



MONTCLAIR STATE
UNIVERSITY

Montclair State University
**Montclair State University Digital
Commons**

Theses, Dissertations and Culminating Projects

12-2020

MCST : An App for Patron Awareness of COVID-19 Safety Measures Instituted by Small Businesses

Jorge Torres
Montclair State University

Follow this and additional works at: <https://digitalcommons.montclair.edu/etd>



Part of the [Software Engineering Commons](#)

Recommended Citation

Torres, Jorge, "MCST : An App for Patron Awareness of COVID-19 Safety Measures Instituted by Small Businesses" (2020). *Theses, Dissertations and Culminating Projects*. 676.
<https://digitalcommons.montclair.edu/etd/676>

This Master's Project is brought to you for free and open access by Montclair State University Digital Commons. It has been accepted for inclusion in Theses, Dissertations and Culminating Projects by an authorized administrator of Montclair State University Digital Commons. For more information, please contact digitalcommons@montclair.edu.

MCST: AN APP FOR PATRON AWARENESS OF COVID-19 SAFETY MEASURES
INSTITUTED BY SMALL BUSINESSES

Master's Project Report
Submitted to the Graduate Faculty
of Computer Science, Montclair State University

By
Jorge Torres

In Partial Fulfillment of the Requirements
for the Degree of Master of Science (MS)
in Computer Science (CS)

Advisor: Dr. Vaibhav Anu
Co-advisor: Dr. Aparna Varde

December 2020



Montclair State University
Montclair, New Jersey

ABSTRACT

Small businesses across America are having restrictions placed upon them due to the COVID-19 pandemic. Those fortunate enough to remain open now face the challenge of trying to generate enough revenue to stay afloat. Small businesses, with their lack of funds, have resorted to listing their safety precautions on their front door to inform patrons. However, viewing these rules would require patrons to leave their homes. Additionally, there is no consistent set of rules being enforced by the government which is dangerous as some patrons may feel that stricter procedures be in place. These inconsistencies and lack of information can lead to patrons being afraid of visiting stores which then harms revenue. To better recognize what precautions each business is taking the MyCovidSafeTown (MCST) app was developed to allow users (i.e., patrons) to find any registered small businesses in the area and inform them of the COVID-19 safety precautions being taken.

TABLE OF CONTENTS

ABSTRACT.....	iii
1. Introduction.....	1
2. Methods.....	2
2.1. Wireframe Survey Results	5
3. Models.....	8
4. Implementation	9
4.1. Browse Page.....	10
4.2. Search Page	11
4.3. Store Page.....	12
5. Results.....	13
6. User Surveys	15
7. Conclusion	19
8. Acknowledgement	20
REFERENCES	21

1. Introduction

With the pandemic expecting to last over a year, businesses and patrons are being forced to adapt to the new environment. For patrons specifically, this includes worrying about what safety precautions are being taken by local businesses or if these businesses are even open at this very moment. Businesses, small ones especially, are also facing challenges such as operating with less staff and operating for fewer hours. Large businesses will have enough stored income to continue operating while searching for ways to adapt. Small businesses however, in a study done by Alexander W. Bartik, it was reported that 75% of businesses that participated in the survey only had enough income stored to last a maximum of two months [1]. It is important that these businesses continue to get a steady flow of patrons into their stores as failure to do so means closure.

Patrons, having been in lockdown for several months now, would like to frequent stores again. This does not mean that they are willing to risk their lives or the lives of their families simply so that they can visit a store. If a patron enters a store which does not take anti-COVID-19 precautions (e.g., requiring face masks if inside the store, sterilizing all frequently touched items, and dining outside to allow proper airflow) then that store is gambling away the lives of their patrons. In addition, if patrons do not know the policies a store is using to protect its patrons, then it is the equivalent of there being no policies at all. Fear plays an important role in deciding whether visiting a store is worth the risk of death. Thus, informing patrons of which stores are including anti-COVID-19 practices and reducing that level of fear is important. This raises the question of how such information will be spread.

In response to this, MyCovidSafeTown (MCST) was developed with the intention of informing the patron of COVID-19 related information and how small businesses are changing

to accommodate the new normal. If a patron wants to check if a business is open or what precautions said business is taking, then MCST is designed to show that. In addition, should a patron want to ask questions (e.g., Asking if a certain item is in stock, or if the store takes reservations.) MCST allows for this through email and phone calls. MCST provides patrons with the information they require by connecting them with the small businesses that lack the advertisement funds needed to convey that information. Ultimately the goal of the app is to show what stores are open near the patron and how it is keeping its patrons safe from the pandemic.

2. Methods

Before creating the app, its design must be planned out first. This involved developing a wireframe for the app. A wireframe is simply a mock-up of how the app is planned to look and function once it is in development [2][3]. This allows us to see how pages will look and reduces the need to think about design later at the implementation stage of development. Here, the focus is on making sure the user has the visual clarity to see all the app's functions while also having all the tools a user might need when using an app like this.

An example of how visual clarity is planned for is in Figure 1 in which the landing page can be seen. The landing page is the first page a user will see when they open the app. This is also the page which has the most diverting paths available to navigate from and thus it is important to make sure the user can see all of these paths and understands what each button within their first few seconds of arriving at this app. If the user does not understand what to do at any page of this wireframe, then the design has failed to assist the user. However, it is because this is a wireframe that improvements can be made to the design during or even before implementation of the app.

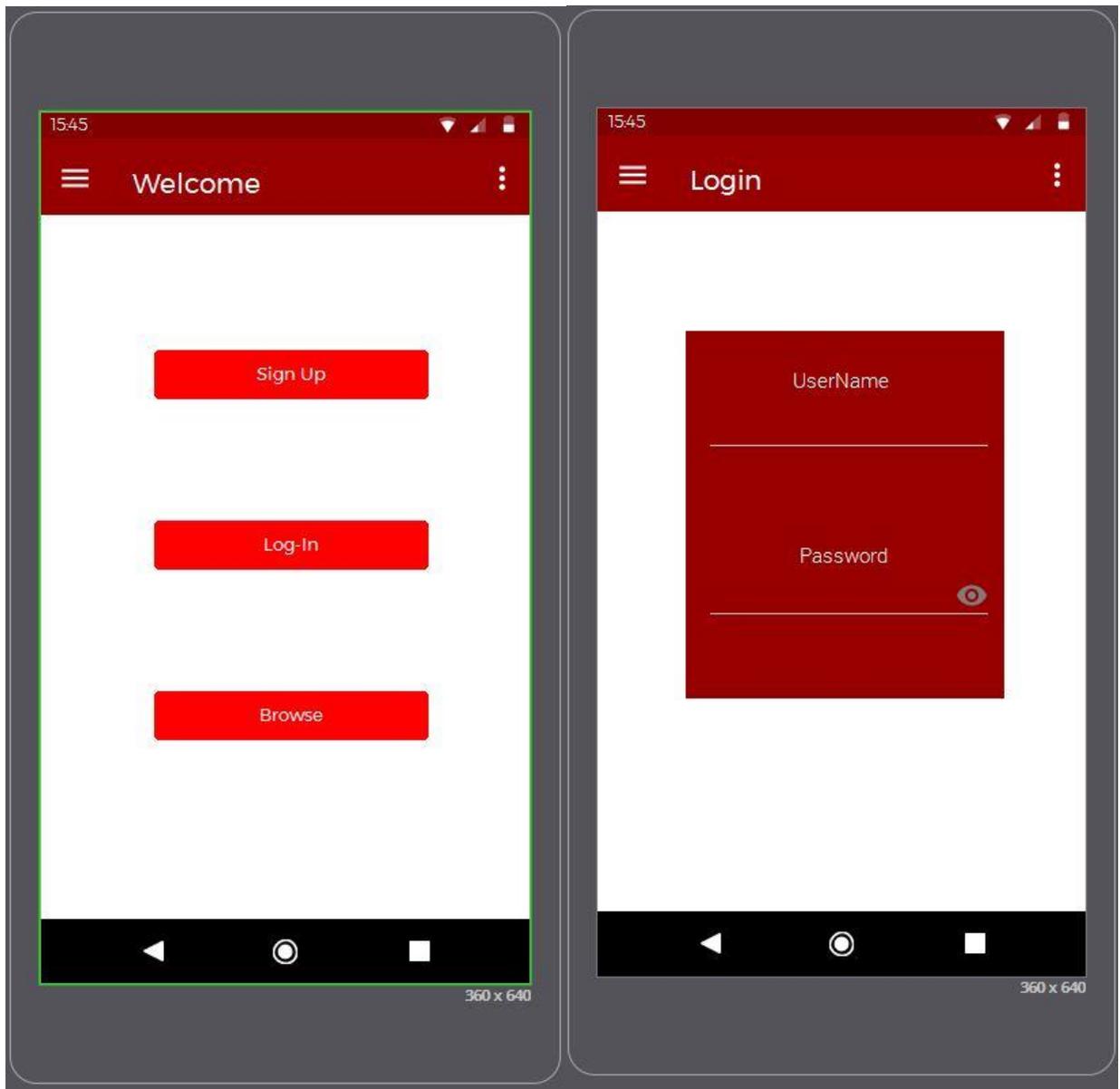


Figure 1 & 2. Welcome Page & Login Page: Wireframe versions of the Welcome and Login page. The Welcome Page is essentially the landing page of the app and the first thing the user would see. The Login Page is the next page a Vendor would see after clicking “log In” on the Welcome Page.

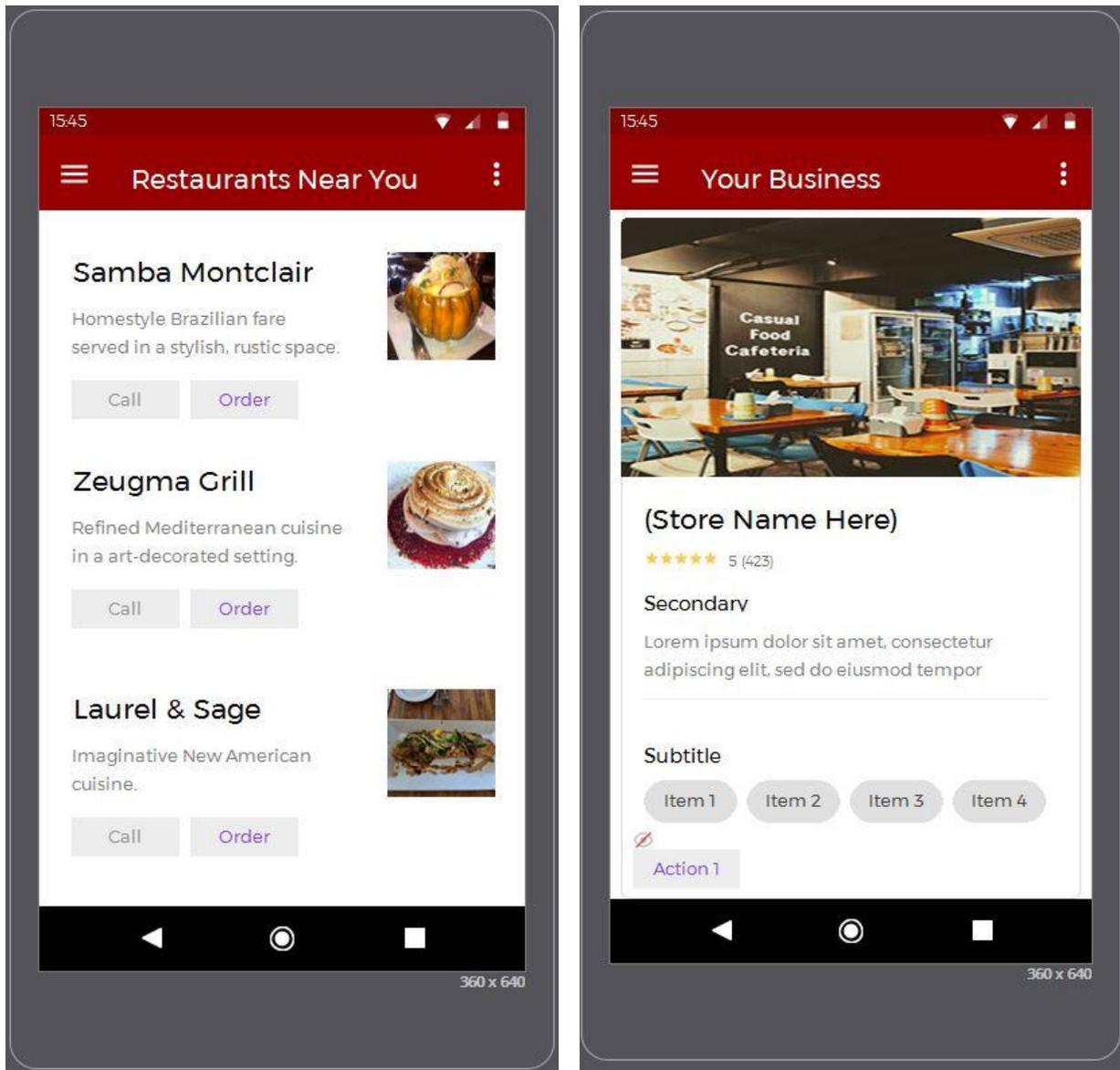


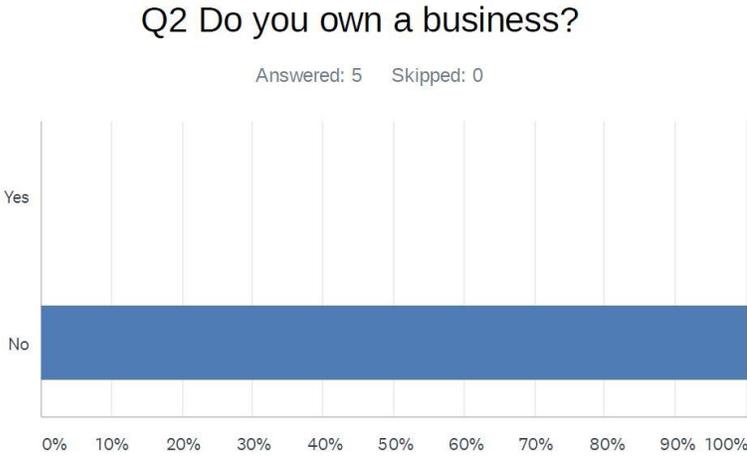
Figure 3 & 4. Browsing Page & Store Page: Wireframe versions of the Browsing and Store page. The Browsing Page is how users can select the store they are interested in finding. The Store Page displays all the information a user could want when viewing their desired store.

Looking at the figures above, we see Figure 1 which is the starting page in which the user can Login, Register, and Browse the app. Figure 2 is just a quick view of how the login will look. As a quick aside, all these pages have a menu bar near the top of the screen which allow for additional options. The next is Figure 3 which showcases how a user would find a store that they interested in and when they click on one they like they are directed to Figure 4. Figure 4 is

simply a store page which includes hours of operation and Covid-19 precautions which is the entire reason for this app in the first place. After having constructed the wireframe, next was to do surveys to see how an audience would react to the app.

2.1. Wireframe Survey Results

Surveys are a very important part of developing an app. Without surveys there would not be a reliable way to gauge user interest in the product being made. The product could be perfect and have absolutely no bugs, but if there is no interest in the product it will not be used. It is for this reason that surveys were conducted for this app after development of the wireframe and after completing the app. The following figures are results achieved after showcasing the wireframe of the app.

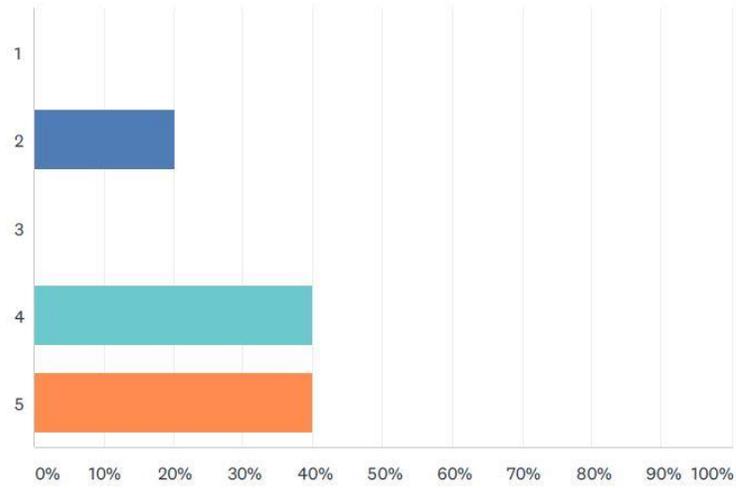


ANSWER CHOICES	RESPONSES
Yes	0.00% 0
No	100.00% 5
TOTAL	5

Figure 5. Question 2 of wireframe survey: This question asks if the user owns a business. Given that the app is designed for both vendors and patrons, it is important to get the opinions of both type of users.

Q3 Please rate the quality of the app's design.

Answered: 5 Skipped: 0

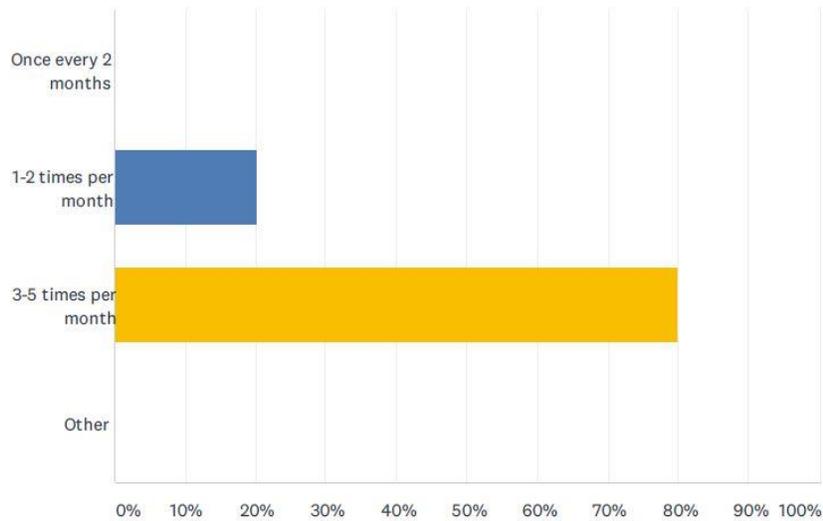


ANSWER CHOICES	RESPONSES	
1	0.00%	0
2	20.00%	1
3	0.00%	0
4	40.00%	2
5	40.00%	2
TOTAL		5

Figure 6. Question 3 of wireframe survey: This question asks users to rate the quality of the app's design. Without this we would not be able to gauge how users feel about the appearance of the app. Here we can see there are mixed opinions and thus the app needs a few improvements.

Q4 How frequently would you use this app?

Answered: 5 Skipped: 0



ANSWER CHOICES	RESPONSES	
Once every 2 months	0.00%	0
1-2 times per month	20.00%	1
3-5 times per month	80.00%	4
Other	0.00%	0
TOTAL		5

Figure 7. Question 4 of wireframe survey: This question asks users how often they would use the app. This is because an app only has value if it is used. As we can see here it would be used 3-5 times per month by most users which indicates the app would be used quite frequently.

Looking at the survey, we can see that there is interest in the app, however its design could use some improvements. These are results we would not have been able to improve upon without the help of these survey participants. Having discussed all these Figures it now becomes apparent that being able to navigate through each of the pages is just as important as the appearance of the pages individually. This is discussed in the next section.

3. Models

While wireframes are great for testing appearance and visual clarity, they are not great for viewing the structure of the app. To accomplish this, we must rely on models like sitemaps and other Unified Modeling Language (UML) Diagrams. UML Diagrams are general purpose diagrams with the intention of allowing the developer and users of the app to easily see the app's workflow [4]. Looking at the Sitemap presented in Figure 8, the flow of the app can be seen forming. This is indicative of how the final app will look while also allowing for changes to be made prior to the final product. For example, in Figure 8 we can see a user starting on the Landing page and then potentially clicking on Login. Assuming the user then logs in, he/she will then have access to the Edit Profile, View Vendor Page, and Browse pages.

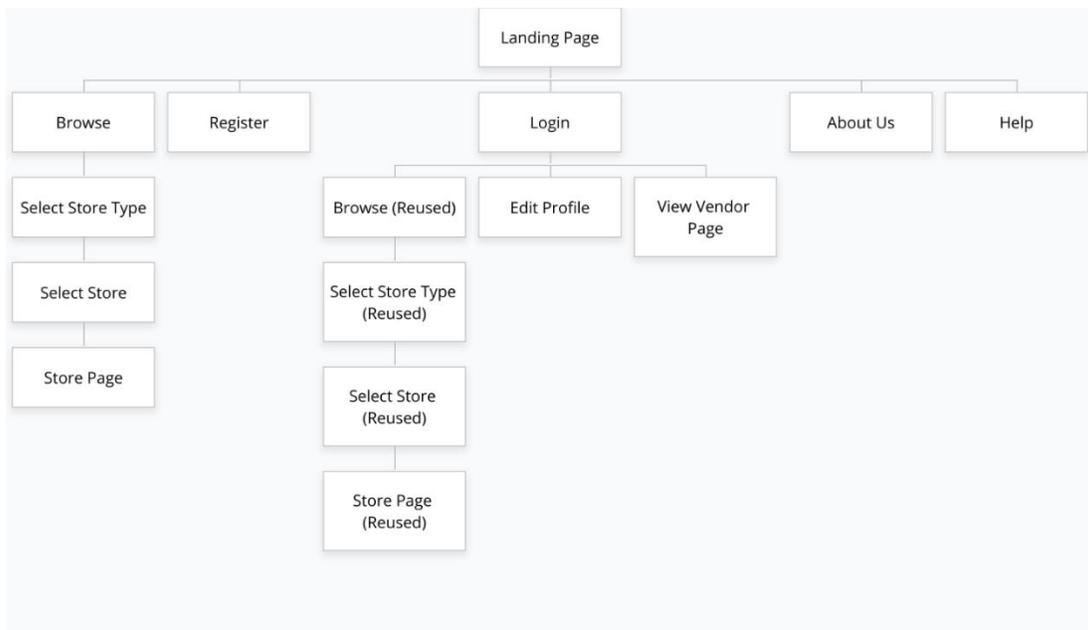


Figure 8. Sitemap: Shows the planned routes for accessing the site. Without this we would not know what page leads where. Essentially the blueprints of the app.

A Sitemap is also not the only diagram needed when designing an app. In the case of this specific app, it requires data to be stored and then called upon frequently. To do this a database is needed and another diagram is needed to map out what is going to be on that database. In Figure

9 we can see that the database is split into two tables with one being the User Account for the vendors and another table for the businesses. Both of which contain several details like names and contact information which will be needed when viewing the store pages in the later portions of the app. After this has been accomplished the app can begin development.

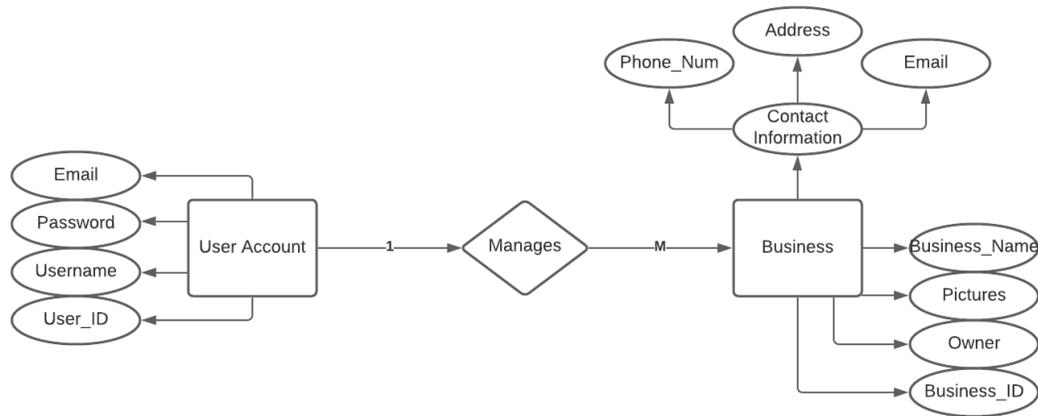


Figure 9. Diagram of the Database Structure: Shows how the database looks like from the back end. Without this we would not know what to store in the database and might even waste space on useless information.

4. Implementation

To implement an app a few details must be discussed first. Mainly the platform and coding language must be established along with any programs that are being used. This app was designed for android and thus uses Android Studio [5]. Android Studio uses both Java and eXtensible Markup Language (XML). In addition to all of this it also uses features outside of the app. For example, SQLite is used as a database and in addition calling, email, and GPS features were added which require other apps from the phone. These all required allowing specific permissions like Google’s API for GPS. Fortunately, since Android Studio is the main program used for developing apps it allows for these permissions to be implemented through its program alone except for a few API codes that needed to be transferred. The next section will discuss different parts of the app and how they have been implemented.

4.1. Browse Page

The Browse Page, of which we see the code for in Figure 10, shows the toolbar used in addition to the different buttons that will be used to pass filters depending on the button pressed. If the user presses “Button1” then the search results will filter for Restaurants specifically. This applies to the three other buttons which each filter for different types of stores. The final results can be seen in Figure 14.

```
ImageButton Button1, Button2, Button3, Button4;
public static final String Type = "com.example.myapplication5.Extra_Type";
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_browse_buttons);

    Toolbar toolbar = findViewById(R.id.toolbar);
    setSupportActionBar(toolbar);
    getSupportActionBar().setTitle("What are you looking for?");

    Button1 = findViewById(R.id.buttonA);

    Button1.setOnClickListener((view) -> {
        Intent newintent = new Intent( packageContext: BrowseButtons.this, SearchResults.class);
        newintent.putExtra(Type, value: "Restaurant");
        startActivity(newintent);
    });

    Button2 = findViewById(R.id.buttonB);

    Button2.setOnClickListener((view) -> {
        Intent newintent = new Intent( packageContext: BrowseButtons.this, SearchResults.class);
        newintent.putExtra(Type, value: "Grocery");
        startActivity(newintent);
    });

    Button3 = findViewById(R.id.buttonC);

    Button3.setOnClickListener((view) -> {
        Intent newintent = new Intent( packageContext: BrowseButtons.this, SearchResults.class);
        newintent.putExtra(Type, value: "Hotel");
        startActivity(newintent);
    });

    Button4 = findViewById(R.id.buttonD);

    Button4.setOnClickListener((view) -> {
        Intent newintent = new Intent( packageContext: BrowseButtons.this, SearchResults.class);
        newintent.putExtra(Type, value: "Pharmacy");
        startActivity(newintent);
    });
}
```

Figure 10. Code for the Browse Page: Shows how the different buttons operate and what filter they pass on to the search results page.

4.2. Search Page

The search page is the code see in Figure 11. In it we can see how the data gets sorted into a results page seen in Figure 15. The two more important takeaways from this code are how we retrieve the data from the database and store it into multiple arrays. These arrays are then all called together at Index 1 then Index 2 and so on. The rows we see in the Figure 15 are all one row duplicated with the information from the arrays swap out each time.

```
//Database
myDB = new DatabaseHelper( context: SearchResults.this);
businessName = new ArrayList<>();
description = new ArrayList<>();
phonenumber = new ArrayList<>();
email_bus = new ArrayList<>();
bType = new ArrayList<>();
bImage = new ArrayList<>();
bImage2 = new ArrayList<>();
CovidInfo = new ArrayList<>();
bStreet = new ArrayList<>();
bState = new ArrayList<>();
bCity = new ArrayList<>();

storeDataInArrays();

Adaptor = new Adaptor( context: SearchResults.this, businessName, description, phonenumber,
    email_bus, bType, bImage, bImage2, CovidInfo, bStreet, bState, bCity);
recyclerView.setAdapter(Adaptor);
recyclerView.setLayoutManager(new LinearLayoutManager( context: SearchResults.this));

Intent intent = getIntent();
type = intent.getStringExtra(BrowseButtons.Type);
//search for correct row to search in database (getAllbusdata)
}

void storeDataInArrays(){
    //Cursor cursor = myDB.GetBusDataFilter(type);
    Cursor cursor = myDB.readAllData();
    if(cursor.getCount()==0){
        Toast.makeText( context: this, text: "No Data found",Toast.LENGTH_SHORT).show();
    }
    else {
        // 1 = BusinessName, 2 = owner, 3= type, 4= Covid Info, 5= EmailBus, 6= Phone number, 7
        while (cursor.moveToNext()){
            businessName.add(cursor.getString( columnIndex: 1));
            email_bus.add(cursor.getString( columnIndex: 5));
            phonenumber.add(cursor.getString( columnIndex: 6));
            description.add(cursor.getString( columnIndex: 11));
            bType.add(cursor.getString( columnIndex: 3));
            bImage.add(cursor.getString( columnIndex: 13));
            bImage2.add(cursor.getString( columnIndex: 14));
            CovidInfo.add(cursor.getString( columnIndex: 4));
            bStreet.add(cursor.getString( columnIndex: 7));
            bState.add(cursor.getString( columnIndex: 8));
```

Figure 11. Code for the Search Page: Shows all the information from the database is stored as arrays the called-on row by row.

4.3. Store Page

The final store page is simply a collection of different buttons and text. That is not to say this page is not important as it also has the most features for the patron than any other page as it can call, email, and issue a GPS command to the store of your choosing. In addition, it also contains any information a patron might want.

```
getAndSetIntentData();

phone_input.setOnClickListener((view) → {
    String phone = getIntent().getStringExtra( name: "bPhone");
    String s = "tel:" + phone;
    Intent intent = new Intent(Intent.ACTION_DIAL);
    intent.setData(Uri.parse(s));
    startActivity(intent);
});

gps_input.setOnClickListener((view) → {
    //Note: Turn gps location all into one string, replace spaces with %
    String gpsline1 = getIntent().getStringExtra( name: "bStreet");
    gpsline1.replaceAll( regex: " ", replacement: "%");
    String gpsline2 = getIntent().getStringExtra( name: "bCity");
    String gpsline3 = getIntent().getStringExtra( name: "bState");
    String combo = gpsline1 + ", " + gpsline2 + ", " + gpsline3;
    Intent intent = new Intent(Intent.ACTION_VIEW);
    intent.setData(Uri.parse("geo:0,0?q=" + combo));
    startActivity(intent);
});

email_input.setOnClickListener((view) → {
    String email = getIntent().getStringExtra( name: "bEmail");
    Intent intent = new Intent(Intent.ACTION_SENDTO);
    intent.setData(Uri.parse("mailto:" + email));
    startActivity(intent);
});
```

Figure 12. Code for the Store Page: This code specifically shows how the GPS, Email, and Call buttons operate.

5. Results

In the following Figures we can see how the front-end patron side of the app turned out. The patron side does not have access to editing any businesses and can only search for and view stores they might have an interest in. They can, however, call the business from the app, email the business, and GPS to the business they selected.

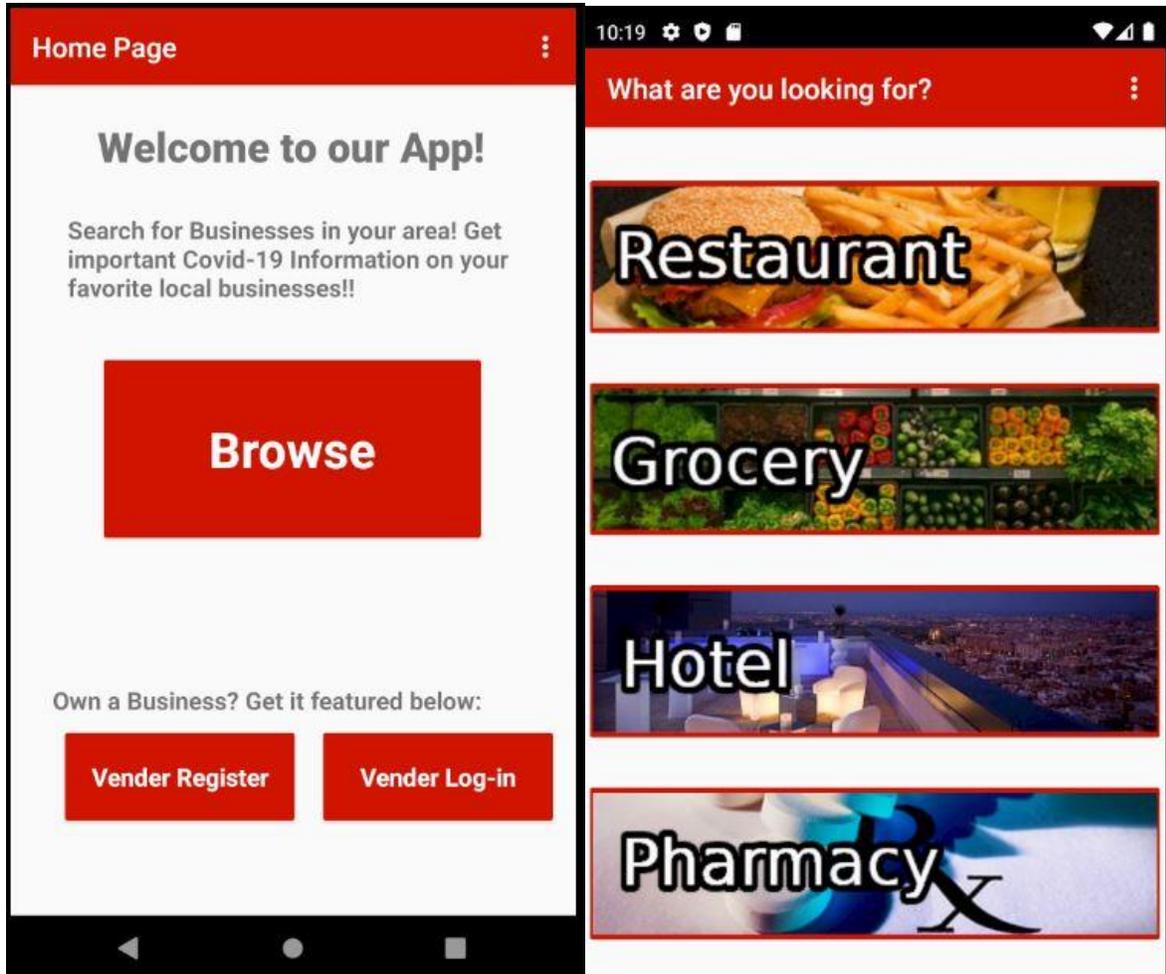


Figure 13 & 14. Landing Page and the Browse Page: These are the final results of how the Landing Page and Browse Page look.

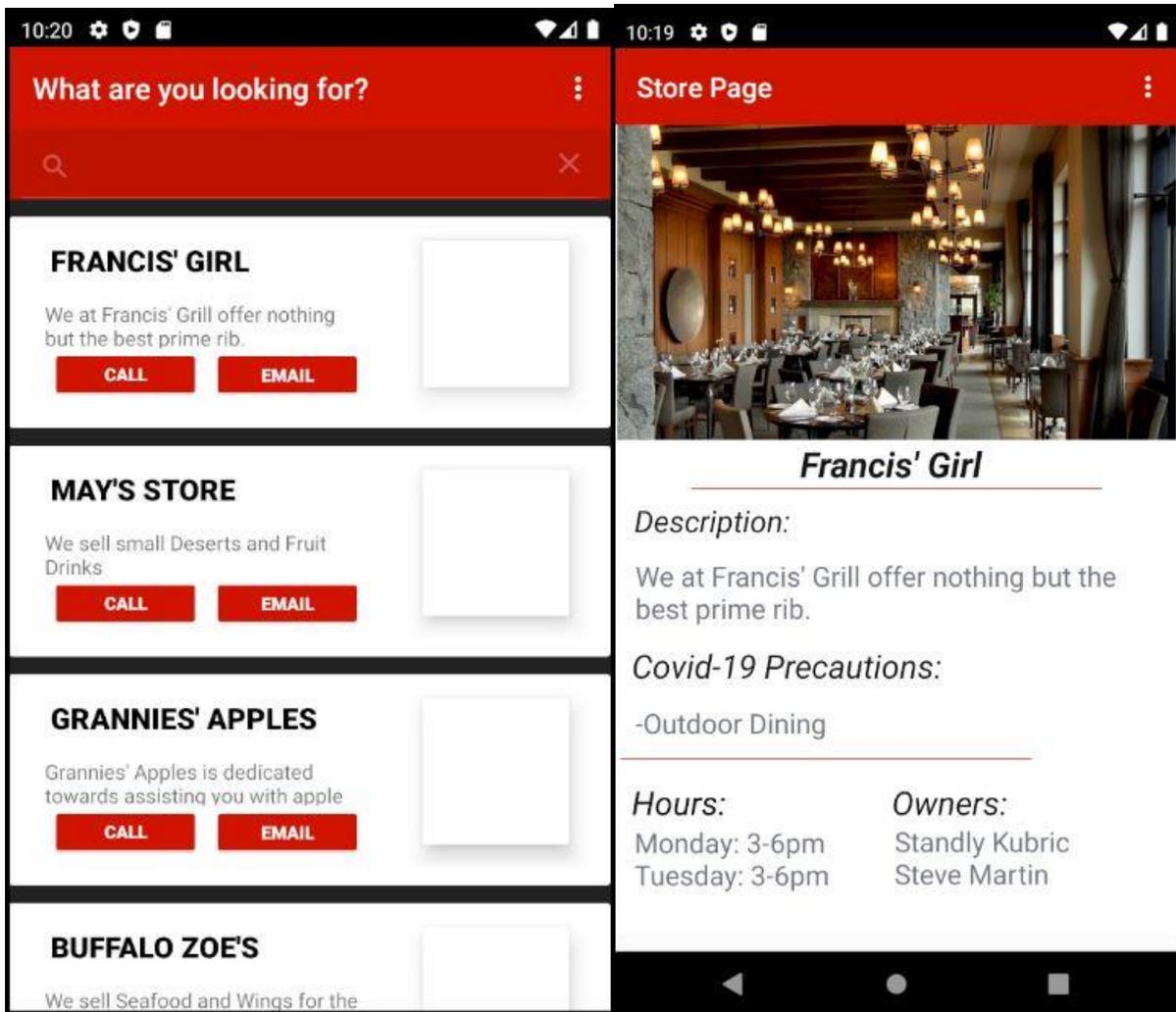


Figure 15 & 16. Search Page and the Store Page: These are the final results of how the Search Page and Store Page look.

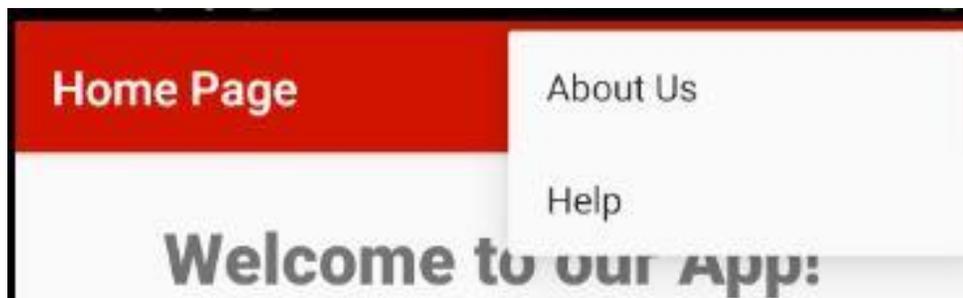


Figure 17. Additional Features: In the top menu of most pages an “About Us” and “Help” page have been added which can be viewed on most pages of the app. Can be identified by the three-vertical ellipsis.

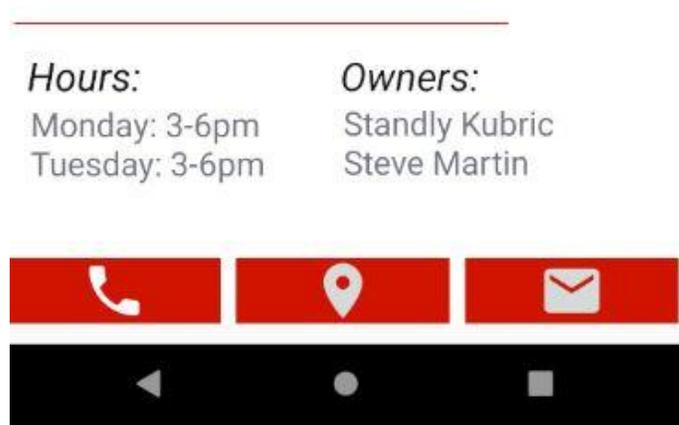


Figure 18. Button Showcase: Shows the calling, email, and GPS feature at the bottom of Store page.

Figure 17 and 18 were added to showcase some additional features that were added that extend beyond what was shown during the wireframe. Overall, the user should be able to acquire any and all information they might be interested in through this app and any additional information can be found by contacting the business.

6. User Surveys

After having implemented the app then did another round of surveys to see how users perceived the app.

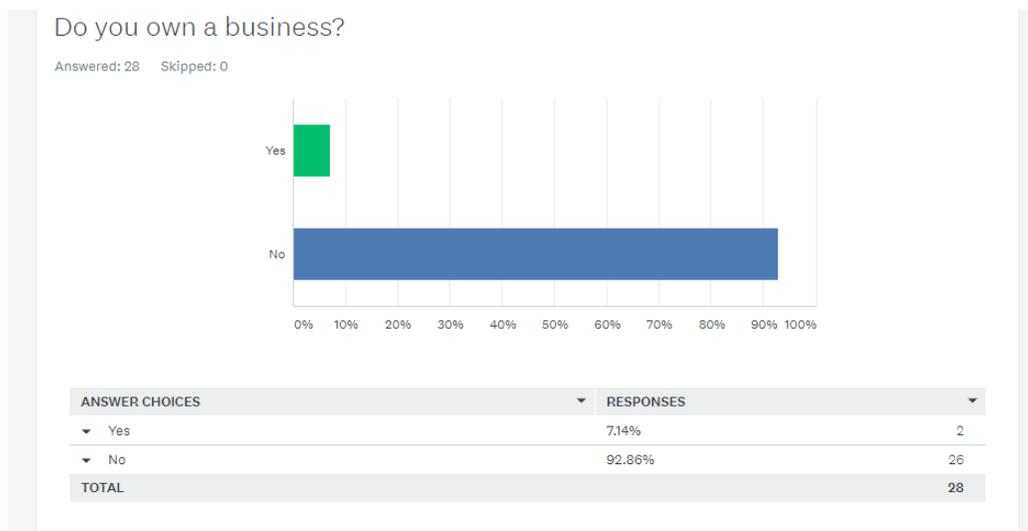
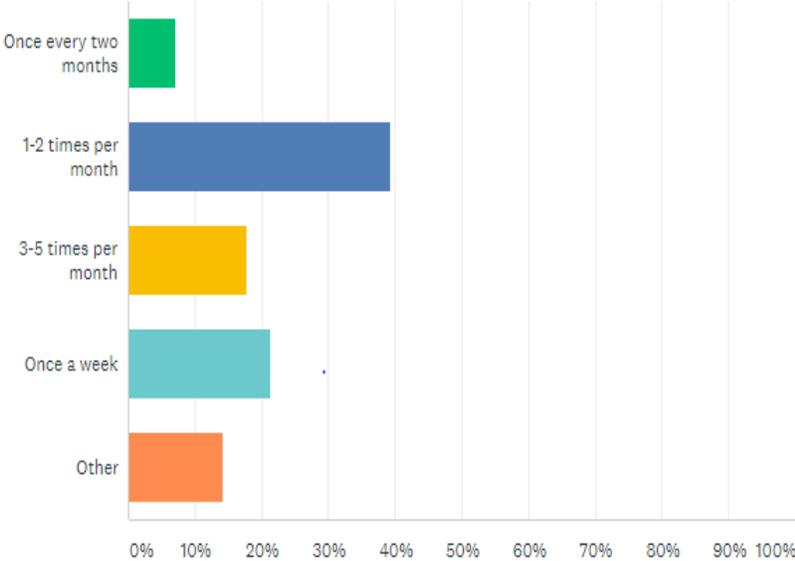


Figure 19. Question 2: Shows the results of how many people were business owners in the survey. It seems that we again could not get many business owners to reply to this survey.

How frequently would you use this application?

Answered: 28 Skipped: 0

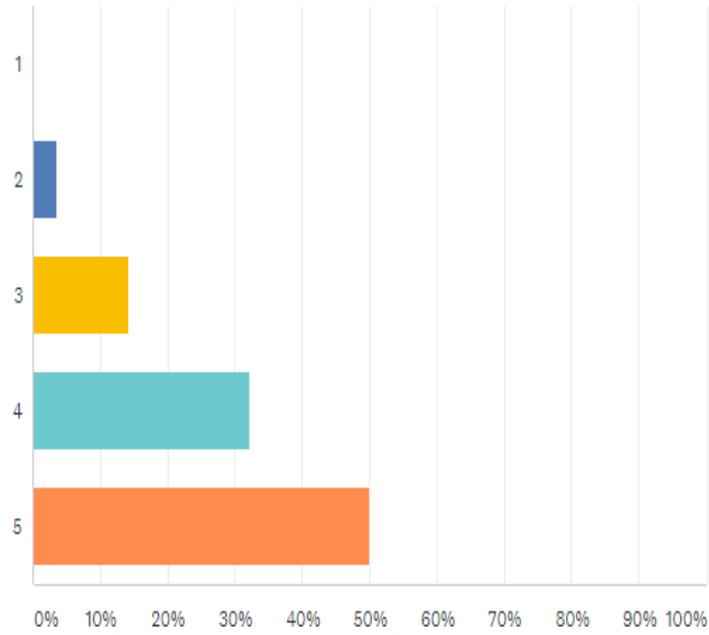


ANSWER CHOICES	RESPONSES
Once every two months	7.14% 2
1-2 times per month	39.29% 11
3-5 times per month	17.86% 5
Once a week	21.43% 6
Other	14.29% 4
TOTAL	28

Figure 20. Question 3: Shows the results of how frequently people would use the app according to our survey. It seems that though most people would only use it one or two times a month the second highest rated answer showed that some people would use it weekly. At the very least this shows that the app has a lot of interest.

On a scale of 1 (worst)-5 (Best), please rate the overall quality of the application with respect to its ease of use, Navigation, and design appeal.

Answered: 28 Skipped: 0

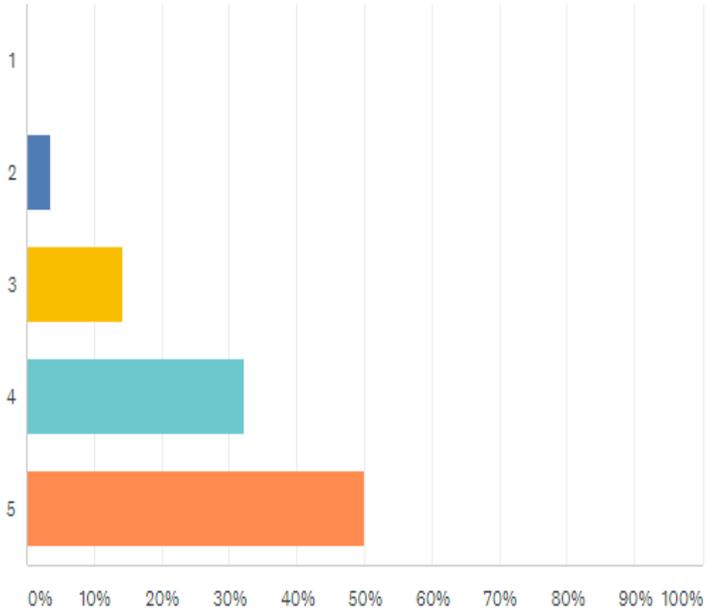


ANSWER CHOICES	RESPONSES
▼ 1	0.00% 0
▼ 2	3.57% 1
▼ 3	14.29% 4
▼ 4	32.14% 9
▼ 5	50.00% 14
TOTAL	28

Figure 21. Question 4: Shows the results of how survey users would rate the quality of the app. It seems that the app was well received and thus can be useful in a real environment.

On a scale of 1 (Not helpful) - 5 (Very helpful), Do you think this app would be helpful in a Covid-19 recovery phase?

Answered: 28 Skipped: 0



ANSWER CHOICES	RESPONSES
▼ 1	0.00% 0
▼ 2	3.57% 1
▼ 3	14.29% 4
▼ 4	32.14% 9
▼ 5	50.00% 14
TOTAL	28

Figure 22. Question 5: Shows the results of how survey users would rate the usefulness of the app in a Covid-19 world. It seems that the app was liked and can help people in a real environment.

<input type="checkbox"/>	Nice work! You should keep track of the number of real users of your app if you release this.	12/11/2020 4:50 AM	View respondent's answers	Add tags ▼
<input type="checkbox"/>	Can you add something for other healthcare businesses besides pharmacies? What about therapy, rehab, counseling etc. Much needed in COVID.	12/11/2020 3:04 AM	View respondent's answers	Add tags ▼
<input type="checkbox"/>	The app is a great idea. It has the potential to connect small business owners and patrons. This will greatly help in the cause of COVID recovery.	12/10/2020 12:26 AM	View respondent's answers	Add tags ▼
<input type="checkbox"/>	Consider adding additional venue connection options - link to the website, or in the case of services maybe to their respective means of delivery	12/9/2020 5:20 PM	View respondent's answers	Add tags ▼

Figure 23. Question 6: Shows the comments of survey users. It seems they understood the intention of the app and many even have recommendations on how to improve the app.

It seems that overall, the User Surveys saw the app as helpful and worth using. It also seems that given the current Covid-19 world we live in, there is no version of the app that has already been implemented and thus would be used quite frequently. The survey results have also led to further developments that can be made with the app as seen in the first comment in Figure 23.

7. Conclusion

The app was designed with the intention of informing users of how small businesses are taking steps to protect their patrons while also informing the patrons of any changes made to small businesses that have been impacted by Covid-19. This includes methods like being able to see if a small business is closed or if its hours have changed where a patron might have had to walk to the store and view its hours posted on the front door to find out if it's going to be open tomorrow. Although the app is still missing features that require additional time investment, the basic features and intention of the app was achieved. After having viewed the surveys it seems the participants of the survey also recognize the intention of the app and its goal. The app itself

was designed to start out small scaled but has the backbone to grow as it becomes more popular. What started out as an app covering the Montclair region can very easily be used on a nationwide level and any browsing limitations can easily be implemented upon and updated. This app truly has the potential to grow and help thousands of people who fear leaving their homes in America.

8. Acknowledgement

Since I could not have done any of this alone, I would like to thank all of my professors and fellow students who helped me while working on my master's degree. In particular, I would like to thank my advisor, Dr. Vaibhav Anu for all of his guidance and advice during my last two semesters. Both he and my co-advisor, Dr. Aparna Varde, provided spectacular feedback during the past six months. Without their help this project would not have been as big or as special as it has become.

I would also like to thank the Montclair State University Department of Computer Science. This program has trained me in skills that will prepare me for my future professional career in programming. From here on, I will represent this program with dignity in my future profession.

In addition, I would like to thank Chris Duran, my partner, who spent several months working on this project with me and developed the business side of this app.

Finally, I want to thank my family for the never-ending support and allowing me to continue my education for an extra two years, as well as my friends who encouraged me to pursue my master's degree.

REFERENCES

- [1] A. W. Bartik, M. Bertrand, Z. Cullen, E. L. Glaeser, M. Luca, and C. Stanton, “The impact of COVID-19 on small business outcomes and expectations,” *Proceedings of the National Academy of Sciences of the United States of America*. 2020, doi: 10.1073/pnas.2006991117.
- [2] D. Rees, “What is wireframing,” Experience UX. [Online]. Available: <https://www.experienceux.co.uk/faqs/what-is-wireframing/>. [Accessed: 13-Dec-2020].
- [3] “All-in-one prototyping tool for web and mobile apps,” Justinmind. [Online]. Available: <https://www.justinmind.com/>. [Accessed: 13-Dec-2020].
- [4] “Unified Modeling Language,” Wikipedia, 11-Dec-2020. [Online]. Available: https://en.wikipedia.org/wiki/Unified_Modeling_Language. [Accessed: 13-Dec-2020].
- [5] “Download Android Studio and SDK tools : Android Developers,” Android Developers. [Online]. Available: <https://developer.android.com/studio>. [Accessed: 13-Dec-2020].
- [6] H. Shin and J. Kang, “Reducing perceived health risk to attract hotel customers in the COVID-19 pandemic era: Focused on technology innovation for social distancing and cleanliness,” *Int. J. Hosp. Manag.*, 2020, doi: 10.1016/j.ijhm.2020.102664.