MSc Computer Science

Project Proposal

Some Title That I haven?t Decided Yet

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Abstract

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1 Introduction

1.1 Background

Over production of food is a global issue that has negative social, environmental and economical impacts with reports of 1.2 - 2 billion tonnes of waste produced by the world. The food industry is sustained by a complex multifaceted supply chain. Having such complex infrastructure results in ample opportunity for waste to occur.

At the start of the chain exists the producers, agriculturalists and farmers who cultivate the plants and livestock. These entities serve as the primary source of supply to the market and respond to orders placed by the retailers. Over production is often encouraged by retailers to compensate for an unfruitful harvest or sudden and unexpected rise in demand.

The intermediator between producer and consumer are the retailers and vendors, the most dominant being Supermarkets, namely, Sainsbury?s, Tesco, Asda and Morrison. Perpetual competition for marketshare lead to aggressive promoting and competitive pricing wars, with such high stakes involved quantity control becomes less of an focus. Ascetically unpleasing but perfectly consumable food is rejected and used as feed for livestock or discarded. Sales forecasts are also influenced by weather and events, errors in predictions can amount to wastage or the need for storage to sell at a later time. Having more products than necessary is unfavourable for business as the rental of warehouses are expensive and real-estate is valuable, idle stock can cost millions to house annually.

At the end of the chain are the consumers. Consumers are regularly influenced by enticing buy get one free offers and discounts. Retailers discount items that are nearing expiration and sold to the consumer as an attempt to compensate for a potential losses. This method of damage control, while beneficial to the supermarkets has negative financial implications on the consumers. Loss can also occur due to basic human errors of simply forgetting to consume purchased items in time. With many people having busy schedules it is difficult to keep track of past purchases and expiration dates, inadvertently contributing to the statistics.

Item tracking is already deployed in the grocery supply chain with the primary intent as inventory management so suppliers are able to track their assets as they move through the chain. Lack of transparency in the supply chain results.

// Page 12: image add The language of food waste along the supply chain

1.2 Problem

The largest culprit of food waste and the focal point of this project are the consumers. The UK alone is estimated to generate15million tonnes of food waste every year, 7 million of which is generated by domestic households. Below are the issues surrounding this epidemic.

Environmental When food is wasted, this is the direct repercussion of over production and a needless contribution to the expanding carbon foot print. Processes such as pesticide application, cooking, packaging creation and disposal, distribution and temperature controlled storage all require enormous amounts of fuel and energy. Not enough space is available to accommodate for waste, with the rate in which waste is produced it is not maintainable causing landfill sites to overflow.

Economical Typically a UK household has been reported to throw away an average of £940 worth of food annually. This amounts to roughly 50kg of food which puts pressure on the council for waste collection, management and recycling all which can result in high taxes and wasted resources.

Social Influenced by the retailers and succumbing to the bargain deals, customers frequently over purchase food and can cause over consumption. Needlessly consuming to avoid loss can cause health risks such as obesity, diabetes, high blood pressure, cardiovascular diseases that are life threatening and can impact life expectancy rates.

Human Memory Failed stock keeping of household items is one of the primary causes of food expiring before consumption. The human brain is constrained by the limited capacity to store and recall information. Research by George Armitage Miller, a prominent figure in the field of cognitive phycology discovered that the number of objects an average human can hold in working memory is seven, give or take two.[2] Foods vary in categories such as meats, fish, fruit, vegetables and nearly all come with different expiration dates, relying on memory alone to recall is unfeasible.

Lifestyle Busy schedules dissuade people to use produces brought in advance and instead opt for the quick and easier choice of eating out, thus items purchased with the intentions of consumption end up as waste. Fresh produces also usually vary in expiration dates and the synchronisation of dates and combining compatible ingredient to create an appetising dish can be time-consuming and an argues task. Households usually have multiple residents living and double purchasing of items is common due to lack of communication.

1.3 Current Measures to Combat Waste

Governments Various campaigns have been launched with the purpose to educate people on the implications of food waste and waste prevention methods. Such organisations as Waste & Resources Action Programme (WRAP), a registered charity part funded by the UK Government have been raising awareness by interacting with communities and working to promote waste avoidance. A campaign launched by WARP ?Love Food, Hate Waste? (LFHW), which primarily operates through an interactive website advocating recycling and provides the viewer with helpful tips. LFHW utilise social media tools such as Twitter and Facebook to gain recognition and publicity. WRAP have also released an mobile application with features such as shopping lists, recipe suggestions, portion size suggestion in accordance to the number of people serving. A flaw in this logic is that produces are often prepackaged and the weight is fixed, even if the consumer carefully weighed out the correct portion as suggested there is still leftover produce that can end up as waste, thus not addressing the problem of waste management. Another example mobile application is ?Smart Cooking?, developed by the Netherlands Nutrition Centre Foundation (NNCF), aimed to educate people on the reduction of food waste and includes similar features to LFHW.

Wageningen University Researchers in the Netherlands are working with the Netherlands Packaging Centre who offer packaging solutions throughout the supply chain, and with NXP Semiconductors have developed a sensor enabled radio frequency identification (RFID) tag developed to monitor environmental changes in the supply chain. The Pasteur sensor tag has the capacity of measuring environmental conditions such shifts in temperature and gas conditions registered during transportation and various stages of storage. This data is then calculated to give an accurate reading of the shelf life of a product. At the currents state this is only available at the level of producer to supplier level for large crates of produces but in future item level tagging being considered.

Pecking University Scientists in Beijing have also developed a colour coded smart tag that uses nanotechnology to indicate when food is spoiling. The metallic nanorods in the gel mimic the length of time microbes propagate in foods, the more bacteria the further it is in the decomposition process. The tag can also react to varying tempters that can have an effect on the shelf life of a product, this could potentially remove the necessity of sell-by-dates. The accuracy of this technology is currently being tested. Meticulous testing is needed when dealing with such sensitive materials as food to avoid any inaccuracy that could pose a potential health risk.

Smart Fridges Interactive appliances for home food management are designed for integration with the Smart Home and automation of

food ordering. The user will scan products using a installed barcode reader, the fridge is able to keep track of foods and suggest a dish depending on the items residing inside it. It can switch on the cooker to the desired temperature setting and timer using wireless connections and provide instructions on how to prepare the dish. The intention was for it to analyse the consumers purchasing habits and to pre-emptively place the orders so the consumer always has a stocked fridge.

TooSkee & LeanPath Software food management applications focusing on reducing waste and using smartphones to keep track of purchased items. Receipts are scanned and items are logged. Much like the other mobile applications it will suggest dishes and has an additional feature of reminding the user to consume products before the expiration date.

While manual campaigning and promoting can be effective and inspirational the labour force required to generate and sustain interest is costly and impractical. The smart fridge that was heavily anticipated was somewhat anti-climatic as flaws in the practicality of the product became evident. Items had to be manually entered, consumers were tied to a single retailer and the appliance was very expensive, costing over $20,000. Mobile phone applications are the most accessible but users are extremely unforgiving of a poor interface design or performance such as slow content loading. With so many apps available with a tap of a screen, apps have become disposable.

Cutting edge innovations such as the atmosphere and temperature sensing RFID tag and the nanotechnology tag are undeniably beneficial to the supply chain. The only bottleneck for the RFID tag is the cost of production at the individual item level. Nanotechnology could potentially replace printed use-by-dates on products and could provide users with the an accurate reading of the longevity of food but this requires the user to manually open the fridge and memorise the colour of the tags. Presently there is no method for the tags to communicate, the data generated could be valuable for waste management and even retailers. Transparency throughout the supply chain is paramount at this moment in time and is achievable with the aid of machine to machine communication. Products and prototypes mentioned here can be enhanced and with the necessary infrastructure to support it. This leads on to the next topic of the movement of the Internet Of Things.

1.4 Internet of Things and SmartCities

A bit of history The first appliance to go online was a Coca-Cola vending machine developed in Carnegie Mellon University in 1982. Users were able to connect via the internet and check if the canned beverages were chilled, this information would be the deciding factor

on whether the user would make the trip to the machine. This technological advancement gave an insight into a new era were objects were able to cater to our immediate needs, depending on the current circumstance and deliver us information with which we are able to make an informed decision.

SmartCities From the success of the lead to? the SmartCities are being erected in many cities such as blah, the idea behind the development is machine to machine communicating and the enablement of a once passive and inanimate object to be able to actively communicate with other ?things? through a network, sharing data and working harmoniously to maximise efficiency to permissively aid our everyday lives.

Complex pipelines such as the food supply chain is a prime candidate for this type of technological advancement. With the ability and accessibility the internet offers could produce a transparent pipeline enhancing multiple as well as the miniaturisation of products. Minimising waste.

With the surge in popularity in smart devices in the recent decade, in particular the smartphone, which has been positively accepted and integrated into our lives has undoubtably accelerated in the movement of the ?Internet Of Things?.

RFID vs Barcodes Product identification and registration is fundamental for the retailers to keep track of stock, to assess sales totals and demand of products. It is also important for the consumer to be able to identify the origin of the produce, ingredients, allergy information and cost.

For the barcode to be read successfully there must be no obstructions between the laser and the code, this includes dirt or scratches that distort the image. The laser must be kept parallel to the barcode for a successful read and simultaneous scanning is not possible. It is also note worthy to mention that barcodes are unique to the product type but not at the item-level. For example in a crate filled with milk made by the same brand will all have the same barcode. Barcodes are cheap to print and is universally utilised. Barcodes are cheap to print and is universally utilised.

Various sensors have the capacity to detect changes externally ranging from atmospherical to the tangible, signals are emitted and received by other devices were necessary computations are carried out. These smart devices serve as the back bone to shape the future for the Internet of Things.

Electronic Product Code (EPC) Developed in Massachusetts Institute of Technology Auto-ID Centre, with the aim of providing a unique identification for every physical object in the world. EPC Network

1.5 Importance of Item-level Identification

'The amount of food waste in the industrialised countries exceeds the total first production of the whole continent of Africa. This is an incredible waste of human effort and environmental and economic cost. I say, ?On some estimates?, because we very rapidly found that the estimates in this field are rather difficult, which limits the degree to which the EU can play as effective a role as it perhaps ought. We found that measurement of food waste at different stages of the chain and between different countries was pretty incompatible. Until that is resolved, the EU level probably has to be aspirational, exculpatory and a matter of learning from best practice. 12'

Food Safety and traceability

Transparency

2 Aims and Objectives

2.1 Aims

Human memory is depended upon to keep track of our supply at home but repeatedly we simply forget and inadvertently contribute to the statistics. By applying a similar concept as the Coca-Cola machine, we can delegate the responsibility of inventory keeping to the fridge. The fridge is able to behave as a monitor and keep track of items and expiration dates residing inside it. Owners are alerted when the product is nearing the end of it?s life span, giving ample time to use it thus avoiding waste. Simply by putting the fridge online it becomes accessible from anywhere with an internet connection.

One of the core issues discussed in the previous chapter was the invasive advertisement of offers and promotions by retailers. It is easy to over purchase without truly knowing what you possess back at home, not even a carefully prepared shopping list is enough to dissuade the shopper from purchasing an extra bag of salad with the promise of a free one. Retailers have been exploiting this vulnerability for decades but by providing consumers with an option to consult their fridge before making the decision to purchase will keep the shopper honest and able to pre-emptively identify if the investment will amount to waste. The fridge can act as a safeguard for the shopper saving the household hundred of pounds annually and most importantly reducing the carbon footprint.

Supermarkets strive to meet a demand in the market, often this is a contrived demand that is orchestrated by marketing and persuasion to boost revenue. The primary source of waste of resides with retailers but is pushed down the chain and dumped with the consumers. By capping demand this would create a ripple effect that would keep the waste at bay with the retailers that would discourage the over production of food, ultimately targeting the root cause of the problem.

Although this may seem negative for the supermarkets they will also be able to benefit from this technology as millions in rent is waster by idle stock being housed in warehouses, this is a clear sign of waster resources and revenue.

2.2 Objectives

3 Development

3.1 Methodology

3.2 Framework

3.3 Architecture

3.4 Tools

4 Conclusion

4.1 Limitations

5 Schedule

5.1 Timetable

References

[1] fjdsfjds

[2] G.A Miller, emphMagical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information, vol. 63. Cambridge, MA: The Psychological Review, 1956.