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Using Data to Revolutionise Sheffield's Food System

What is SELA?

Sheffield Engineering Leadership Academy (SELA) develops engineering undergraduate students to become leaders of tomorrow, who create positive impact in research and industry. We recruit talent from the University of Sheffield's Faculty of Engineering, work with industry partners and academics, and fast track the development of engineering leaders with the skills, confidence and aptitude to make a positive difference.

Sheffield Engineering Leadership Academy is a leadership development programme for undergraduate students in the Faculty of Engineering at the University of Sheffield. Inspired by the acclaimed Gordon Leadership Programme at MIT, SELA addresses the UK skills gap in engineering by supplementing the outstanding technical knowledge of Sheffield engineering graduates with the skills, confidence and aptitude to take the lead and make a positive impact. SELA members are recruited through a highly competitive selection process specifically designed to identify and recognise potential. Applicants are judged against seven foundational attributes, around which the development programme is designed. Industry involvement is central to the programme. Our industry partners provide motivational speakers and summer work placements, deliver skills training, and offer mentoring to the SELA members. SELA members learn from these opportunities, whilst industry benefits from the opportunity to work with top engineering talent, identify exceptional candidates, and play a role in their education.

What is Regather?

Regather is Sheffield-based cooperative that offer a variety of products and services such as veg-boxes, catering services, venue hire and even a micro-brewery to improve sustainability of Sheffield's food system whilst also having a positive impact on our local community.

They offer a refreshing alternative to typical supermarket shopping by ensuring their produce is local, fresh and traceable. Regather also aims to reduce food waste by employing a "Just in time" strategy, often used in the car industry.

What is Our Goal?

The challenge we are faced with is based on the phrase "Data is the new oil". Everyday, billions of people all over the globe are generating data with almost every move they make. More data has been generated in the past two years than in the entire history of the human race. Everyday, 500 new websites come into existence and if big data was integrated effectively and the US health system could save $300 billion a year. How can Regather and SELA tap into this abundance of data to improve the fluidity of the city's local food system?

SELA and Regather are working together to use data-mining to improve Regather's service and customer transparency. We are collaborating together to build the following:

- A refrigerated locker-style delivery system. This allows customers to order their food boxes and have them delivered to a secure, refrigerated locker for them to collect at their convenience.

- A smart-widget that will be attached to each locker. This will contain crucial (unique) data on the contents of each box. Customers will become aware of information such as food mileage, farm locations, pesticides used in growing their food, CO₂ output and statistical comparisons between their boxes and the equivalent produce if purchased at a supermarket.

- A smartphone application that will display the data usefully to the customer. It will update them about their box orders, include a digital version of Regather's monthly newsletter and also update them about future events at Regather.

The Widget Design Proposal

The Regather boxes shall be fitted with a removable device that will monitor the temperature and humidity of the box, and transmit the data in real time to a central hub. It will communicate using LoRaWAN (Long Range Wide Area Network) radio, provided there is a gateway or connection available to the device. This will be controlled using an Arduino microcontroller such as an Arduino Uno or Nano.

Further Developments to the Widget

Further developments could include GPS technology, like Hermes or UPS or Parcelforce use, so that the customer can know exactly where their delivery is if it hasn't yet reached their door yet. Equally it means that Regather can then know whether the customer has retrieved their box.

The Locker Design Proposal

Below is the SELA team's design proposal for the smart locker. It will be refrigerated, well lit, secure and insulated. The team is currently in talks with staff at The University of Sheffield about manufacturing feasibility. Also seen in the proposal is a graphic that illustrates the widget which will have fully integrated smart functionality.

Regather/SELA Box Prototype 1

The Locker Hub Design Proposal

Below is the SELA team's design proposal for the smart locker hub. Each hub will consist of eight individual lockers with a central interactive console. The hub will be solar-powered which will provide energy for the refrigeration and lighting. Each locker can be opened by scanning a unique barcode that will be given to the customer on their personalised smartphone application.

Regather/SELA Locker Hub Proposal

Why the Veg-Box?

While general retail is increasingly moving online, the vast majority of Britons still buy their food in brick and mortar supermarkets. These provide a large variety of produce for low costs and are thus attractive and efficient for the consumer. The reliance of our food system on supermarkets has downsides. Since the store operator is unable to know demand in advance, they have to stock a huge variety to cater for demand.

Where demand is unknown, supply has to cater for all eventualities, This results in wasted produce, time, and energy. One way to turn this equation on it's head is collect demand before. This allows for efficient, optimized networks that reduce waste and still provide the customer with their produce. Online grocery shopping is the most prevalent, with Tesco being the largest single provider (28% market share).

Online grocery shopping reports much lower waste, 0.05% compared to 10%. But the same characteristics that cause this make them a less attractive option for consumers. It requires much more planning by the customer.

The Plan Going Forward

The Regather Cooperative and the SELA group will continue to work together to develop a functioning prototype - the exact timescale of which is demonstrated in the Gantt chart below. Furthermore, the team is liasing international with 3rd-party companies to perform life-cycle analysis on the various products that Regather has to offer, thus maximising the quantity of data available to the customers. This increases transparency and customer trust.

The Process

Our chosen locker design uses a heat pump powered by a 12V battery pack, fed by a 12V solar panel. The heat pump fan works with the evaporator coils inside the locker to draw heat out . The condenser coils radiate this heat away outside. The locker body is made of plywood, in two layers encasing an insulating sheet. We are considering two methods for locking the box; either using an off-the-shelf solution, 'BoxLock' (with an app that can generate custom QR codes), or issuing programmable RFID tags to each customer.

Another option we considered is using the insides of a mini-fridge to retrofit our locker, which would greatly bring down unit cost. Alternatively, we thought we could use cool blocks on the inside faces of the locker, if we made units without dedicated refrigeration.

- Customer orders food package from Regather Connect.
- Food package delivered to refrigerated locker unit.
- Customer notified in-app that their package is available for pick-up.
- Customer uses custom barcode in-app to unlock their food package's locker.
- Customer retrieves their package. Door automatically closes and the locker is 'wiped' in preparation for a new barcode and food package.

https://regather.net   https://www.sela-sheffield.org