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MSc Computer Science

Project Report

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UBIQUITOUS CONSUMER INVENTORY MANAGEMENT  
SYSTEM FOR WASTE PREVENTION

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# **1 Introduction**

## **1.1 Abstract**

What the project is about in regards to the proposal. The problem i am trying to solve. Over production food. Tackeling the core, If the consumers stop over purchasing the supermarkets will stop over producing.

## **1.2 Structure of the report**

Present the reader with an overview of each chapter.

## **1.3 Development Methodology**

UML and agile. And the reasons why this is a productive methodology. Version control for documentation and history.

## 2 Background & Analysis

This section presents the problem and the intent for the project supported by the analysis of currently available processes.

### 2.1 Motivation

The intention of the system is to aid the reduction in food waste created by households. Below highlight the motivation for the project and the cause of waste.

#### 2.1.1 Environment

Globally food waste has exceeded to two billion tonnes annually. Spoiling food emits methane, a particularly harmful greenhouse gas contributing to the warming of the earth's surface and threatening the eco-system. Due to human activity methane gas being released into the atmosphere has increased two and a half folds since the industrial revolution. Further more, resources used during the rearing and plantation process for the produce, as well as the use of packaging and transportation all contribute to the detrimental effect on our environment. Local councils are continuously pressured to fuel more funds into waste management recourses, landfill sites are overflowing and space to accommodate the waste is fast diminishing.

In the United Kingdom alone consumers and households are responsible for at least seven million tonnes of waste, whilst in comparison the retailers contribute a mere two hundred and twenty five thousand tonnes. Although the reported figures implicate the household as the largest culprit, retailers are in fact the catalyst force behind the mass generation of waste. Frequent buy-one-get-one-free and multi-buy discounts hosted by retailers contribute largely to the problem. Competition for market share is fierce between the retailers and goods must always be available at a lower price than that of their neighbours. Farmers and other producers alike are pressured to over produce to accommodate for a sudden rise in demand or to simply cover the risk of a potentially bad harvest. But when the sales forecast is not met or the harvest is overly fruitful, supermarkets will routinely deduct the price of food nearing expiration as a method of damage control for their investment.

Consumers are enticed by the attractive offer of a free item after purchasing two, and encouraged to over purchase food that they do not need and will most likely not consume before the use-by-date. Thus, waste that was originally created by the retailers is pushed down the chain, residing with the consumers. This aggressive sales strategy not only causes monetary waste to the individual but also engineers the blind participation in driving up demands in goods, in turn encouraging the overproduction of food.

### **2.1.2 Public Health**

In addition to the environmental damage, there are growing concerns over the public health risks the bargains offers bring. Over purchasing of food can encourage excessive consumption. Discounted foods usually come with a shorter use-by-date, meaning over a shorter span of time an individual must consume more than necessary in order for their investment to be justified. This side effect is detrimental to the health and well being of the public as the national statistics report for the United Kingdom has unveiled. Obesity rates in male adults have increased 13.2% and 7.4% for female adults since 1993. These figures are rising every year and the World Health Organisation (WHO) has predicted that by 2030 74% of male adults and 64% of female adults will be obese if precautionary measures are not implemented.

### **2.1.3 Aiding the modern lifestyle**

The final problem is simply human errors. We purchase produce with the good intention of consuming them. But as the demands of our fast paced modern life-style take priority, we often forget all about the existence of what we stocked and inadvertently let our stock expire until it is no longer fit for consumption. Expiry dates for different produces vary, and keeping track of all dates is a near impossible task by relying on human memory alone. A popular study carried out in by George Armitage Miller, a prominent figure in the field of cognitive psychology discovered that the number of objects an average human can hold in working memory is seven, give or take two. With this limited capacity is no surprise that once the fridge door is closed, it is inevitable that some of the produce is destined for the waste bin.

## **2.2 Current Waste Reduction Methods**

Governments and organisations have implemented various measures to tackle the rising figures in waste. Below describe the techniques used and the strengths and weaknesses that each possess.

### **2.2.1 Manual Labour**

Such efforts include manual labour by distributing flyers aimed to inform and educate individuals if the implications of waste. Engaging with communities by setting up stalls and public demonstrations to raise awareness has been a favourable method for generating interest. This form of engagement is inspirational and informative but an expensive operation; sustaining the interest of the community is tough and effects are short lived.

### **2.2.2 Anaerobic Digestion**

Waste management organisations such as Biffa and the retail giant Sainsbury's have collaborated to recycle food waste using anaerobic digestion. By utilising the gases produced from the waste they are able to generate power to sustain the running of retail stores. Anaerobic digestion creates a circular process where the waste produced by the retailers is pumped back into the production line to fuel the very instrument creating the problem. This method has been questioned as to whether it is a true solution as the resources used throughout the process also leave a carbon footprint.

### **2.2.3 Smart Fridge**

Smart fridges were introduced in the early 2000's as a home inventory management system. Designed to be integrated with our every day lives and to monitor the inhabitants investment. The user inputs the product on either an embedded screen or mobile device. The fridge was designed to keep track and inform the owner if items are running low on stock and support the automatic replenishment of goods. The primary hindrance to sales of this product is largely attributed to cost and lack of infrastructure.

### **2.2.4 Nano Technology**

Most recently, Nano technology has been used to monitor the stages of decomposition in foods. A small gel like cube emits a colour corresponding to a particular stage of decomposition and visually representing the shelf life of the product. Nano technology is able to remove the need for printed sell-by-dates but it still requires the inhabitants to actively open the fridge door, view, process and memorise the colours of the tags for various products.

### **2.2.5 Mobile Application**

Mobile phone applications have been created by charity-funded organisations such as Love Food Hate Waste. This application informs the user of the recommended portion to discourage over purchasing. Other features include recipe recommendations and a shopping list creator and inventory manager. Apps such Love Food Hate Waste and other product login applications all suffer from the same bottleneck, that act of having to manually punch in the product details. This arduous process dissuades many, and the application is soon discarded. Some applications have implemented barcode scanning using the phones camera but if the barcode is damaged in the slightest it is rendered unreadable.

### **2.2.6 Radio Frequency Identification**

Radio frequency identification (RFID) has been utilised in the food supply chain for many years for inventory tracking. Recently Dutch researchers have developed sensor enabled tag, the tag monitors atmospheric changes in the environment the produce is exposed to during transit. By analysing the data collected with the Pasteur sensor tag an estimate shelf life for the produce is generated thus reducing the likelihood of waste occurring. Currently this technology is only available for large-scale shipments and used only to protect the transportation between producers to retailers.

## **2.3 Proposed Solution**

In the past the British government has intervened in attempts to reduce the production of waste. Officials pressured retailers to abolish the multi-buy offers but the suggestion was met with reluctance, instead a compromise was met and the revised promotions allowed the consumers a wider variety of products to choose from. It is evident from this that persuading retailers to prioritise the reduction of waste over the potential increase in revenue is an up hill battle. The multi-buy marketing strategy has proven successful in increasing revenue and responsible trading can easily be overlooked in favour of this.

For this reason the proposed solution is not to try to persuade the retailer to change their practice but the consumer. By equipping the consumer with an application that will monitor the contents of their fridge, over stocking can be avoided and reduce the likelihood of succumbing to the attractive offers. With the incentive of monetary savings and the positive side-effect of waste prevention, the system intends to achieve an up stream ripple effect that will keep the waste at bay with the retailers that in turn will provide enough motivation for the retailers to termination of over production.



### **2.3.1 Automation**

### **2.3.2 Ubiquitous**

## **2.4 Current Item Level Product Identification Methods**

### **2.4.1 Barcode**

## **2.5 Requirements**

### **2.5.1 Functional Requirements**

### **2.5.2 Non-Functional Requirements**

## **2.6 Technology Analysis**

### **2.6.1 Mobile Platforms**

Why i chose android over iOS

### **2.6.2 Java**

Android Java and JavaEE compare and discuss. Scalaroid? IAndroid studio  
inteliJ like IDE.

### **2.6.3 RFID**

Currently used in xyz, provide examples. Different classifications.

### **2.6.4 Cloud Services**

Getting rid of the burden of server maintenace.

**Google and Amazon Web Services** A bit of history

### **2.6.5 NoSQL vs Relational**

## 3 Design

### 3.1 Design Strategy

Activity diagrams Sequence diagram

### 3.2 Architecture Design

Describes hardware software and network infrastructure.

### 3.3 Interface Design

How the user will navigate through the application. Navigation methods such as buttons and settings.

### 3.4 Database and File specification

Defines exactly what data is being stored and where they will be stored.

#### 3.4.1 DynamoDB

DynamoDB is a NoSQL key, value store distributed database designed by Amazon. The original motivation behind this was to cope with the massive amounts of data Amazon produces. The primary principal for DynamoDB is high availability, with data being replicated across multiple nodes if a node eliminating the single point of failure. Heartbeat signals are sent to the.

#### 3.4.2 Android Storage

### 3.5 Program Design

This defines the programs that need to be written and exactly what each program will do.

#### 3.5.1 Amazon Web Service SDK

#### 3.5.2 Multi-platform Consistency

#### 3.5.3 Amazon Web Service Cognito

*This may for the conclusion or implementation.* Security:

#### **3.5.4 Mobile Application**

#### **3.5.5 RFID Client**

### **4 Implementation**

#### **4.1 System Construction**

#### **4.2 Android**

##### **4.2.1 Life Cycle of a Process**

java for android.

##### **4.2.2 User Interface and Responsiveness**

##### **4.2.3 Networking**

##### **4.2.4 Threads and concurrency management**

Design static or dynamic comparidant Activity life cycle. UI and threads

#### **4.3 Setting up Amazon Web Service**

##### **4.3.1 Amazon Web Service IAM**

##### **4.3.2 Amazon Web Service Cognito**

Example policy goes here

#### **4.4 User Authentication**

##### **4.4.1 Third-party Authentication**

#### **4.5 Data Management**

##### **4.5.1 Amazon Web Service DynamoDB**

##### **4.5.2 NoSQL model**

##### **4.5.3 Data modelling**

##### **4.5.4 Caching Data**

offline use

#### **4.6 RFID Client**

### **5 Testing and Evaluation**

Importance, maintainable code.

### **5.1 Unit test and mocking**

### **5.2 Integration Test**

## **6 Review and Conclusion**

### **6.1 Security Concerns**

look at link from George.