Project: PxPUC - Project x Police Union Contracts

A Technical Report submitted to the
Department of Informatics and Networked Systems
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Pittsburgh, Pennsylvania

Angela Tseng
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Project Team Members
Thomas Chang
Anton Tamkovitch

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Advisor: Dr. Ahmed Ibrahim, Department of Informatics and Networked Systems

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Abstract

Police union contracts are littered with unclear and inconsistent language that can discourage citizens from filing police misconduct complaints. Project Police Union Contract (PPUC) analyzes language from police union contracts to help demystify the process of filing complaints by providing an educational complaint tool and a searchable database of police union contracts. Due to the interactive nature of the project, the user interface is vital in conveying knowledge efficiently and effectively in a user-friendly manner. Citizens visiting the website should ideally be able to easily navigate through the site and find the information they need. The capstone team formed the basis of their contributions off of this understanding.

After analyzing the existing website, the team isolated specific goals to improve on the current interface and as a result worked largely on front-end development. Per request of the customer, additional data visualization tools were also implemented to help contract analysis and quick information digestion. Through a multistep process of identifying system requirements, specifying development components, creating mockups and prototypes, developing front-end code, and multiple iterations through the customer to achieve customer approval, the team created an interface that more effectively communicates necessary information to a visiting user. While putting the information out for citizens is important, that information is rendered ineffective and useless without proper presentation and data visualization models. In addition, proper acknowledgement should be provided about the major contributors and partners to a project so socially relevant. Users visiting the website should be able to understand the tool, its significance in their lives, and also be able to reference other materials if it is relevant to their cause. The capstone team worked collaboratively with the client to redesign the user interface to

achieve this goal. With the revamped interface, users of the website are able to navigate through efficiently, contact the team, look at relevant projects, and through data visualization models are able to easily understand the prevalence of misreported police misconducts.

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1. Introduction

The past couple decades have been punctuated by protests and revelations about long-standing social injustices regarding racial inequities. While social demonstrations are vital to publicity and garnering support, there are other ways to contribute to the cause.

Grief to Action (G2A) is an interdisciplinary working group formed from University of Pittsburgh students, alumni, and staff, community activists, undergraduate students and faculty from outside of Pittsburgh. A project of the Center for Analytical Approaches to Social Innovation (CAASI), it is dedicated to using data science to empower marginalized communities (G2A, 2020).

When the George Floyd protests began in the summer of 2020, the director of CAASI reached out to the Pitt community, inviting students, faculty, and staff to convene weekly to discuss methods to transform the community's grief into action. With the question of "what can we, as citizens with access to resources, do our part to help the community?" the G2A team has met weekly since then to discuss and work to educate the public about racial justice. There are two projects under development; Project Black Business and Project Police Union Contract.

1.1 Problem Statement

The relevant project for the capstone assignment was Project Police Union Contract (PPUC). By analyzing police union contracts, the tool aims to help clarify the process to file a police misconduct complaint (G2A, 2020). With data from a similar project, Campaign Zero, two major

functions were formed; a complaint tool to educate users on the complaint process, and a database tool to easily search and learn about the problematic language in police contracts.

Still in its early stages, the website for PPUC had a very straightforward layout. The data for the system had not been integrated into the user interface, and what information was present on the pages of the website was found in bulky, user-unfriendly formats. While completely functional for the purpose of searching information, there was some confusion when the capstone team tried navigating the website. There was no real Contact Us page for users to reach out to the G2A team for more information, there were no further resources available or acknowledgements to major contributors on the About Us page, and the page directed at researchers lacked information on the functionality of the tools offered with this project and why it is relevant to the user. The changes the capstone team proposed were largely to alleviate these user experience issues.

1.2 Contributions

To solve these user experience issues, the capstone team mapped out the current website and its pages onto a wireframe through the online Balsamiq tool. With the structure on an easily editable interface, the team chose to work on certain pages determined to be more problematic. These included the Contact Us page, About Us page, and Researchers page.

After redesigning the pages, the team started on implementing the changes through writing HTML code. After multiple iterations, the customer was satisfied with the edits and the team progressed to finalizing the changes. To do this, members of the team learned JSX, D3, and

React to push the changes into the already existing system. Upon running the system locally, the customer gave their approval to implement the team's code into the live system, and therefore the site.

For the Contact Us page, the design was changed to appear more welcoming and be easier to operate. As opposed to the two emails listed as "General" and "Tech Support" originally found on the page, the capstone team added an interactive form that would collect relevant information from the user and send it to the relevant parties. The listed emails are still present on the site, and when clicked on still prompt the user with the email application, but there is now an additional form for users to choose between which is more convenient for them. With this, rather than having to email the PPUC team separately, a user visiting the website with questions could simply fill out a form to contact them. The staff from G2A are now also able to organize the inquiries and keep record of the user who contacted them, and the state/city the request originated from.

The original About Us page, consisting of repetitive information from the landing page of the website, was trimmed to add a "Meet the Team" section to acknowledge the work of important contributors, and a section highlighting partners to the PPUC project. These additions also included links to personal profiles and clickable icons to relevant resources that a user may find useful in their search. By adding information about individual contributors and the project's partners, visitors to the website can not only learn about the project itself, but also visit related projects dedicated to the advancement of social issues.

Changes to the researcher's tab included adding a short description of the problem with police union contracts, an example of the problematic language that may mislead citizens, statistics and charts highlighting the relevance of this issue, a reorganization of the searchable database, and a heat map with descriptions about problematic provisions by categories versus cities. The original page for researchers to look up information on police union contracts consisted only of a search bar and sample keywords. With the new additions, a user visiting the website can see what the problem is, an example of the problem, and why it is relevant to look further into correcting this social issue. Furthermore, the data visualization tools help emphasize the prevalence of problematic provisions in a way that is easy to digest.

2. Related Work

Campaign Zero is a non-profit that analyzes policing and searches for ways to stop and put an end to police violence across the country (Campaign Zero, 2015). A large contributor to the data PPUC uses in its database, the capstone team also pulled data from Campaign Zero archives to create data visualization models. Custom written, the site offers models that the team was able to base new models off of and provides information about the complaint process. However, it is far too broad and expansive for a regular user who is attempting to understand the process to file a misconduct complaint; Campaign Zero serves as a hub for data or large-scale outreach, but not as an analysis tool.

For example, “Review Police Contracts” is a spreadsheet containing policy language that the PPUC team identified as “contributing to making it more difficult to hold police accountable for misconduct" (G2A, 2020). After cleaning the data, the parsing program written by the team found that the file contains 1,375 policy language instances, but the annotated data was disconnected from the source files and as a result, created ambiguity in the instances reported. For example, each report only indicated the name of the cities with no context about the state, disregarding that the United States contains duplicate names between states and cities. So if a user submitted a complaint with no specification of the location, the data would be misrepresented and the contract would then be invalid and unfit for analysis. To a citizen, they would not be able to understand what is expected of them when submitting a complaint in a certain city in a certain state.

The PPUC tool fixes this issue in this example by using an external city dataset to identify the ambiguous cities and remove them in the following analysis. In context of this city/state problem, the cleaning removed about 26% instances, including 98 instances not found in the external dataset and 266 instances in ambiguous cities, resulting in 1011 instances. Now that the data is as accurate as possible, it is then processed into a database that a visiting user to the PPUC website can easily search for and see represented in quantitative visualizations.

Figure 1: Campaign Zero's landing page

Another resource that the team drew inspiration from was an article published in the Duke Law Journal titled "Police Union Contracts" by Stephen Rushin[3]. This article shows how the language used within various police union contracts can lead to difficulties with police

accountability. Using this article as reference, the team developed a definition table for problematic provisions, as well as a heatmap for these provisions based on the city. The most glaring issue with this source is its bulk; an extensive 94 page document, it becomes difficult for an everyday citizen to extrapolate the important points in a comprehensive manner. The visualization model developed by the capstone team aims to summarize the points made in this article.

3. System Design

The capstone team added content to the system that offered informative descriptive statistics to the user and improved their general experience on the website. Users are now able to use the Contact Us page to submit a message or comment to the team. They are also able to find information about specific team members and find other relevant information on similar projects. Finally, they are able to see some summary statistics and various other information about problematic provisions in police union contracts.

To further develop the system, the team used languages and frameworks already included in the system, such as HTML, CSS, Javascript, JSX, and React. Another framework used to develop the visualization models was D3. These frameworks were selected due to the format of the pre-existing files in the system; for easier integration, the content that the team produced should match the original work. After consulting the client for suggestions on how to represent the data, D3 was selected as the most effective way to display the descriptive models.

3.1 System Requirements

In order to have a clear idea and understanding of the project goals to be met, it is important to outline the system requirements early on in the development process. This helps divide the work in a coordinated manner and stay organized and allows the team to clearly define to the client what features they plan to develop for the project. This in turn allows the client to easily comprehend the development process from an outside point of view. Below is a list of minimum, desired, and optional requirements that applied to our project.

Minimum requirements:

Create and implement a data visualization model (Sprint 4 / 5)

Develop a new interface for the About Us page (Sprint 2 / 3)

Develop a new interface for the Contact Us page (Sprint 2 / 3)

Make additions to the Researchers page under the search bar (Sprint 4)

Decide what summary statistics are important to the user (Sprint 1 / 2)

Desired requirements:

Create introductory/narrative section (Sprint 4)

Make the data visualization interactive (Sprint 5)

Add more design to the site through styles, images, etc. (partially complete)

Optional requirements:

Develop a login feature for admins and users (Determined to not be necessary)

Start development of AI chat feature to answer questions (not within scope)

3.2 Wireframes

Wireframes are important for laying out the general user interface planned for the project. This gives the project team an idea of what will work or look good for the end product, and serves as an outline throughout the development process. Due to the majority of the capstone team's work being front-end development, wireframes played a large role in determining many of the steps in development. Below are a few screenshots of the wireframes generated for this project.

Figure 2: Wireframe 1

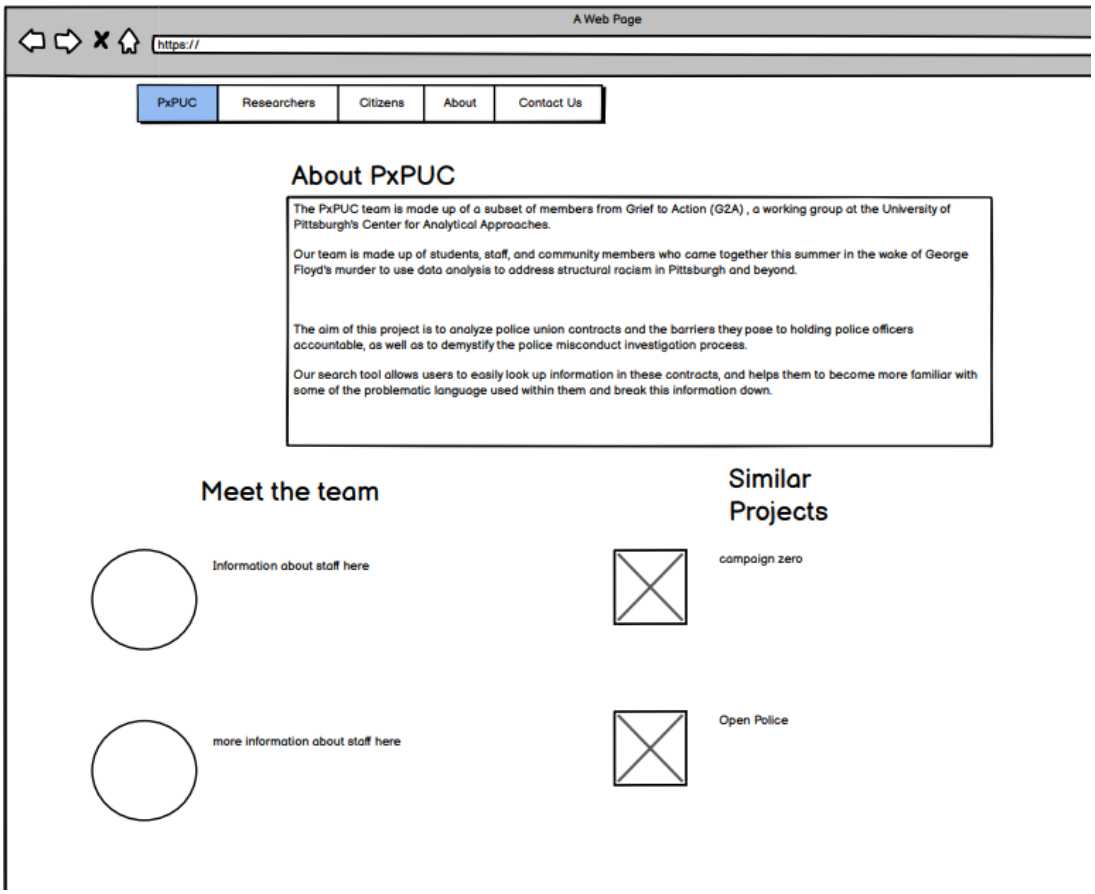


Figure 3: Wireframe 2

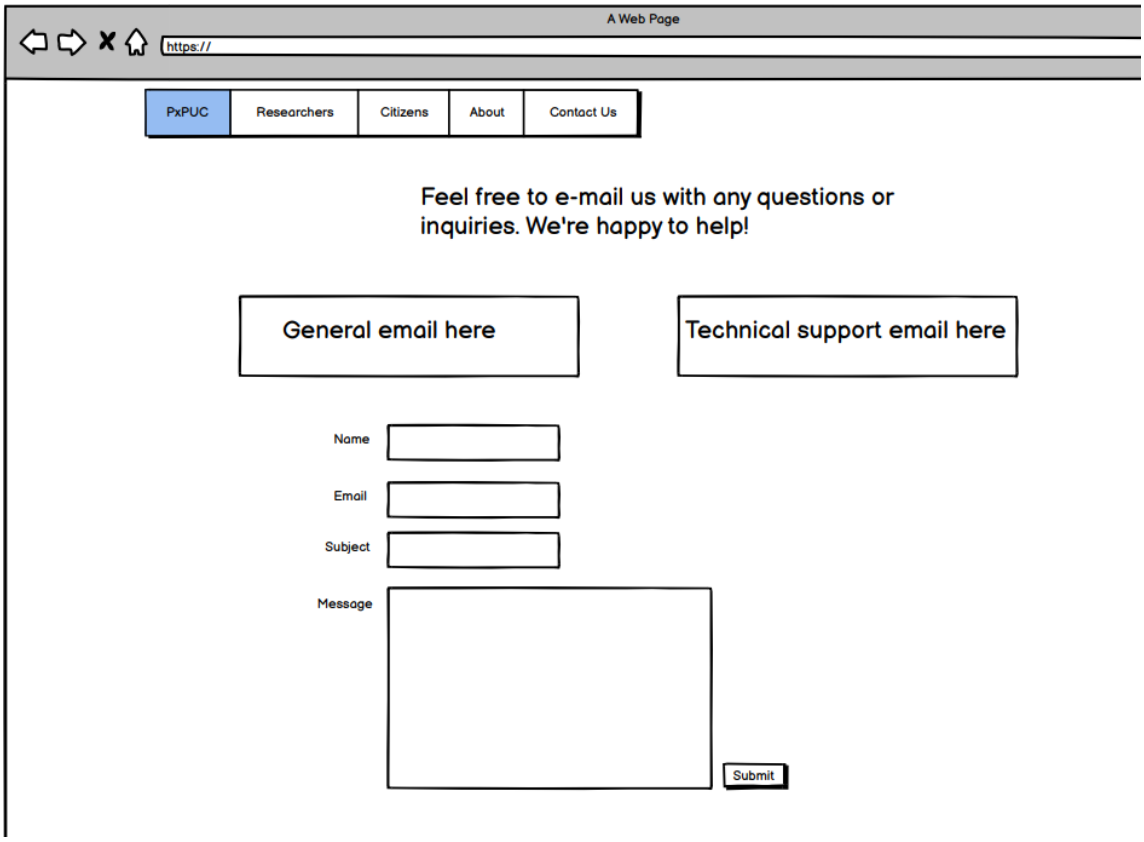
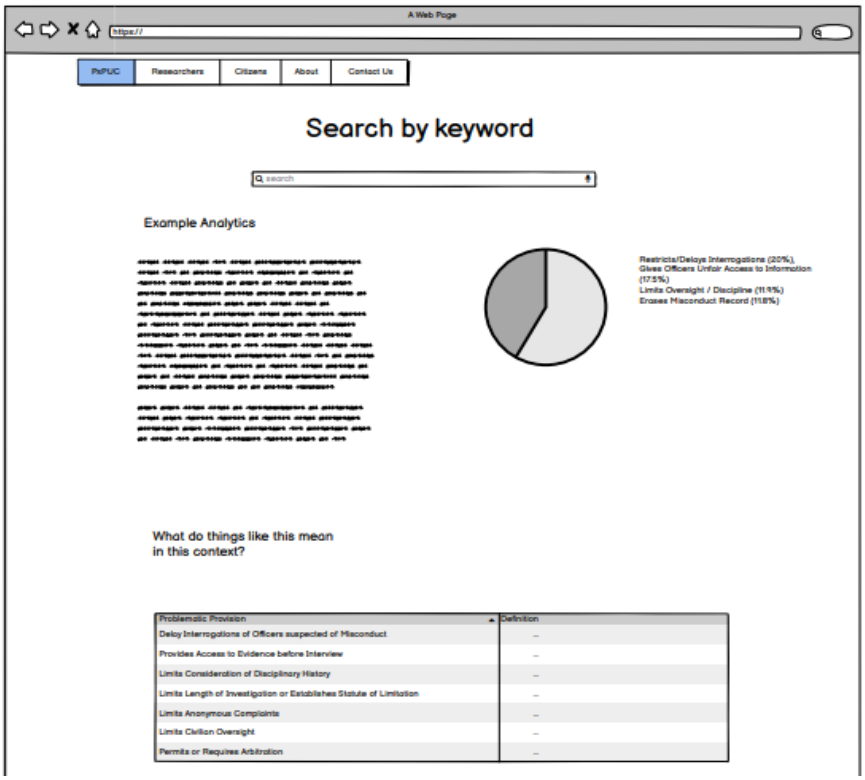


Figure 4: Wireframe 3



3.3 Sample Code

Included in this section is sample code from the Contact Us, About, and Researchers pages.

Contact Us:

```
      <div>
        <h1 className="text-center pt-5 pl-2">Contact Us</h1>

        <div className="jumbotron pt-2 bg-white">
          <hr className="my-4 border-top border-secondary" />
          <p className="lead text-center">
            Feel free to e-mail us with any questions or inquiries. We're happy
            to help!
          </p>
          <address className="text-center">
            <strong>General:</strong>
            <span>
              {" "}
              <a href="mailto:iph34@pitt.edu">iph3@pitt.edu</a>
            </span>
            <br />
          </address>
          <address className="text-center">
            <strong>Tech Support:</strong>
            <span>
              {" "}
              <a href="mailto:cjk94@pitt.edu">cjk94@pitt.edu</a>
            </span>
            <br />
          </address>
          <hr className="my-4 border-top border-secondary" />
        </div>
        <div class="contact-email-wrapper row jumbotron">
          <div class="contact-img-wrapper col-md-5 text-center">
            <img
              src="/static/app/img/contact_us.jpg"
              alt="Contact Us"
              width="90%"
            />
          </div>
          <div class="col-md-7">
            <Form>
              <FormGroup>
                <Label for="firstName">First Name</Label>
                <Input placeholder="First Name" />
              </FormGroup>
              <br />
              <FormGroup>
                <Label for="lastName">Last Name</Label>
                <Input placeholder="Last Name" />
              </FormGroup>
              <br />
              <FormGroup>
                <Label for="state">State</Label>
                <Input type="select" name="selectMulti" id="selectState">
                  <option value="pennsylvania">Pennsylvania</option>
                  <option value="new jersey">New Jersey</option>
                  <option value="ohio">Ohio</option>
                  <option value="florida">Florida</option>
                  <option value="kentucky">Kentucky</option>
                  <option value="california">California</option>
                  <option value="texas">Texas</option>
                  <option value="new york">New York</option>
                  <option value="wisconsin">Wisconsin</option>
                  <option value="arizona">Arizona</option>
                  <option value="delaware">Delaware</option>
                  <option value="illionois">Illionois</option>
                  <option value="north carolina">North Carolina</option>
                  <option value="south carolina">South Carolina</option>
```

This code shows the front-end of the Contact Us page, including the emails for the people to contact and the textbox entry sections for the messaging system. The bottom section shows the dropdown menu for the state the form is submitted from, and not shown is one more section for the textbox of the actual message the user wishes to send.

About:

```
<div class="meet-the-team-wrapper row">
  <h2 class="text-center">Meet the Team</h2>
  <div class="meet-the-team-row row d-flex align-items-center">
    <div class="col-md-4 text-center">
      <div class="profile-img-wrapper">
        <img
          src="/static/app/img/profiles/sera.png"
          class="rounded-circle"
          width="120"
          height="120"
        />
      </div>
      <div>
        <a
          href="http://www.linardi.gspia.pitt.edu/"
          class="profile-name"
          target="_blank"
        >
          Sera Linardi
        </a>
      </div>
      <div>  CAASI Director</div>
    </div>
    <div class="col-md-4 text-center">
      <div class="profile-img-wrapper">
        <img
          src="/static/app/img/profiles/yuru.png"
          class="rounded-circle"
          width="120"
          height="120"
        />
      </div>
      <div>
        <a
          href="http://www.yurulin.com"
          class="profile-name"
          target="_blank"
        >
          Yu-Ru Lin
        </a>
      </div>
      <div>  Project Advisor</div>
    </div>
    <div class="col-md-4 text-center">
      <div class="profile-img-wrapper">
        <img
          src="/static/app/img/profiles/mikaela.png"
          class="rounded-circle"
          width="120"
          height="120"
        />
      </div>
```

```
<h2 class="text-center">Our Partners</h2>
<hr class="my-4"></hr>
<div class="partner-row row d-flex align-items-center">
  <div class="col-md-3 text-center">
    <a href="https://joincampaignzero.org" target="_blank">
      <img
        src="/static/app/img/partner_camp_zero.jpg"
        alt="Open Police"
        width="100"
      />
    </a>
  </div>
  <div class="col-md-9">
    <h3>Campaign Zero</h3>
    <p>
      A comprehensive platform of research-based policy solutions to
      end police brutality in America.
    </p>
  </div>
</div>
<div class="partner-row row d-flex align-items-center">
  <div class="col-md-3 text-center">
    <a href="https://openpolice.org" target="_blank">
      <img
        src="/static/app/img/partner_open_pol.jpg"
        alt="Open Police"
        width="200"
      />
    </a>
  </div>
  <div class="col-md-9">
    <h3>Open Police</h3>
    <p>
      Prepare, file, and track reports of police conduct because your
      story is too important to be ignored.
    </p>
  </div>
</div>
```

The first image provided shows the new ‘meet the team’ section. This section includes images for the portrait pictures and links to their personal websites for more information. The second image is the section that lists partners of PPUC and hyperlink icons to relevant projects. In addition, the implementation for this section was constructed so that more information can easily be appended if needed.

Researchers:

```
renderPieChart() {
  const width = 250,
    height = 250,
    margin = 10;

  let canvas = d3
    .select(this.svg.current)
    .append("g")
    .attr("transform", "translate(" + width / 2 + "," + height / 2 + ")");

  console.log("canvas: ", canvas);

  // The radius of the pieplot is half the width or half the height (smallest one). I subtract a bit of margin
  var radius = Math.min(width, height) / 2 - margin;

  // Data here
  var data = [
    {
      category: "Gives officers Unfair Access to Information 17.5%",
      ratio: 17.5,
    },
    { category: "Restricts/Delays Interrogations 20%", ratio: 20 },
    { category: "Limits Oversight/Discipline 11.9%", ratio: 11.9 },
    { category: "Erases misconduct Record 11.8%", ratio: 11.8 },
    { category: "Disqualifies Complaints 2.8%", ratio: 2.8 },
  ];

  var color = d3
    .scaleOrdinal()
    .domain(data.map((d) => d.category))
    .range(d3.schemeSet2);

  // Compute the position of each group on the pie:
  var pie = d3.pie().value(function (d) {
    return d.ratio;
  });
  var data_ready = pie(data);
  // Now I know that group A goes from 0 degrees to x degrees and so on.

  // shape helper to build arcs:
  var arcGenerator = d3.arc().innerRadius(0).outerRadius(radius);

  console.log("data_ready: ", data_ready);

  // Build the pie chart: Basically, each part of the pie is a path that we build using the arc function.
  canvas
    .selectAll(".slice")
    .data(data_ready)
    .enter()
    .append("path")
    .attr("class", "slice")
    .attr("d", arcGenerator)
    .attr("fill", function (d) {
      return color(d.data.category);
    })
    .attr("stroke", "black")
    .style("stroke-width", "2px")
    .style("opacity", 0.7);

  // Now add the annotation. Use the centroid method to get the best coordinates
```

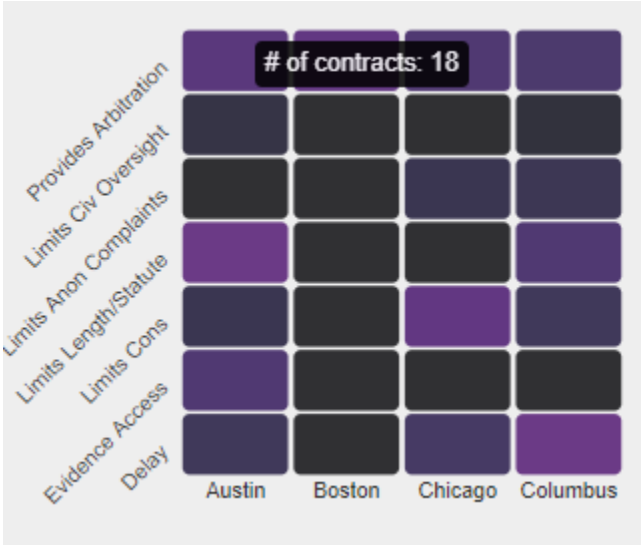
```
renderHeatmap() {
  const tooltip = d3tooltip(d3);

  const width = 250,
    height = 250,
    margin = 10;

  let canvas = d3
    .select(this.svgHeatmap.current)
    .append("g")
    .attr("transform", "translate(" + 100 + "," + margin * 3 + ")");

  const data = heatMapData;

  // Build X scales and axis:
  var x = d3
    .scaleBand()
    .range([0, width])
    .domain(data.map((d) => d.City))
    .padding(0.05);

  canvas
    .append("g")
    .style("font-size", 12)
    .attr("transform", "translate(0," + height + ")")
    .call(d3.axisBottom(x).tickSize(0))
    .select(".domain")
    .remove();

  // Build Y scales and axis:
  var y = d3
    .scaleBand()
    .range([height, 0])
    .domain(data.map((d) => d.Problem))
    .padding(0.05);

  var yAxis = canvas
    .append("g")
    .style("font-size", 12)
    .call(d3.axisLeft(y).tickSize(0));

  yAxis.selectAll("text").attr("transform", "translate(-5,0)rotate(-45)");

  yAxis.select(".domain").remove();

  // Build color scale
  var myColor = d3
    .scaleSequential()
    .interpolator(d3.interpolateInferno)
    .domain([1, 100]);

  // add the squares
  canvas
    .selectAll()
    .data(data)
    .enter()
    .append("rect")
    .attr("x", function (d) {
      return x(d.City);
    })
    .attr("y", function (d) {
      return y(d.Problem);
    })
```

The first image in the researchers section shows the code used to create the pie chart with problematic provisions. It uses D3 to define the different properties of the chart as well as the data included within it. The next image similarly uses D3 to create a heatmap with the data of the contracts and their locations.

3.4 Sample Tests

Testing is an important step that helps determine the reliability and functionality of various features. In our project, the only testing that had to be done was the functionality of the heatmap. This heatmap required the team to test a set of data that included the number of contracts in each city for each problematic provision category. In addition, different values had to be tested from the csv file and make sure hovering over the cell displayed the correct value and was shaded accordingly. Below are Figures 2 and 3 which display an example of the heatmap and corresponding data.

Figure 5: Heatmap and Data



	City	Problem	Contracts
2	Austin	Delay	10
3	Austin	Evidence Access	15
4	Austin	Limits Cons	8
5	Austin	Limits Length/St	23
6	Austin	Limits Anon Con	0
7	Austin	Limits Civ Overs	6
8	Austin	Provides Arbitrat	18

3.5 Code Coverage

For this project, no software was used for code coverage.

3.6 Installation Instructions

In order to get the system to work locally on a personal machine, users must clone the Github repository in their console through the following link.

https://github.com/CAASI-G2A/g2a-website.wiki.git

Next, make sure the following are preinstalled on the local system:

NodeJS/NPM (12+)

Python (3.6+)

Then navigate to the root directory of the project source code and install the necessary python libraries:

pip3 install -r requirements.txt (or pip install -r requirements.txt for Windows)

Next run the application setup code:

python3 manage.py runscript -v3 setup_app

Then change the frontend code directory:

npm install

Then build react application assets:

npm run build

Then change back to the main source code directory and start the backend:

python3 manage.py runserver

Through these steps, a user or developer can run the entire system locally without affecting the main Github repository. However, unless users wish to test development changes, it is recommended that users simply access the website online where the development team will update the system periodically.

4. Results

The system developed solved most of the main problems that the client wished to address. There was no visualized data on the site for researchers to see, which the team was able to provide through multiple data figures. These data figures included a pie chart with data pulled from a sister project, an example translation of a contract, a definition table defining various problematic provisions, and a heatmap that shows these provisions in different locations. Our project is simply a website, so all users have to do is to navigate to the site and click through the different sections on the navigation bar. Under the Researchers tab, the user can scroll through the information and use their mouse to hover over different cells in the heatmap. This will then display the number of contracts related to that provision in that specific city. Because the capstone team's development was based on displaying more information, it is difficult to quantify the effect it would have on the user. However, it is safe to assume that the amount of information conveyed to the user through the new additions is at least worth several minutes of manual searching that they would have had to do on the old system.

5. Conclusions

After completing the project, a few observations can be made. The most important is the importance of teamwork and iteration in the development of any project. Starting with an idea, that idea must go through multiple steps of refinement before arriving at an achievable goal. That goal must be broken down into steps and different contributions must be assigned to different team members to progress to the goal efficiently. Even upon reaching the goal, the product has to reach client expectations to be deemed "successful."

A noteworthy point that the capstone team would like to convey is the multidimensional nature of social injustices. While attending protests, publicizing issues, and trying to advance public policy is a way to influence change, there are other ways to contribute. The G2A team was able to capitalize on their skills to create tools for the everyday citizen to educate themselves. Ultimately, each individual can help enact change in their own way, in their own community; what is truly rewarding is knowing that the work done can contribute to increasing the quality of life for those who may not be as privileged.

Project Police Union Contract (PPUC), a subdivision under G2A, analyzes police union contracts to clarify the process to file a police misconduct complaint. There are two major functions; a complaint tool directed at general citizens to educate users on the complaint process, and a database tool directed at researchers to easily search and learn about the problematic language in police contracts.

However, when the capstone team first accessed the PPUC website, there was little that was clear to the user. Information was presented in chunks of text, and a first-time user would have little way of understanding how to use the tool itself. It was completely functional as a basic framework, but there were a few glaring issues when assessed for easy user experience. There was no method of contact to the G2A team, no further resources, no acknowledgement to contributors and partners, and lacked information on the functionality of the tools offered with this project and why it is relevant to the user. The changes the capstone team proposed were largely to alleviate these user experience issues.

After completing the changes to the system that would ultimately improve the website interface and a visiting citizens understanding of the tool, the team and the client reviewed the resulting product for a final time. While some of the changes deviated mildly from the original wireframe, the edits were more in line with the pre-existing format of the site. From this, it is evident that while planning ahead is necessary, there are other factors that could change the end product during the development process. Part of the experience is learning to adapt to the unexpected and learning to work interactively to produce a product both the team and client are satisfied with.

With the changes that the capstone team has contributed, a visiting citizen will ideally feel more welcome and find it easier to access the information they need. Ultimately, this would lead to more accurate misconduct complaints, more issues being exposed, and therefore advance the current justice system to be more equal. Tools like PPUC are but a small step in correcting the problems in our society, but education and free access to information will definitely aid in exposing injustices and encouraging advocacy.

6. Future Work

This project was just one step in the vision that PxPUC has for their end product. However, the contributions the capstone team made serve as an important foundation for further development and research. As separate teams continue to gather data on contracts on different locations, the heatmap feature can be expanded and improved. It also lays the groundwork for future functionality such as making the heatmap link to related or translated contracts. Future work for the site includes gathering more contract information from various locations, translating these problematic contracts into comprehensible summaries, and developing an AI chat feature that can help answer questions users may have.

7. References

[1] Campaign Zero. (2015). Retrieved April 26, 2021, from https://www.joincampaignzero.org/

[2] G2A - PxPUC. (2021). Retrieved April 26, 2021, from https://www.grieftoaction.org/

[3] Police Union Contracts. (2017). Retrieved April 26, 2021, from https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=3890&context=dlj