Utilizing Web Technology for Improving Food Crop Distribution

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Abstract

During the last hundred years, improvements in mechanical technologies have led to innovations that greatly influenced agriculture—new tools and techniques improved productivity, precision, and land coverage. These advances in technology led to prosperous agricultural economies all over the world; however, food distribution remains a problem today. Foods lose freshness as they are shipped far distances resulting in lower quality goods. Consumers have difficulty connecting to fresh markets and produce grown in their area. Urban environments deal with geographic areas where low-income residents do not have access to fresh food at all. Our project seeks to use Internet technologies to explore methods for increasing connectivity and decreasing strain in these problem areas by finding new methods to connect food producers with consumers.

I. Motivation and Objectives

While there have been many technological innovations related to agricultural improvements, few have explored the inherent difficulties in food and crop distribution. Nutrient dense produce begins to deteriorate as soon as it is harvested from the farm. Foods from tropical regions travel long distances to consumers during colder seasons. Time-sensitive produce is often thrown out merely because it could not find a home in time. Gardeners experience crop-specific surpluses at certain times throughout the season when that crop produces more than the gardener is able to consume. Gardeners may share this bounty with friends and family, but otherwise lack knowledge of how to efficiently share their surplus. Our project seeks to narrow this gap by developing crowd-sourced improvements to food distribution by providing visibility to crop and garden resources.

Many times, knowledge is the weak link in food distribution issues. A grocer may throw out produce because he expected greater demand. A farmer may discard or compost crops he is unable to sell because he is unaware of a better use. Some consumers desire more nutrient-dense foods but are unaware of the options in their area. By creating an interface for this type of data, we provide relief to these stress points that will encourage a distributed system originating at the grass roots. Our high-level objectives to achieve this involve:

1. Connecting consumers more directly to farms and produce markets
2. Connecting gardeners to other gardeners for seed, expertise, or harvest surplus exchange
3. Connecting in-need community members to local community gardens and surplus
4. Helping community members discover food sources in their area

II. Related work

Innovations and powerful computing are providing new solutions to many classical agricultural problems. Automation and robotics aid the physical constraints and manipulation of crop growth. Computer vision allows for the visual identification of crops and preventative action like disease recognition and disposal. Machine and deep learning enable the analysis of ideal crop planting times and conditions. While there exist commercial solutions to improve the logistics behind the distribution of food surplus, these are business solutions unrelated to growing. Our system aims to improve the distribution of locally-grown nutrient-dense foods and promote the sharing of knowledge necessary for crop successes.

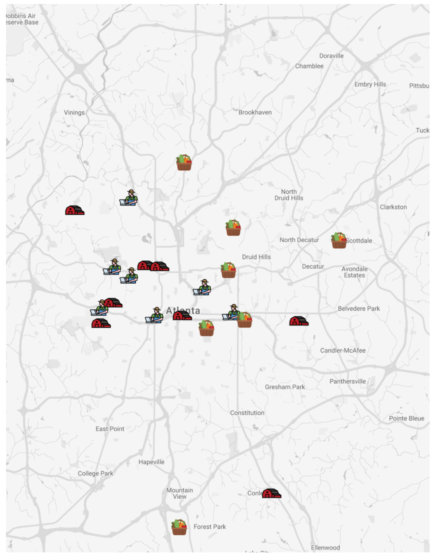

Figure 1: *Map for viewing points of interest*

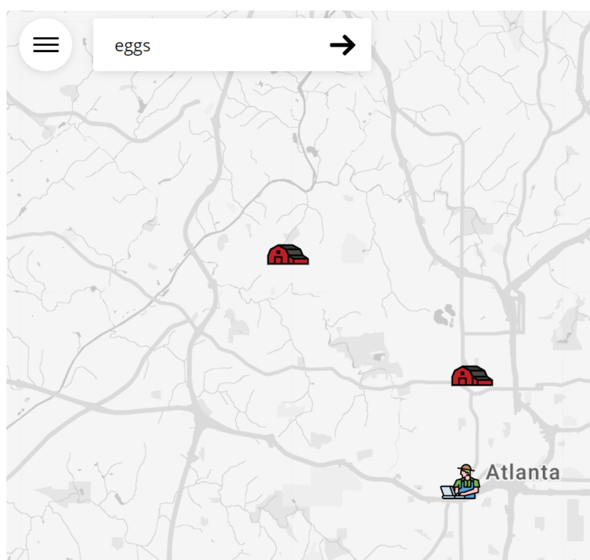

Figure 2: *Use search filters to find locations, types of produce, or seeds to trade with other gardeners.*

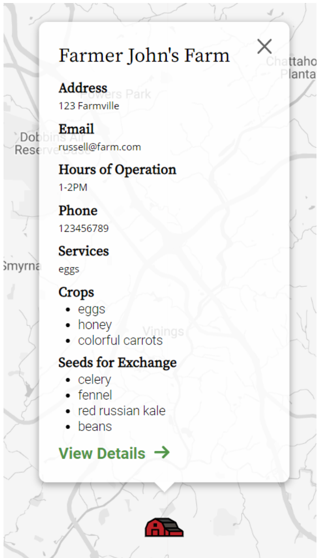

Figure 3: *View detailed information for locations of interest.*

III. Implementation

We implemented our architectural design using a few simple technologies. Google's Firebase handles the user authentication and persistent data storage for the application. This allowed us to focus on the specific and predetermined purpose of our application rather than investing time and effort developing a custom user system or other commonly available functionalities orthogonal to the original problem set.

All front-end user interactions in the application are handled by Vue.js. This creates an extremely flexible and scalable interface that is responsive when new data is passed to the system. All interface components such as the map, search, location toolbar, and photo gallery, all have their own modules that can be extended or reused and customized in the system.

Early in the project, we identified 3 major user types for interaction: gardener, farmer, and market. Gardeners may like to share photos of their gardens or exchange seeds and meet up with other gardeners in their neighborhood. A farmer may wish to post information about his farm or where his produce is available onsite or in local markets. Farmers markets often meet in dispersed locations and brief durations on weekly or monthly bases. The map allows community members to easily visualize locations in their area to understand what is available near them and even learn of new locations. Finally, any generic user that visits the application should be able to view all public locations. Using these three perspectives, we formed our perception of their motivations for using the system in order to determine and prioritize user features that we used to inform the development of the project.

Due to the crowd-sourcing nature of the application design, it is important that all users can log in to contribute their own information to the system. We deployed the application to a public domain here: https://growasis.technology. HTTPS is configured to the remote server for the private transfer of user data.

A video discussion and demonstration of the early interactive system is available here: https://youtu.be/asRmy-QmLtc.

i. Features

- Fully interactive map
- Guest users can view maps
- User authentication
- User account information customization: personal details, crops, and seeds for sharing
- User privacy controls (Profile info, contact, locations, etc.)
- Search produce types and location names
- Provide safe way to contact others for sharing produce (gated upon first contact)

ii. Problems Encountered

- Difficulty implementing for team mates who are not previously familiar with the web platform and technology architecture (i.e Vue.js).
- Server configuration for node.js, slowing development of photo uploads and email routing
- Browser testing - all issues performing consistently on all browsers.
- Difficulty injecting click events into Google Map pop ups for custom actions such as triggering a photo gallery
- Built fully functional responsive interactive user photo gallery, but couldn't implement with custom photo uploads in time due to server configuration with hosting company

iii. Problems We Solved

- Adding points of interest to the map
- Providing visibility to user on fresh produce available in their area
- User logins to store persistent information and points of interest
- Ability to share gardens with friends–provide users with platform to share or find buyers for their crops

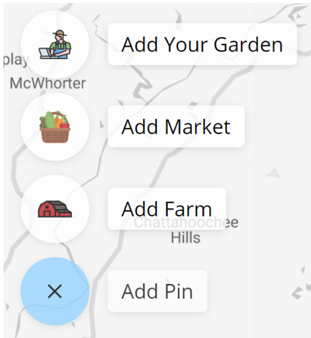

Figure 4: *Log in to add your own data–farms, markets, or your own personal garden.*

- Ability to search desired crops in your area
- Crowd-sourced solution to food crop distribution
- Improve local access to nutrient dense and high quality foods
- Maximize distribution of time sensitive food crops after harvest
- Promote the sharing of knowledge necessary for crop success
- Inspire amateur gardeners to grow and learn
- Increase health of aggregate populations
- Encourage the use of unused land for food growing

iv. Advantages of the System

Our system provides unique advantages not available in any other existing products. These advantages include:

- Knowledge of food origin
- Reduced carbon footprint
- Possible price reduction from direct to consumer
- Fresher produce since they are nearby
- Less waste from less travel time and more efficient distribution
- Accessibility to unique varieties not typically available in the store
- Performance benefits from using Google's full-featured servers (speed, geographic CDN)

IV. Further Extensions

The success of the project merits the generation of new ideas to continue and expand the functionality of our existing application. A few key areas that we see for improvement involve:

- Email proxies for keeping email addresses private.

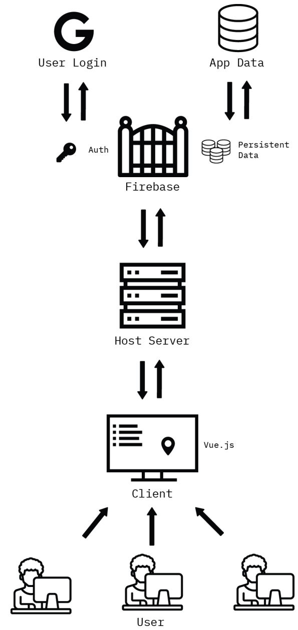

Figure 5: *System architectural diagram*

- Datepicker handling of crop listings for freshness and seasonality.
- User testing to better understand farmers', consumers', and members of the community's needs.
- Payment option using a third-party like Paypal.
- Handling user photo uploads to utilize the photo gallery and user profile photos.
- Expand searches and filters.
- Seek ways to legitimize user data and prevent spam.
- Security and performance testing.
- Add analytics to provide metrics on user interaction choices and data.

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