Web Developing with Block Bins

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EXECUTIVE SUMMARY

Block Bins is a compost collection company based in Chicago that creates food scrap drop off points using shared bins, providing an inexpensive solution to people who want to compost their food scrap. This service is enabled with a website, automation, and data collection & analysis, which were developed and improved over the course of this internship. The goal of this project was to improve the current website with an updated front-end that uses modern web frameworks and a revised back-end that is better tailored to the Block Bins use-case. These improvements would reduce reliance on third-party software and developers, and automate more of Block Bins' workflows. Working on the front-end of the website gave me the opportunity to learn Vue.js, a front-end JavaScript framework, and to utilize the Leaflet API in order to render maps. Developing with Vue.js was a significant aspect of this internship as the framework is increasing quickly in popularity due to all the functionality it provides. Back-end work entailed using Node.js to write scripts that compile collection statistics for each bin, and then analyze the statistics to determine optimal service intervals, and detect overuse, theft, and service issues. Through this process we created a JSON data model for Block Bins to structure its back-end and front-end development around, which will provide guidance for future web development.

CONTEXT

Adequate soil health is necessary for agriculture to occur, and compost is one of the best ways to improve soil structure. However, each American throws away approximately 1,200 pounds of compostable organic waste every year (University of Southern Indiana, 2012). This waste then finds itself in landfills, taking up space and producing methane, a harmful greenhouse gas. In recent years, the general public has become increasingly environmentally conscious and it has led to large growth in the compost industry. The market for compost is expected to surpass $9.2 billion with an average compound annual growth from 2019 to 2024 (Zubair et al., 2019). This growth means that there is currently immense potential for innovation in the field.

Unfortunately, it is often cheaper to send organic waste to landfills rather than compost it. Block Bins acknowledged this fact as well as the potential of the growing compost industry and started working towards creating an affordable composting solution for their customers. Several contributors each pay a monthly subscription for a bin near them where they can drop off food scrap and other compostable waste. Block Bins provides the services of picking-up and maintaining the bins. The collected materials are then delivered to the Harbor View compost facility where it is turned into compost.
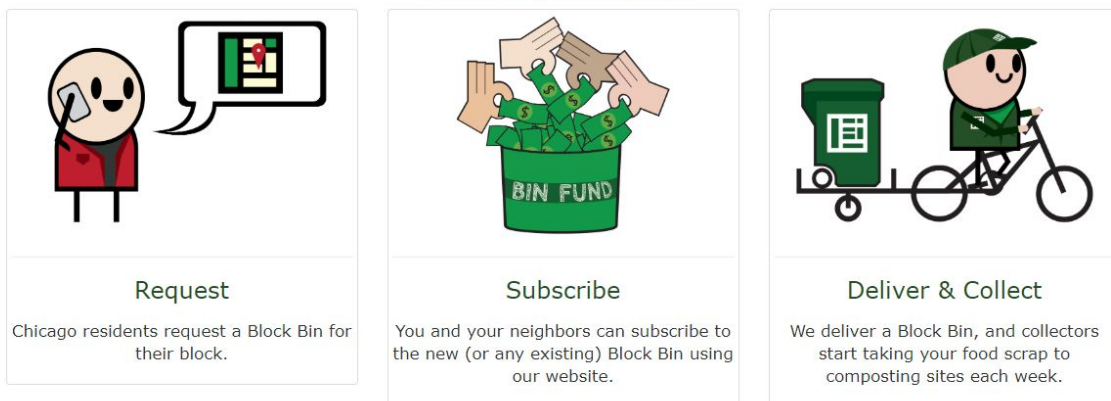
An example of a bin that Block Bins would provide in order to collect food scrap.

DESCRIPTION

While Block Bins may offer an extremely useful and practical service with an excellent business model, the company still needs a credible way for their services to gain attention. My internship focused heavily on achieving this goal through the creation of a quality website. In order to build an adequate website for a business, my mentor and I would have to create something that was easily navigable, allowing for potential customers to find product and contact information quickly, while also presenting the website in a clean and attractive fashion. This type of website would ideally function by conveying all needed information to the consumer, reducing any uncertainty that arises from not being able to assess the product in person (Wells et al., 2011).


How does it work?

Request
Chicago residents request a Block Bin for their block.

Subscribe
You and your neighbors can subscribe to the new (or any existing) Block Bin using our website.

Deliver & Collect
We deliver a Block Bin, and collectors start taking your food scrap to composting sites each week.

One of several instances where information about the service is provided on version 1.0 of the site.

Currently, Block Bins is able to deliver on most of the aspects that a quality website possesses, however the company places a heavy reliance on third-party web developers in order to update and perform maintenance on the site. A reduction in the reliance of these third-party developers would allow for Block Bins to improve the front-end of the website using more recently constructed frameworks, such as Vue.js. The process of learning and utilizing Vue.js for our benefit consumed the first several months of the internship.

There were several reasons for why integrating Vue.js into the second version of the website became the focus of this internship. For starters, Vue.js is able to provide modern tooling and access to certain packages that other frameworks are unable to use. Vue.js is also quickly growing in popularity compared to other relatively older frameworks such as React.js and Angular. A 2020 study from Stack Overflow found that Vue.js had a 15.2% popularity among respondents while the most popular framework, React.js held a 31.3% popularity. However, this survey also revealed that Vue.js's popularity grew by 229% over the course of the year and attracted over 40 million downloads (inVerita, 2020). This period of growth does not show any signs of stopping, meaning that currently being able to utilize Vue.js is an extremely valuable skill.
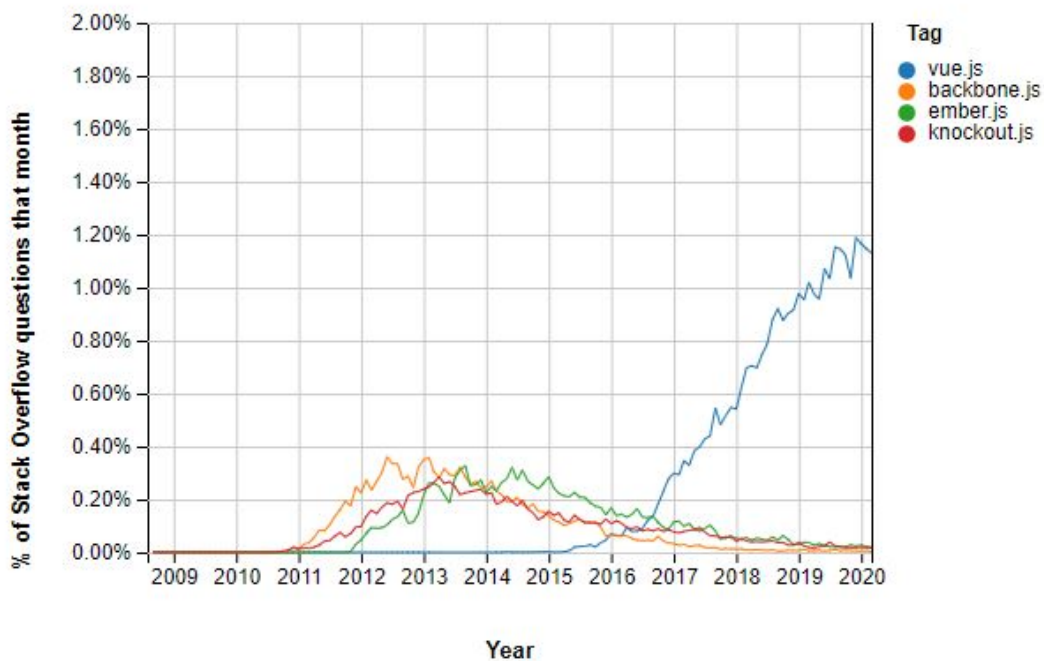
This graph displays the rapidly increasing popularity of Vue.js compared to other small JavaScript frameworks.

Vue.js was also an ideal choice for this internship due to its straightforward and unrestricted nature compared to other JavaScript frameworks. In addition to

this, Vue.js is also able to provide many tools that prevent the need for my mentor and I to learn JavaScript. This was essential to the internship, as our time was limited and studying JavaScript would consume lots of valuable time. There was also one package that Vue supported that was significantly helpful to our project, Vue2Leaflet. Leaflet is an open-source application programming interface (API) that provides interactive map functionality to websites. This interactive map is one of the main features of the Block Bins website, as it allows visitors to see where current bins are located and they can search their address to find if there are any bins near their home that they are able to subscribe to.
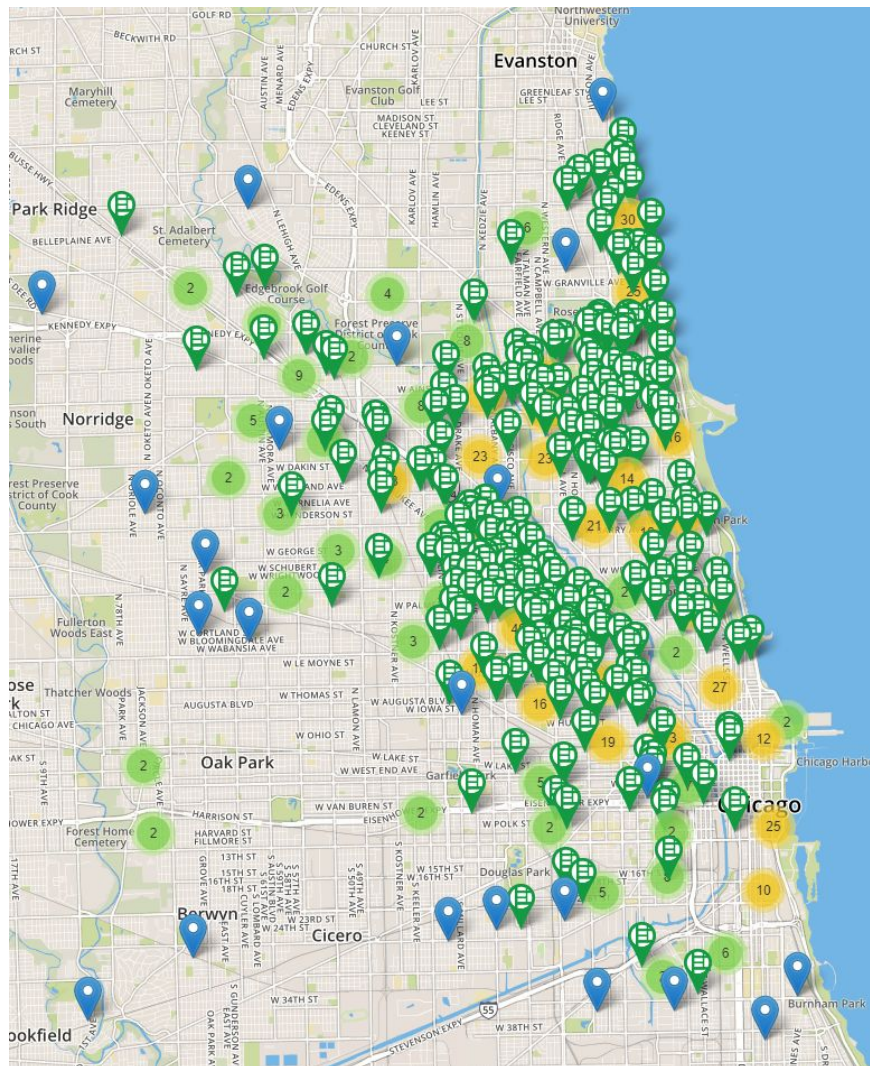
An example of the current map that Block Bins uses on their website. The markers with the Block Bins logo represent existing bins. The blue markers represent individual requests for bins and the green/yellow circles are a way of grouping individual requests that are close together and displaying the count.

Rather than continuing to focus on the front-end, the second half of the internship instead revolved on developing a functional back-end of the website

that would help automate some of Block Bins workflows. The collectors at Block Bins collect data each time they service a bin, including statistics such as the service date and gallons of compost collected. Combining the knowledge for each bin with customer information from the Stripe API (Block Bins online payment processor) can yield beneficial results that would help the company become more efficient.

Using Node.js, my mentor and I worked together to create several scripts that analyzed data for us and prevented the need for manual work in the future. One of the first scripts that we created parsed an excel sheet (or any csv file) and recorded information such as the amount of gallons collected for every service date for every bin. This data was added to a JSON (JavaScript Object Notation) data structure, which is formatted in key/value pairs (W3Schools, n.d.). Properly structuring and and creating a reusable JSON object was crucial to this project as it would allow for a less painful creation of future scripts.

Some of these scripts proved to be immensely useful to Block Bins. For instance, one script took the average gallons per service date as an input, and was able to output how often Block Bins collectors should be servicing each individual bin. Another script was able to reference the Stripe API in order to gather the number of customers subscribed to each bin for each service date. Using this information would allow us to flag bins for overuse if the average gallons of compost per customer of that bin exceeded a certain value. During the second half of the internship, my mentor and I would spend almost all of our time writing and revising these scripts.

```
12
13   function performAnalysis() {
14       //Sort service log by service dates
15       Object.keys(binData).forEach(function(item) {
16           binData[item] = binData[item].serviceLog.sort(function(a, b) {
17               return new Date(b.ServiceDate) - new Date(a.ServiceDate);
18           });
19       });
20
21       Object.keys(binData).forEach(function(item) {
22           var avgBinGallons = 0;
23           analyzedBinData[item] = {};
24           var binTotal = 0;
25           var numMonths =
26               (new Date(binData[item][0].ServiceDate).getTime() -
27                   new Date(
28                       binData[item][binData[item].length - 1].ServiceDate
29                   ).getTime()) /
30               2629746000;
31
32           //Catch bins with only one service date. We should REALLY be measuring from the service start date
33           if (numMonths == 0) {
34               numMonths = 1;
35           }
```
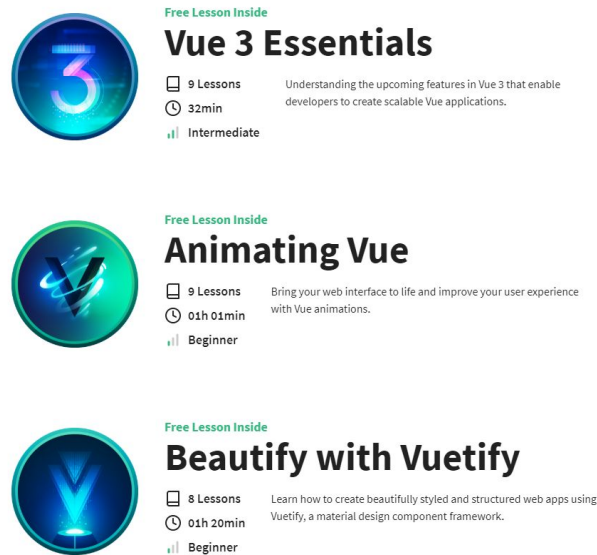
This script uses Node.js to manipulate and access JSON objects. In this piece of code, the service dates for each bin are first being organized chronologically and then the number of months are found by

subtracting the time between the newest service date and oldest serviced date (in milliseconds). It then divides this number by the number of milliseconds in a month to compute the number of months.

RESEARCH

Due to my limited initial knowledge of website development, a lot of my time spent working on this business project was solely dedicated to research. The research was driven by two main questions: how can Vue.js be used to create a functional website and determining whether code can be used as an efficient way to automate Block Bins workflows. The main method used to research these questions was learning through online sources, most notably VueMastery and Stack Overflow. These online tools provided useful examples of code that my mentor and I could learn from and then apply that knowledge to create our own functional scripts.

Over the course of my internship, I spent approximately 15 hours going through different video tutorials and practicing the different problems that VueMastery provided. The concept of VueMastery is providing the user with different courses, each related to a certain capability that Vue.js provides. Each course consists of a series of videos that inform the audience about how to use this capability to its full extent while also ensuring that the code is easy to read and will be ready for maintenance in the future.
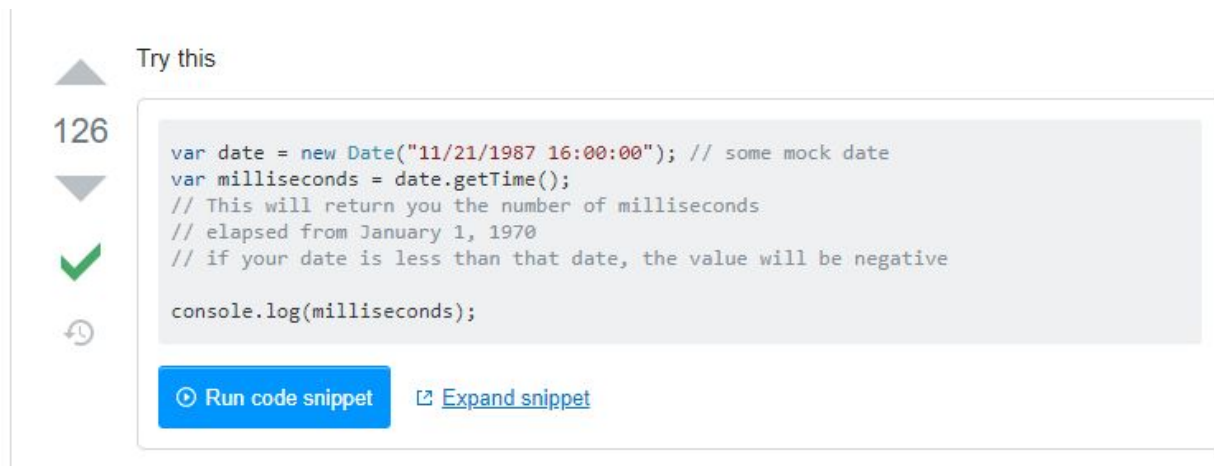
Free Lesson Inside
Vue 3 Essentials
9 Lessons
32min
Intermediate
Understanding the upcoming features in Vue 3 that enable developers to create scalable Vue applications.

Free Lesson Inside
Animating Vue
9 Lessons
01h 01min
Beginner
Bring your web interface to life and improve your user experience with Vue animations.

Free Lesson Inside
Beautify with Vuetify
8 Lessons
01h 20min
Beginner
Learn how to create beautifully styled and structured web apps using Vuetify, a material design component framework.

This is a screenshot of VueMastery's GUI. In this example, there are three different courses that each focus on a different aspect of Vue.js.

Stack Overflow was another resource that proved to be immensely useful during the internship, especially when VueMastery did not provide the specific information that was needed. On this platform, any user is able to ask a question related to coding and receive almost immediate responses from the expansive community. Although the questions were often related to the project of the asker, it was still useful to analyze the answers to their questions and incorporate these answers in order to create working and polished code.

An example of an answer to a question asked on Stack Overflow on how to convert a date to milliseconds in Node.js.

However, researching and learning from online sources was not always the most efficient way to learn how to code. For example, there are a lot of complex topics that arise when using Node.js to code the back-end of a website. The most notable problem that my mentor and I faced with Node.js was dealing with the asynchronous await and chaining functions together. Even with online sources, it was still confusing to us and we were unable to receive the necessary help to our questions. For learning these more complex topics, a classroom setting would be ideal as there a teacher would explain the concepts more thoroughly than a website. However, it was more beneficial to our internship to pursue online learning in the interest of time.

KEY LEARNINGS & RECOMMENDATIONS

Besides causing me to realize the need for society to adopt composting, this internship has taught me a lot of valuable information that I did not know prior. For instance, I did not know how much free material for learning code was available online. I also did not know that I would actually be able to create something useful just given this free material. It is unbelievable how easy it is to access and study these resources and develop a skill that can be extremely

profitable. Learning new programming languages online is something I will continue to do even after this internship ends.

Another major realization that occured to me during this internship was the importance of data to a company. Just by recording the amount of gallons collected for each service date was enough information to write a script that automatically determines the pickup frequency for each bin. Analyzing data can make a company much more efficient and profitable, and writing scripts to allow future data to be automatically analyzed is significantly more useful than sorting through the data manually each time.

I think that Block Bins has a couple things it can still improve on when it comes to web developing and automating workflows. One would be to continue making the second version of the website. The goal of this internship was never to complete the second version, but to set up some of the front-end so it could be accomplished in the future. While the current version of the Block Bins site is functional and provides all the necessary information, it would be helpful to make it more user-friendly by updating some of the visuals and automating ways of contacting the company directly. In addition, I think that automating the process of sending emails to customers would save tremendous amounts of time for the company. While working at my internship, I noticed that my mentor was constantly responding to emails from customers, and he was constantly sending similar replies. Instead, scripts can be written to identify certain groups of customers that need to be sent a common email and then send a pre-written message.

My internship with Block Bins was genuinely a helpful and interesting experience. I gained a lot more knowledge from my work than I first expected at the start of my business project. Besides just learning how to utilize the Vue.js framework or write scripts with Node, I also gained a deeper understanding of how smaller businesses function as well as the importance of collecting and analyzing data. I believe that this information will be of use to me in my future endeavours and I will continue to extend my knowledge through online learning.

REFERENCES

inVerita. (2020, March 26). Why Is Vue.js a Front-End Trend of 2020? Retrieved From https://medium.com/@inverita/why-is-vue-js-a-front-end-trend-of-2020-4081e8c799aa
Vue.js scored a 15.2% popularity among respondents according to a Stack Overflow study. This percentage has increased by 229% compared to last year. The company inVerita argues that this growth can be attributed to the easy integration and usable yet still flexible tooling that Vue.js provides. The framework has already attracted over 40 million downloads and offers a less time-consuming option for those who do not want to learn JavaScript or a more difficult framework like React.js or Angular.

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The University of Southern Indiana has gathered lots of data in order to
promote recycling on their campus. This includes the fact that the average
American throws away 1,200 pounds of compostable waste every year.

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https://www.w3schools.com/js/js_json_objects.asp
W3Schools is a free online learning tool that provides anyone looking to
learn how to code with detailed written tutorials. This particular page
describes the nature of JSON objects. These objects hold data in key value
pairs and can store different types of data in order to form more complex
structures. Once stored, these values can be later accessed, added on to, or
deleted from the object entirely.

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Quality Influences Perceptions of Product Quality and Purchase Intentions. *MIS
Quarterly*, *35*(2), 373. doi: 10.2307/23044048
This study published by MIS Quarterly reveals how websites are able to
influence and change the perceptions of consumers. The study was
designed in order to consider how changing a website could signal
credibility and found that website quality directly influenced the
consumer's perception of product quality. They theorized that this was
likely due to information asymmetries (the lack of information the
consumer had as they could not view the product in person). In order to
make up for information asymmetries, a website should provide lots of
detailed information about their product.

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Biological
nutrient removal and recovery from solid and liquid livestock manure:
Recent advance and perspective. *Bioresource Technology*, *301*, 122823. Doi:
10.1016/j.biortech.2020.122823
The article poses the option of removing nutrients from solid manure and
then composting it. This method of nutrient recovery seems even more
probable because of its low cost and the fact that the compost market is
currently increasing.