaced when full.				
Reference	Main Report – 6.3.1				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Sensor does not give notification of a full bin unless it is completely full.				

1.2.6 Stimulus 6 - Energy Management

The following is a set of functional requirements of the system in relation to the processes the system can undertake with the conservation and management of energy consumption.

1.2.6.1 Functional requirement 6.1

ID no	FR-EM01	Category		Functional – Energy Management	
Description	The system will revert to a constant ‘sleep’ mode when not in use.				
Justification	This will save energy.				
Reference	Appendix 1 – Interview 9				
Timestamp	09/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	No system will be active while there are no processes being performed and nobody in the kitchen. ‘Sleep’ mode will be activated when there is an inactivity of systems if a period of time set by the user.				

1.2.6.2 Functional requirement 6.2

ID no	FR-EM02	Category		Functional – Energy Management	
Description	The system will have the capability to fully shut down when the house is empty.				
Justification	Students technically have approximately 16 weeks of holiday every year. A full power shut down will save power and improve security.				
Reference	N/A				
Timestamp	09/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Turned off physically by a switch in the kitchen. The system cannot be rebooted remotely.				

1.2.6.3 Functional requirement 6.3

ID no	FR-EM03	Category		Functional – Energy Management	
Description	The system will monitor and display all utility usage (Gas, Electricity and Water) and costs.				
Justification	This will enable students to know exactly how much the kitchen is costing them in money. It would be straight forward to link this to the rest of the house to view total cost. It will also allow the students to see how much each appliance is costing them.				
Reference	Appendix 3 – Interview 15				
Timestamp	09/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	A monthly, quarterly and yearly cost can be produced. The costing information will be relevant at all times despite changes in utility prices.				

1.2.6.4 Functional requirement 6.4

ID no	FR-EM04	Category		Functional – Energy Management	
Description	The system will monitor a user's position in the room and power on and off interfaces depending on vicinity.				
Justification	This will save power by only utilising needed interfaces.				
Reference	Main Report – 6.2.6				
Timestamp	12/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	The user has a 0 second wait time to use a free interface, regardless of how many other users are in the kitchen.				

1.2.6.5 Functional requirement 6.5

ID no	FR-EM05	Category		Functional – Energy Management	
Description	The system will learn patterns of when appliances are used.				
Justification	With a rough understanding of when appliances are used, other tasks can be performed e.g. cleaning or powering down to save power. Follow-up research highlighted this as a necessary requirement to ensure processes in the kitchen are as less intrusive as possible to routine.				
Reference	Appendix 3- Interview 15				
Timestamp	12/04/2014	Importance	2	Version	2
Change information	Justification added through follow-up research.				
Testing Criteria	Appliances are available 99% of the time when they are needed. (With exceptions to when they are already in use).				

1.2.6.6 Functional requirement 6.6

ID no	FR-EM06	Category		Functional – Energy Management	
Description	The system will have the capability to control climate of the kitchen on the interfaces either automatically, or manually.				
Justification	Conserves energy, economical.				
Reference	Main Report 6.3.6				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Less than 10 second reactions to stimulus by the heating system.				

1.2.7 Stimulus 7 - Entertainment Capabilities

The following is a set of functional requirements of the system in relation to the processes the system can undertake in regards to entertainment in the kitchen.

1.2.7.1 Functional requirement 7.1

ID no	FR-EC01	Category		Functional – Entertainment Capabilities	
Description	Interactive games are available within the interfaces.				
Justification	Follow-up research highlighted the need for this. It is common for students to have parties in their kitchens in which 'Drinking-Games' are played. If the surface has the capability to play games, such as card games, students will utilise this.				
Reference	Appendix 3 – Interview 17				
Timestamp	12/04/2014	Importance	3	Version	1
Change information	Requirement added after follow-up research.				
Testing Criteria	Must be an option to download games from a specified 'app-store'.				

1.2.7.2 Functional requirement 7.2

ID no	FR-EC02	Category		Functional – Entertainment Capabilities	
Description	The system will be able to play music from any Bluetooth device.				
Justification	After follow up research it became apparent that kitchens also get used for students having party style drinks before a night out. This highlighted the need for entertainment such as music to be available in the kitchen.				
Reference	Appendix 3 – Interviews 1 & 17				
Timestamp	11/04/2014	Importance	2	Version	1
Change information	Added after follow up research.				
Testing Criteria	Speakers must be inbuilt into the kitchen. Any Bluetooth device, regardless of operating system must be able to connect.				

1.2.8 Stimulus 8 - Shopping Management

The following is a set of functional requirements of the system in relation to the processes the system can undertake with regards to semi-automated shopping.

1.2.8.1 Functional requirement 8.1

ID no	FR-SM01	Category		Functional – Shopping Management	
Description	The system can push the shopping list to smart device.				
Justification	This will allow portability of the list.				
Reference	N/A				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Smart device should contain an updated shopping list at any given time.				

1.2.8.2 Functional requirement 8.2

ID no	FR-SM02	Category		Functional – Shopping Management	
Description	The system will provide a list of what food items have been used.				
Justification	Only 9% of students shopping lists vary significantly from each time they shop. 20% of the 9% do not expect a shop to last for more than a week. 48% of students regularly forget to purchase things needed while only 4% have never forgotten. This proves an automatic shopping list will be useful for students.				
Reference	Appendix 1 – 1.8, 1.9				
Timestamp	07/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Displays a list of all foods at all times that has been consumed. List can be reset after every shop.				

1.2.8.3 Functional requirement 8.3

ID no	FR-SM03	Category		Functional – Shopping Management	
Description	The shopping list can be altered in the interface with the capability to add and remove items.				
Justification	42% of students say their shopping habits slightly change each time they go. It is important to have an option to add and remove items.				
Reference	Appendix 1 – 1.8				
Timestamp	07/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	An item can be removed with two touches. An item can be added with two touches. The whole shopping list can be cleared in one touch.				

1.2.8.4 Functional requirement 8.4

ID no	FR-SM04	Category		Functional – Shopping Management	
Description	The shopping list can be exported to all major online shopping sites.				
Justification	Added through follow up research – a shopping list isn't much use when students use online grocery shopping.				
Reference	Appendix 3 – Interview 6				
Timestamp	11/04/2014	Importance	2	Version	1
Change information	Added after follow up research.				
Testing Criteria	Compatible with all major supermarkets online function.				

1.2.8.5 Functional requirement 8.5

ID no	FR-SM05	Category		Functional – Shopping Management	
Description	The system will provide price comparisons on shopping list cost from all supermarkets that are selected by the user.				
Justification	Students are renowned for being frugal and careful cost planning is essential to students.				
Reference	N/A				
Timestamp	07/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	The information provided is up to date and relevant 100% of the time. All supermarkets that have an online shopping capability are available in the price comparison.				

1.2.9 Stimulus 9 - Tap Control

The following is a set of functional requirements of the system in relation to the processes the system can undertake with regards to controlling the taps in the kitchen.

1.2.9.1 Functional requirement 9.1

ID no	FR-TC01	Category		Functional – Tap Control	
Description	The taps in the kitchen are controlled by both voice and touch.				
Justification	Voice activation provides less interaction between the user and the machine, making the system as whole more ubiquitous. Advanced voice activation is also faster and easier than touch screen interfaces.				
Reference	Main Report – 6.3.4				
Timestamp	07/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	No repetition of commands to get taps to work. All accents are recognised. Taps do not conduct heat making touch activation possible and safe. Conversations and instructions to the system must be differentiated from one another 100% of the time.				

1.2.9.2 Functional requirement 9.2

ID no	FR-TC02	Category		Functional – Tap Control	
Description	Quantities and heat of water distributed are recognised by commands.				
Justification	Due to the nature of pervasive computing the less input, the more pervasive the system, the less input is required by a user. If a user were to command a cup of tea then the system should recognise the correct quantity and temperature. Follow-up research highlighted this as an important requirement due to the energy and water efficiency.				
Reference	Main Report – 6.3.4				
Timestamp	12/04/2014	Importance	3	Version	2
Change information	Follow up research highlighted greater justification for this requirement. The justification has been altered accordingly.				
Testing Criteria	All quantities and heat are accurate to 10 millilitres and 5^{o}C of the commands inputted. Insulated taps stay below 40^{o}C 100% of the time.				

1.2.9.3 Functional requirement 9.3

ID no	FR-TC03	Category		Functional – Tap Control	
Description	Taps can change their extreme temperatures between highest temperature and lowest temperature in less than 2 seconds.				
Justification	This will mean there is a reduced real-time constraint, an issue of pervasive computing.				
Reference	N/A				
Timestamp	08/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Achieve the two temperature extremes from one another in less than 2 seconds. Top temperature is 99 degrees Celsius. Bottom temperature is 7 degrees Celsius. Taps do not conduct heat making touch safe.				

1.2.9.4 Functional requirement 9.4

D no	FR-TC04	Category		Functional – Tap Control	
Description	Taps will have the option for free pouring water.				
Justification	Students may not always need specified amounts of water. For example, filling a bucket for mopping. Follow-up research highlighted the need for this requirement.				
Reference	Appendix 3 – Interview 6				
Timestamp	12/04/2014	Importance	3	Version	1
Change information	Added after follow up research.				
Testing Criteria	Taps turn on and do not turn off until the command is given.				

1.2.10 Stimulus 10 - Communal Storage

The following is a set of functional requirements of the system in relation to the processes the system can undertake with regards to the communal storage areas in the kitchen.

1.2.10.1 Functional requirement 10.1

ID no	FR-CS01	Category		Functional – Communal Storage	
Description	The system will automatically recognise storage space for communal items.				
Justification	The average student household spends £3.30 on communal items per week. The system has to recognise a space allocated to communal items.				
Reference	Appendix 1 - 1.3				
Timestamp	09/04/2014	Importance	4	Version	1
Change information	N/A				
Testing Criteria	Everybody has access to the shelf.				

1.2.10.2 Functional requirement 10.2

ID no	FR-CS02	Category		Functional – Communal Storage	
Description	The system will keep records of the last 20 people who accessed the communal shelf and what items were removed.				
Justification	It was highlighted in research that some households have issues with residents not paying for their fair share of used goods. Follow-up research highlighted that it would not be possible to assess how much of a product was used by an individual as the scales in Storage spaces will not be sensitive enough to assess. For example, using salt will not register a large enough change in the weight of the cupboard.				
Reference	Appendix 3 – Interview 9				
Timestamp	12/04/2014	Importance	2	Version	2
Change information	Requirement altered to no longer state the quantities of items used. Justification and Testing Criteria also updated.				
Testing Criteria	The list will not grow longer than 20.				

1.2.10.3 Functional requirement 10.3

ID no	FR-CS03	Category		Functional – Communal Storage	
Description	The system will provide a record of who purchased the items stored in the communal shelf.				
Justification	This is to stop disputes as to who has purchased what items.				
Reference	Appendix 3 – Interview 9				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	No duplication of user names for the same item.				

1.2.10.4 Functional requirement 10.4

ID no	FR-CS04	Category		Functional – Communal Storage	
Description	Communal items that have been emptied are automatically added to the shopping list of the user whose turn it is to purchase it.				
Justification	This will further stop disputes as to whose turn it is to purchase items.				
Reference	Appendix 3 – Interview 9				
Timestamp	09/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Items are not added to multiple persons' shopping list. Items are not re-added after deletion. The system will add items to the correct shopping list 95% of the time.				

1.2.11 Stimulus 11 - Health Information

The following is a set of functional requirements of the system in relation to the systems capabilities in searching and displaying the health attributes of food.

1.2.11.1 Functional requirement 11.1

ID no	FR-HI01	Category		Functional – Health Information	
Description	The system will have the capability to 'look-up' information on health attributes for specific foods to display them either on charts or by text.				
Justification	With Cardiff University alone having over 60 different sports clubs, and three separate universities run gymnasiums it would be a reasonable assumption that maintaining a healthy lifestyle is important for students of Cardiff university, and by extension, Universities across the country. Follow up research confirmed this as a good feature to include in the system.				
Reference	Appendix 3 – Interviews 4 & 16				
Timestamp	12/04/2014	Importance	3	Version	2
Change information	Further justification based on follow-up research added.				
Testing Criteria	Information gathered is accurate to the items used. Can visualise data on 5 different graphs				

1.2.11.2 Functional requirement 11.2

ID no	FR-HI02	Category		Functional – Health Information	
Description	The system will have the capability to have dietary requirements inputted to a user's 'profile' to provide warnings on food containing potentially harmful substances.				
Justification	It is not uncommon for food that contains items such as nuts, or gluten to be accidentally ingested. Information on the content of food is stored with the barcode as a reference to the information.				
Reference	N/A				
Timestamp	09/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	The system will provide a visual warning on the interfaces if a food contains a harmful substance. This function will not be used unless it has been specifically set-up.				

1.2.12 Stimulus 12 - Individual Tasks

The following is a set of functional requirements of the system in relation to the systems capabilities in performing tasks for an individual.

1.2.12.1 Functional requirement 12.1

ID no	FR-IT01	Category		Functional – Individual Tasks	
Description	Each user will have an individual 'profile' page where they can view all of their own information.				
Justification	Improves the heuristics and usability of the system.				
Reference	N/A				
Timestamp	09/04/2014	Importance	3	Version	1
Change information	N/A				
Testing Criteria	Only information relevant to that user will be shown. All information will be up to date.				

1.2.12.2 Functional requirement 12.2

ID no	FR-IT02	Category		Functional – Individual Tasks	
Description	The system will calculate the estimated spend of a student in a specified period.				
Justification	As a student it is extremely important to ensure finances are being managed extremely careful. This is a useful tool for students.				
Reference	N/A				
Timestamp	08/04/2014	Importance	2	Version	1
Change information	N/A				
Testing Criteria	Provide an approximation breakdown of daily spend. Provide an approximate breakdown of weekly spend. Provide an approximate breakdown of monthly spend. Provide an approximate breakdown of yearly spend.				

1.2.12.3 Functional requirement 12.3

ID no	FR-IT03	Category		Functional – Individual Tasks	
Description	The system will provide the option to provide a meal planner for a set period of time.				
Justification	This can enable users to set a planned meal schedule. 46% of students buy their food for a week while 27% buy their food for at least 10 days at a time. This shows that there is somewhat of a 'loose' plan of what to eat in the following period of time and this function would allow it to be more set in stone – should the user wish.				
Reference	Appendix 1 – 1.6				
Timestamp	08/04/2014	Importance	1	Version	1
Change information	N/A				
Testing Criteria	Deviations of the plan are automatically registered and the plan is altered accordingly. Predicted deviations can be edited in.				

1.3 Performance Requirements

ID no	NF-PR01	Category	Non-Functional Performance Requirements
Description	An interaction with the interface is reflected on the display instantly.		
Justification	Real-time computing is the study of hardware and software systems that are subject to a “real-time constraint”. With the speed of computing tasks it is possible for software to react and call a new function instantly. Unlike requirement *NF-PR04* it is possible to implement this due to fact that processing time isn’t needed to analyse external stimulus.		
Reference	N/A		
Timestamp	07/04/2014	Importance	5	Version	1
Change information	N/A		
Testing Criteria	Zero second wait time for any process or function.		

ID no	NF-PR02	Category	Non-Functional Performance Requirements
Description	Surface must be responsive to intentional touch, not accidental.		
Justification	A requirement that was highlighted in follow-up research. If a surface is touch screen and being used to cook on, accidental touches could change and affect a number of things.		
Reference	Main Report - 6.24		
Timestamp	12/04/2014	Importance	5	Version	1
Change information	Requirement added after follow-up research.		
Testing Criteria	In testing the screen is not responsive to accidental touches. Screen does not respond to body parts resting on the surface.		

ID no	NF-PR03	Category	Non-Functional Performance Requirements
Description	The system will 'wake' in within 1 second once triggered.		
Justification	If the system is in a constant 'sleep' mode, the user doesn't want to be waiting for the system to load up and get in a state of full functionality.		
Reference	N/A		
Timestamp	09/04/2014	Importance	4	Version	1
Change information	N/A		
Testing Criteria	Sensors on the door will register a person entering the room and the system must be ready to use in <1 second.		

ID no	NF-PR04	Category	Non-Functional Performance Requirements
Description	Storage doors will unlock with a thumbprint in less than 1 second.		
Justification	Real-time computing is the study of hardware and software systems that are subject to a "real-time constraint". Although it is desired for a seamless coordination between real life interaction and computing processes this is not always completely possible.		
Reference	N/A		
Timestamp	06/04/2014	Importance	4	Version	1
Change information	N/A		
Testing Criteria	Open in <1 second every time. In the event of power failure Storage spaces automatically revert to unlock position.		