

How a Web Application can Better Serve Students during Lockdown

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

The COVID-19 pandemic has caused endless harm and inconvenience to almost everyone in the world. In 2020, I was one of five University of Virginia students who built a web application for the Advanced Software Development class. As the group's Requirements Manager, I interviewed more than twenty UVA, George Mason University, George Washington University, and Northern Virginia Community College. Students by online survey and Zoom meetings and analyzed their responses to ensure that the features in our web application would better serve students during the COVID-19 lockdown. Using the Django framework, our group implemented in Python the web application built with GitHub, Heroku and Travis-CI platforms. Our website has three major features: an online food ordering system, detailed information about Charlottesville public institutions, and a system to rate local businesses. These features helped local restaurants survive better during the COVID-19 pandemic and provided students with more specific information about Charlottesville public service institutions.

1. Introduction

Two months ago, UVA appeared to be on the verge of shutting down as coronavirus cases in the student body skyrocketed. On September 18, 2021, there were 259 active student cases, and more than a quarter of the quarantine rooms were full [1]. Due to the rapid spread of the epidemic in late 2020, the Charlottesville area was locked down for several months. Under such circumstances, UVA students' lives were very much inconvenienced. According to an email sent December 4, 2020, to the employees from UVA Health Department, the University of Virginia Medical Center was experiencing an increase in coronavirus cases. While Virginia's central hospitals had yet to be overwhelmed by the COVID-19 pandemic, growing demand was forcing them to shift their priorities [2]. The best way for UVA students to help prevent the growth and spread rate of the COVID-19 epidemic was using the remote option as much as possible, instead of participating in outdoor events. If students had to go out, wearing a medical mask was a very important step for students and others they might be in contact with.

2. Related Works

Most students who live on-campus rely on the school cafeterias and online ordering from the restaurants around the school. However, due to the impact of the pandemic, many of the small restaurants in Charlottesville were closed, which reduced dining options for UVA students. Charlottesville distributed wage refunds to help companies hire, reinstate, or retain employees. GO Hire's COVID grants offered up to \$5,000 to businesses, and about thirty businesses received the grant. However, some establishments were unable to continue operating during the pandemic. About thirty stores closed last year, including a handful of grocery stores and restaurants [3]. Many small businesses in Charlottesville did not survive the impact of

the epidemic on business. This not only affected the local market economy but also caused great inconvenience to UVA students and other residents.

3 Project Design

To help address this problem, I was one of five UVA students who built a web application for an online food ordering system with local public institution appointment list features. The team finished the project within four months in early 2021. We decided to divide the group project into four stages: requirements elicitation, documentation discussion, implementation, and testing.

3.1 Importance

A defined software development process is important because it helps the team take fewer risks to build a more organized software application. First, it allows team members to understand what requirements the customer wants us to meet so we can successfully write all the requirements into code. Second, it helps the team detect bugs faster and more easily by testing the code, piece by piece, while we build it. Last, it helps the team share ideas and thoughts about what we want to design for the web application, which enables the team to maintain a high level of communication and precisely track the team's progress. Therefore, a defined software development process helps the whole team make a well-planned blueprint and transfer it into a successful web application.

3.2 Methodology

The team decided to use Scrum methodology to approach the project. The first advantage of Scrum methodology is that it pushes the team to be more organized and disciplined. Since the team only had five members and less than four months to get the project done, team members had to keep organized. For example, the sprint check requirements ensure that every team member can follow the plan and finish the project perfectly. Another key benefit of the Scrum methodology is that it helps the collaboration process and motivates every team member. Even though each member has a specific role for the project, we are also responsible for helping each other get work done by the deadline. If all of the team members are willing to help and collaborate, then the team could design a perfect project that combines all of the members' ideas and thoughts. Moreover, since there are several different sprint check deadlines, team members will be able to get useful feedback from the TA about the project, as well as suggestions about what the team should do next or what adjustments to make to the current plans.

3.3 Stage 1—Requirements Elicitation

During the requirements elicitation stage, the group used questionnaires and interviews to elicit responses from more than twenty students in four different schools: UVA, GMU, GWU, and NOVA. The team chose Google Surveys and (online) interviews as the best choices for the questionnaires, because everything was remote last year. Each of the participants had two weeks to complete the

survey. Everyone’s result was significant to the team, because as a representative of different groups of students, the participants helped the team build an application that better met the needs of the users.

As the Requirements Manager for the team, I devised eight questions regarding the negative impact of COVID-19 on their personal and school life. I put the questions into a Google Form, and sent them to 25 individuals. For the interviews, I devised five questions for each team member to ask of 3-5 individuals. Due to the Covid-19 pandemic, it was difficult and risky to choose elicitation methods requiring meeting face-to-face, such as in-person interviews. Consequently, the whole team thought that Google Survey and Zoom interviews were the safest and most responsible ways to collect feedback about the features of the web application.

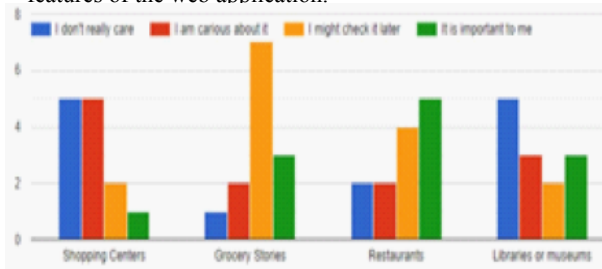


Figure 1: Statistics of the Google Survey Results

Figure 1 shows the results of the Google Survey displayed in bar chart format. Most of the students did not care if the team wanted to implement a shopping center, library, or museum feature. However, most of them stated they are looking forward to seeing restaurant features on the web application.

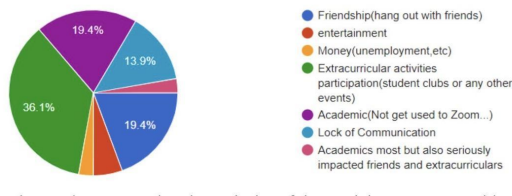


Figure 2: Statistics of the Zoom Interview Results

Figure 2 shows the side effects COVID-19 has brought to their personal life. More than 90 percent of the participants stated that the pandemic has caused negative impacts on their academic, extracurricular activities, and friendships.

3.4 Stage 2—Document Discussion

During the documentation discussion stage, my responsibilities were to convert the interviewers’ responses into a software development professional language and address it to all of the other team members. Based on the interview responses, the majority of interviewers considered restaurant and local public institution features were the most important.

Therefore, the team decided to implement an online food ordering system and local public institution appointment system as the two major features of the web application. After deciding the two major implementation features, the team had a weekly meeting every Friday and made a Google Doc that listed all the to-do items and assigned specific jobs to each team member. The team also made a diagram that included the overall layout of the web application features, which helped us start the next stage step-by-step.

3.5 Stage 3—Implementation

As the Requirements Manager, I implemented Google Login API, because the web application required a customer to login first to have full access.

Within two weeks, I also implemented the online food ordering system with the Testing Manager.

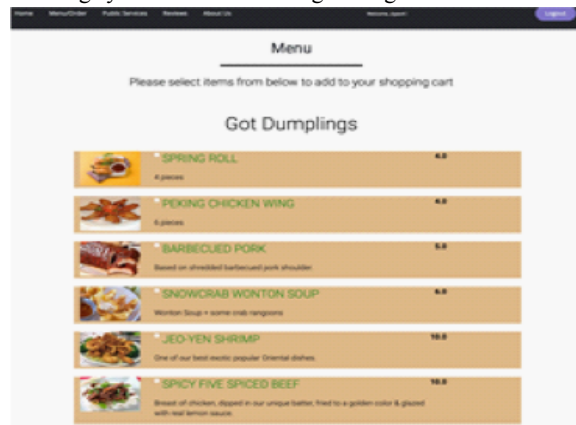


Figure 3: Restaurant Menu page

Figure 3 shows six menu items from “Got Dumplings” Asian restaurant. Each of the items has a name, price, picture, description, and a check box that allows users to add it to the checkout box. After completion of the first feature, I also helped the other two members insert the contact information of the local public institutions into our database and linked the form into our database.



Figure 4 shows a particular public service’s information which includes the name, contact information, address, description, location via Google Map, and a button to the

appointment form page. Last, since the online food ordering system required users to submit payment, I implemented PayPal API that allows every user to process a payment after placing an order.

3.6 Stage 4—Testing

During the testing stage, as the Requirements Manager of the team, I interviewed each of the individuals that I had interviewed previously, asking for feedback and suggested improvements about the web application. According to the results, some of the users wanted the team to add more restaurants to the ordering system, change the display format of the restaurant review page, and adjust the font of the page for the local public institutions. After collecting all of the responses, I made a document that listed all of the improvement suggestions and shared them with the other members. After discussing the second round of interview responses, the team decided the following: add two more restaurants that serve different types of food to the database, sort and display the review page by date, and change the public services page to a bigger font.

4 Findings and Discovery

By completing this web application group project, I have gained better team collaboration and software development skills especially in web design. In addition, the team had encountered and resolved several programming issues during the development stages.

4.1 Outcomes

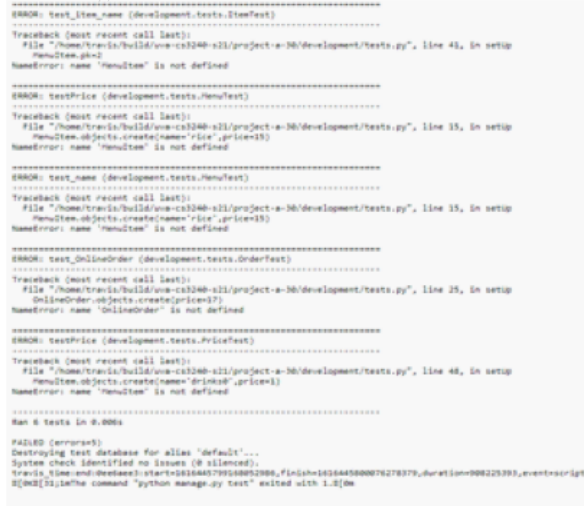
This web design project was my first formal and professional software development group project. Through this group project, I not only learned more skills about web design, but also increased my group collaboration ability and team communication skills. More importantly, the major features of our website revolved around the lockdown period during the COVID-19 epidemic. The epidemic has brought a lot of inconvenience to UVA students and caused great economic loss to many small restaurants in the Charlottesville area. However, using our website has provided UVA students not only more dining options and ability to obtain the most frequent updates of various local public facilities, but also has helped local small restaurants increase their chances of survival through the online food ordering system. In addition, this web application experience has helped me considerably to get a summer web developer internship offer. However, because of a conflict with my summer class schedule, I did not take it.

4.2 Difficulties

During the development processes, the team encountered several challenges related to the database, deployment, unit tests, and Google Calendar API. First, as a transfer student, I had no prior experience with the Python programming language, which made the implementation stage even harder for me. For example, my goal was to come up with at least ten unit tests covering every functionality that I implemented. After wasting a couple of hours on debugging, I found the solution was to ask the Testing Manager to design several unit tests and walk through each of them with me first.

Second, the team decided to use the PostgreSQL database instead of the default database (MySQL). However, there were several issues when transferring data to the new database and uploading it to GitHub. For example, the images did not appear after the application was deployed to Heroku, but worked locally. After debugging for a long time, the solution was to convert all the images to PNG and redeploy them to Heroku.

Third, the team decided to implement Google Calendar for the public institutions' feature. However, whenever a user tried to submit a form, the request never reached Google Calendar and fell into a timeout error. However, the connection with Google Calendar works on the local machine. The alternative solution was to create another HTML template that records all of the appointment details. Once the user submitted a form, it will automatically redirect the user to the records page and show all the details of the submitted form. Fourth, after pushing the code to GitHub, Travis-CI (a continuous integration service) does not recognize all of the unit tests with the new database.



```
##### test_item_name (development.tests.ItemTest)#####
Traceback (most recent call last):
  File "/home/travis/build/isa-cs3240-211/project-a-360/development/tests.py", line 41, in setup
    MenuItem.prices
NameError: name 'MenuItem' is not defined

##### test_price (development.tests.MenuItem)#####
Traceback (most recent call last):
  File "/home/travis/build/isa-cs3240-211/project-a-360/development/tests.py", line 35, in setup
    MenuItem.objects.create(name='rice', price=35)
NameError: name 'MenuItem' is not defined

##### test_name (development.tests.MenuItem)#####
Traceback (most recent call last):
  File "/home/travis/build/isa-cs3240-211/project-a-360/development/tests.py", line 35, in setup
    MenuItem.objects.create(name='rice', price=35)
NameError: name 'MenuItem' is not defined

##### test_online_order (development.tests.OrderTest)#####
Traceback (most recent call last):
  File "/home/travis/build/isa-cs3240-211/project-a-360/development/tests.py", line 25, in setup
    OnlineOrder.objects.create(price=37)
NameError: name 'OnlineOrder' is not defined

##### test_price (development.tests.PriceTest)#####
Traceback (most recent call last):
  File "/home/travis/build/isa-cs3240-211/project-a-360/development/tests.py", line 48, in setup
    MenuItem.objects.create(name='drink', price=1)
NameError: name 'MenuItem' is not defined

Ran 6 tests in 0.000s

FAILED (errors=6)
Destroying test database for alias 'default'...
System check identified no issues (0 silenced).
travis_time_end:domain:start=38384077938852988, #id=14334458807427879, duration=9822393, event=script
[Q]23:13:16 the command "python manage.py test" exited with 1-0j
```

Figure 5: Failing All of the Unit Tests

Figure 5 is a screenshot of the error code of the unit tests while running the Travis-CI test. The alternative solution was to add several condition statements into the database file and only run the unit tests with the default database but everything else with the updated database. Last but not least, the team encountered several different problems during the deployment process, such as a display layout different from the local machine and requested data did not match when redirected to a different page. After searching online sources and going to office hours multiple times, I found the solution was to recheck the data type of some variables and run a series of commands on Heroku console. Another example was related to data type and length errors: The team declared the length of the menu item price with a maximum of ten decimal values. However, on Heroku database, any number of prices with two or more decimal digits will return an error page. The solution for this issue was to organize all of the prices with one decimal digit.

4.3 Learning Experiences

This group project was my first experience building a website using multiple web design platforms. By completing this project, I have gained many web design skills, such as knowledge of the basic skills for HTML, knowing how databases work, and hosting a web application on a web service host. Moreover, this project taught me how to create a web application project using the Django framework, how to work remotely using GitHub, and how to create a virtual environment and rebuild the whole program using the Travis-CI integration platform. Furthermore, because I enjoyed interacting with the interviewees and providing suggestions to the rest of the team members, I have gained more interest in web design and specific work as a back-end developer.

5 Conclusion

The main purpose of the group project was to find a way to serve more UVA students by providing a website with features such as dining options, getting the most frequent updates for Charlottesville public institutions, and collecting restaurant reviews during the COVID-19 lockdown period. Another purpose was to help more of the local businesses endure this special period. By completing this project, I not only gained knowledge about web design and web platforms, but also realized how important the internet is in providing ever greater conveniences to daily life.

6 Future Work

Although the web application is finished, it still has some flaws that can be improved. The online food ordering system does not have a form that asks users to input their contact information when placing an order. This issue can be solved by creating a form that includes user addresses and contact information. Another flaw of the web application is that, due to a technical issue with Google Calendar API, the appointment form is not sent to a user's email. The solution to this issue may be to figure out how to connect the form with Google API or use a different calendar API. Because I have great interest in web design after completing this group project, with four other classmates, I have started another web design project: a fantasy soccer application that allows users to create a soccer team, compete with other online players, and chat with ~~any~~ other users. For this project, my role is the Requirements Manager for the back-end team, which helps the team with UI designs, creates a database and insert tables, and provides suggestions for the web pages.

References

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- [2] Cj Pashchall, 2020. NBC29: UVA Medical Center gearing up for rise in COVID-19 cases. <https://www.nbc29.com/2020/12/04/uva-medical-center-gearing-up-for-rise-in-covid-19-cases/>

<https://www.nbc29.com/2020/12/04/uva-medical-center-gearing-up-for-rise-in-covid-19-cases/>

[3] Charlotte Rene Woods, 2021. Charlottesville Tomorrow: Businesses buffeted by the pandemic. <https://www.cvilletomorrow.org/articles/businesses-buffeted-by-the-pandemic/>