

# Foodchain: Distributed Ledger Technologies for Refugee Food Security

## Motivation and Rationale

### *The Context and the Problem:*

The majority of Syrian refugees in Lebanon are food insecure (where food insecurity is defined as - when all people, at all times, have *physical, social* and *economic* access to *sufficient, safe* and *nutritious* food which meets their dietary needs and food preferences for an active and a healthy life). Because of this, food aid organisations such as WFP (World Food Programme) are investigating the use of Blockchain technologies to improve the efficiency and reliability in the distribution of aid to refugees by running Proof of Concepts in refugee camps based in countries with significant amount of refugee population such as Jordan and Pakistan [1]. They are doing so by making refugees' cash assistance available on a blockchain based system rather than actual cash which makes it easier for WFP to record each and every transaction that takes place without their sensitive data being shared by third parties and also to bypass corruption which happens a lot in the cash-based aid systems where the people assigned for distributing the aid quite often charge some money as a condition of receiving the aid [2].

However, the previous researches done have highlighted that current blockchain practices such as the one implemented by WFP in their system do not account for the practices that refugees engage in. Such practices can just as easily use a traditional centralised database to run their system on and it would not make much of a difference as these systems have been designed from top down keeping WFP's and the UN's needs in mind rather than refugees', whereas what is needed here is a bottom up design of the system which would take into account the needs of refugees and the practices they engage in such as - negotiating with the shop owners for prices and swapping products which cost the same, so as to ensure that they are granted correct amount of aid that they require on the right time without any delays. Furthermore, the mobile app aimed at refugees, called *Dalili*, which is developed to give them up-to-date information on the prices of food items available in shops closer to where they live, also has discrepancies, the major one being that at times the prices on the app are incorrect as they aren't synced with supermarket prices.

### *Solution:*

Considering the problems and flaws in the current implementations of blockchain and the mobile application, the wider scope of my project involves working with a refugee community in Lebanon to get feedback and design a blockchain infrastructure and applications running on top of it accordingly which would facilitate their interactions and transactions that would ultimately aid in coping with their food insecurity. The new system would then also be able to consider the malpractices that take place in refugee camps such as corruption by people in power, and would ensure that this does not happen as the transaction data would have a transparent record of how the aid is distributed. This would be achieved by creating mockups and digital prototypes of individual elements (such as smart contracts and mobile application for the use of refugees) of the proposed system and infrastructure for 'FoodChain'.

As for the scope of my individual project, I will be studying through the survey material that comes along from the ongoing field research in Lebanon being conducted by one of our PhD students from Newcastle University and generating user requirements from that data. I would then use those user requirements to build a digital prototype for a mobile application that would run on blockchain infrastructure and which the refugees would be able to use to find out and compare the prices of food products they want to buy from supermarkets in their vicinity, thus improving their experience of buying the products they want.

## Aims and Objectives

As mentioned briefly in the above section, the aim of my project is to create a mobile application for refugees that can be used to see what kinds of offers and deals are being provided by the supermarkets in their vicinity so they would be able to get better deals and value for their money on products that they buy. As the wider aim of the entire project also involves this application being deployed and run with a blockchain back-end, it would further ensure greater privacy and security when handling personal data of refugees as it would not be visible to any unnecessary third parties. In addition to this, a blockchain back-end for all the systems in the wider scope (such as till machines at the supermarkets, mobile applications, etc.) would mean there would not be any discrepancies between prices displayed on the mobile application and the actual prices of products in shops or of any other kind whatsoever.

Additionally, this would also ensure that an accurate record of transactions is kept as the blockchain system would take into account refugees' all kinds of practices as described in the above section. This would ultimately lead to - development of a mobile application with fluid interface, and also a clean back-end system, because of which refugees would be able to receive the aid and purchase items easily and the aid supplying authorities such as WFP would be able to ensure greater security in their systems and have an accurate record of transactions.

My objectives to achieve my aim are as follows -

1. Investigate the problems refugees face with the current mobile application (Dalili) and other systems that they interact with (such as machines used for checking out at the supermarkets) by going through surveys that are currently being conducted with refugees in Lebanon.
2. Design use cases for the mobile application keeping in mind the needs of refugees as described in the above section.
3. Follow the finalised design pattern, choice of tools and platforms to implement the functionalities of mobile application and build a prototype to get feedback from refugees and/or researchers if it is suitable for deployment and production.

## Background

**Paper:** (Reem Talhouk, Andy Garbett, Kyle Montague, 2018), "Blockchain for Refugees: Current Uses, Opportunities and Considerations"

**Description:** This research paper provides an overview of how blockchain technologies are currently in use within humanitarian responses and highlights the problems with current systems. It then also provides solutions to fixing the said problems.

**Relevance:** This paper frames a huge part of motivation for my project as it is written by one of the PhD students who is actually working on this same project on a wider scope. This paper mentions the current blockchain technologies in use within humanitarian responses, focusing on the refugees' food insecurity problem, and points out the issues that said technologies still fail to address. Progressing further, the paper also outlines a number of opportunities for the blockchain applications to work on to create reliable and efficient blockchain systems that can be used for the welfare of refugees and people in general. This paper basically lays the foundation of my project as it touches several topics addressing mitigating corruption, refugee practices of negotiating with shop owners and transparency in aid systems.

**Web Article:** (Russ Juskalian, 2018), "Inside the Jordan refugee camp that runs on blockchain"

**Description:** This website article explains how WFP has used blockchain practices to build their aid system (Building Blocks) to ensure food security for refugees based in Jordan and Pakistan.

**Relevance:** This article introduces the problem and frames the motivation for my project as it outlines what Building Blocks is and gives an introduction to how the aid system is currently working in war struck countries which is useful to understand how the current blockchain systems in practice have been developed. It mentions the high points of the system but also points out where the scope of improvement is still, which is what I have addressed in my aim and objectives.

**Paper:** (Chris Elsdon, Arthi Manohar, Jo Briggs, Mike Harding, Chris Speed, John Vines, 2018), "Making Sense of Blockchain Applications: A Typology for HCI"

**Description:** This paper discusses how blockchain infrastructure and applications work in general, their uses in various different fields such as finance and identity management and how it can be used alongside HCI going forward.

**Relevance:** This paper explains about decentralised systems, DLTs, blockchain protocols and smart contracts which are helpful in the wider scope of my project as described in the above sections as we would need a working understanding of blockchain terminologies in order to build a platform on it. The paper also explains in depth about advantages of using blockchain for currencies and payment services such as reduction of processing times of international payments which would be very useful in this project where basically the most important issue is to get aid as quickly as possible from WFP, the UN and other organisations from developed part of the world to places with large amounts of refugee population.

**Paper:** (Bettina Nissen, Larissa Pschetz, Dave Murray-Rust, Hadi Mehrpouya, Shaune Oosthuizen, Chris Speed, 2018), "GeoCoin: Supporting Ideation and Collaborative Design with Smart Contracts"

**Description:** This paper introduces a platform named *GeoCoin* which runs on location-based smart contract infrastructures in conjunction with Ethereum/Bitcoin blockchain.

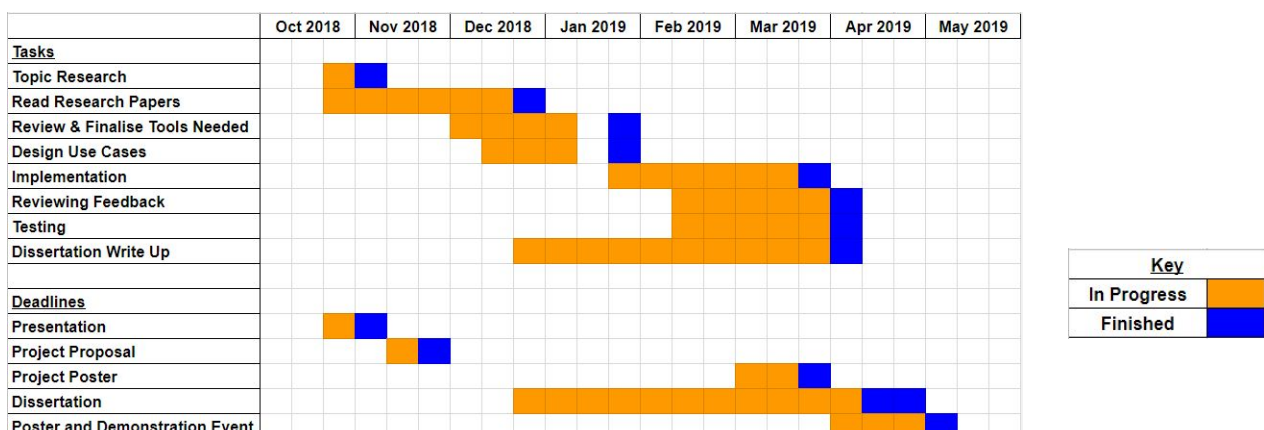
**Relevance:** This paper talks about a blockchain infrastructure having location-based contracts which are particularly useful for me to understand as I aim to develop an application that would run on a blockchain back-end in the wider scope of my project, which would further aim to implement smart contracts (potentially even location-based contracts) for transactions taking place between various parties involved in getting aid from WFP to each of the refugees.

**Website:** GlobalStats, Mobile Operating System Market Share Worldwide: Stat Counter Global Stats

**Description:** This website provides statistics about market share of different mobile operating systems in the world categorised region-wise, year-wise, etc.

**Relevance:** As my project is based around developing a mobile application, I researched on the market share of different kinds of mobile operating systems in Lebanon, the country where the application would be used by the refugees. This website helped me research about the same, and helped me in finalising a platform on which I want to develop the application - Android.

## Gantt Chart



## **Work Plan**

### *Work done so far:*

As shown in the Gantt chart and also explained in the above sections, I have already started off by doing some general research and background reading of articles which go about explaining how blockchain technologies and mobile applications are currently being used for the aid systems already developed for refugees. In addition to this, I have now started investigating on the tools that I would require to build the application and starting to create a set of very high level requirements for it having details such as if the mobile app developed should be cross platform, what sort of database it should use, etc.

I also did a project presentation as a part of my coursework a few weeks back where I presented my project plan in front of 2 members of staff and some fellow students. They critiqued my technical solution which also made me identify some risks to my project which I have now addressed to work on as a part of my future work plans.

### *Future work:*

As can be seen from the Gantt chart, I am still in the process of reading research papers to understand the relevance of the project and the linking of design with applications of blockchain technology to be used in the humanitarian field. Progressing on that, I will then be making a start in the first half of December on designing use cases and building up a set of functional and non-functional requirements for the mobile app which would aim to simplify and improve food purchasing experience of the refugees. I aim to finish this by the start of my exams in January.

I would start working for my next task after my exams in January. This task would involve developing the mobile application ('Implementation' in Gantt chart). I have planned to use Agile development methodology when developing and testing the application, according to which I would be dividing the development and testing work into sprints which would each last for a week and would be spread throughout my timelines for Implementation, Reviewing Feedback, and Timing sections mentioned in the Gantt chart - lasting from end of January to end of March. I have also planned to adopt the MVVM architectural pattern for the development task which would allow me to separate the development logic of the UI for my application from the back-end development logic, and would work neatly with the Agile approach of development as I can then have a modular design for my application which would help me in segregating the modules of the application and working on them in different sprints.

I would be working on specific tasks during each of the sprints such as developing specific functionalities of the application, unit testing, changes to design and the UI if needed (based on the feedback received from supervisors after the end of each sprint). Since I have opted to use a modular design structure, the final stage of my project would be to integration test towards the end of my testing section (end of March) to make sure that all of the components of the app (the UI, controllers and database) work with one another.

Lastly, I will be starting working on my dissertation in the mid-half of December and would keep working on it as I progress through the implementation, testing and other stages of my work plan and keep updating it as I finish with sprints and other work, all the way until the end of March.

## References

1. Russ Juskalin, 2018. Inside the Jordan refugee camp that runs on blockchain. [ONLINE] Available at: <https://www.technologyreview.com/s/610806/inside-the-jordan-refugee-camp-that-runs-on-blockchain>. [Accessed 25 November 2018]
2. Reem Talhouk, 2018. Blockchain for Refugees: Current Uses, Opportunities and Considerations. [ONLINE] Available at: <https://www.hciforblockchain.org/wp-content/uploads/sites/25/2018/04/Talhouk.pdf> [Accessed 28 November 2018]
3. Chris Elsdén, Arthi Manohar, Jo Briggs, Mike Harding, Chris Speed, John Vines, 2018. Making Sense of Blockchain Applications: A Typology for HCI. [ONLINE] Available at: <https://doi.org/10.1145/3173574.3174032> [Accessed 29 November 2018]
4. Bettina Nissen, Larissa Pschetz, Dave Murray-Rust, Hadi Mehrpouya, Shaune Oosthuizen, Chris Speed, 2018. GeoCoin: Supporting Ideation and Collaborative Design with Smart Contracts. [ONLINE] Available at: <https://doi.org/10.1145/3173574.3173737> [Accessed 30 November 2018]
5. GlobalStats. Mobile Operating System Market Share Worldwide: Stat Counter. [ONLINE] Available at: <http://gs.statcounter.com/os-market-share/mobile/> [Accessed 30 November 2018]