HACETTEPE UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF COMPUTER ENGINEERING

INTERNSHIP REPORT

Mehmet Giray Nacakcı

Performed at

AppNava

July 2022 – September 2022

1 Introduction

I worked Remotely as a Frontend Development Intern at AppNava – a predictive game analytics company – , in the Development Team, from July to September 2022.

My main areas of work were:

- Design and implementation of Blog and Error pages
- Search Engine Optimization (SEO)
- Mobile-friendly responsive design (CSS)

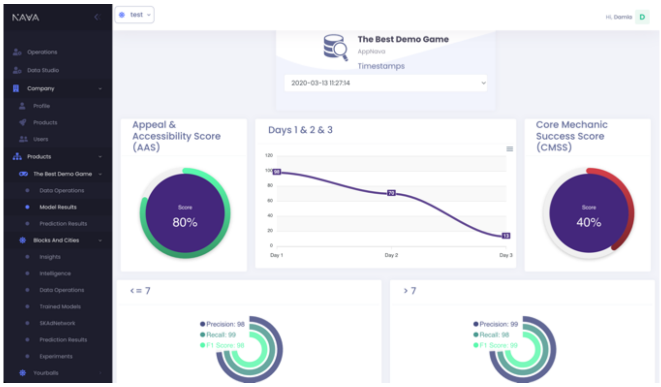
All of my work has been deployed into the live appnava.com website. My work has increased the visibility and credibility of the public website and increased the time visitors spend on the website, engaging with more content, on more devices with different screens.

My initial motivation for working with AppNava was due to AppNava's good-looking website, and their focus areas such as: developing strategies to improve player experience and keep them in the game, Machine Learning and optimization. Yet, however exciting the ML operations at the backend of the product may be, I worked only on the website Frontend, yet I'm glad for this experience, as I learned a lot.

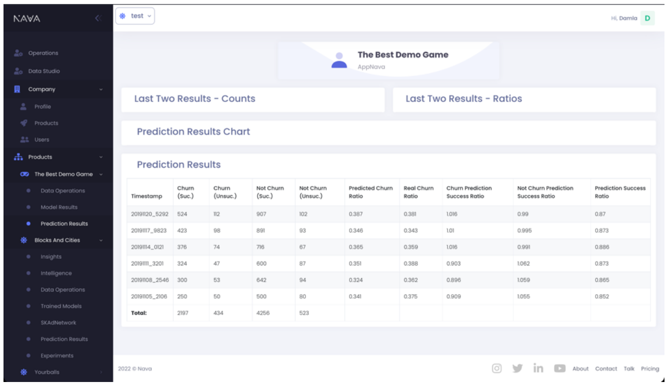
2 Company Information

AppNava is located in METU Technopolis, Ankara; and focused on their only product: AppNava. AppNava is a Software-as-a-Service startup, founded in May 2019 by data scientist Damla Dokuzoğlu (CEO), and software engineers Burkay Sucu, Ahmet Rıdvan Potur and Kıvanç Kamay.

AppNava (App + Navigator) helps mobile game companies get to know their users and their behaviors better (and with less effort), thus take more precise actions to maximize profit. Game studios spend huge budgets on marketing; yet, user acquisition is only the beginning. It is important to keep them in the game as long as possible ("retention"), to maximize revenue [2]. This is where AppNava comes in to help. AppNava is an analytical tool that analyzes data and predicts future behavior of players, with Machine Learning.



Timestamps
2020-03-13 11:27:14



Prediction Results

Timestamp	Churn (Suc.)	Churn (Unsuc.)	Not Churn (Suc.)	Not Churn (Unsuc.)	Predicted Churn Ratio	Real Churn Ratio	Churn Prediction Success Ratio	Not Churn Prediction Success Ratio	Prediction Success Ratio
20191120_5292	524	112	907	102	0.387	0.381	1.016	0.99	0.87
20191117_9823	423	98	891	93	0.346	0.343	1.01	0.995	0.873
20191114_0121	376	74	716	67	0.365	0.359	1.016	0.991	0.886
20191111_3201	324	47	600	87	0.351	0.388	0.903	1.062	0.873
20191108_2546	300	53	642	94	0.324	0.362	0.896	1.059	0.865
20191105_2106	250	50	500	80	0.341	0.375	0.909	1.055	0.852
Total:	2197	434	4256	523					

When a mobile game company registers to AppNava, after API integration and choosing the ML training model, service works automatically [3]. ML algorithms learn and segment players based on past in-game behavior data. The players can be segmented by their: device, location, in-game behavior, number of rewarded ad videos they will watch, how much will they spend in in-app purchases, how many days/levels will they play and when will they stop playing the game ("churn"), LTV (lifetime value)(estimated total revenue from this player) [4], and more. Then, within first 30 seconds of a new user entering the game first time (and then continuing to be updated), based on their in-game behavior, AppNava predicts and assigns them to a segment.

Then, game experience can be tailored/personalized to each segment/player via actions such as: changing push notification or ad frequency, rewarding gift boxes, custom pricing adjustments to in-game items and in-app purchases, special offers, custom adjustments to game difficulty and content, and more. Improved user experience leads to increased loyalty and enjoyment, reduced churn; and in return: profit [4].

AppNava's efforts and business model have been appreciated by many critics.

- Türk Telekom Pilot incubation/acceleration program accomplishment/funding, 2019 [5].
- 3rd Best Startup of the Year award by Webrazzi, 2019 [6] .
- Euroasian Startup Awards, finalist in 5 categories including "The Master of AI", 2020 [7].

AppNava has reached more than 30 customers (game studios) worldwide, and proudly aiming for more…

2.2 About my department

The Development Department produces all software outputs of AppNava. Developers team up in small groups or work individually based on tasks. During half of my time in AppNava, I did individual work; and half time multidisciplinary teamwork with the Marketing team; all while being in touch and getting feedback from Development team.

The Development Team is agile and works with weekly sprints. Not perfectionism but fast output and communication are appreciated.

I mostly reached out to my team for help and advice, and seldom asked the previous writers of a code section for their intention.

2.3 Hardware and software systems

The customer interface of AppNava is a website. Data processing and prediction operations happen at the Backend server running Django.

Frontend technologies I touched: HTML, JS, jQuery, CSS, Bootstrap.

Testing is done on the Staging website, then deployed to production.

2.4 My supervisor

My supervisor Ulya Türker Çelik is a Software Development and Test Engineer with 10+ years of experience. Her supervision to me is mentioned in other chapters. Her review of my work, code-writing, and discipline were positive.

3 Work Done

My local development environment consisted of Docker images, GitHub Desktop, PyCharm IDE, and multiple web browsers. HTML and CSS were the technologies I used most frequently. “Inspect element” tools in browsers helped me test ideas, learn CSS, and also make very quick changes to design. My work also touched Django for handling errors, fetching data, and integration with Frontend.

In the development of public pages, three tests are done: on local, on stage, and on production. Testing on Frontend is done manually. Different devices, browsers, zoom amounts, page resizes; are tested for layout, style, and functionality. Chrome and Safari have user agent tools to emulate a wide range of mobile devices.

I, as a developer, have done coding all my three main projects individually. Teamwork came into practice with idea exchange, help, review and testing. Since my creativity was utilized mostly on the public side of the website, other developers could have more time to focus on pending tasks for improving the dashboard and Backend operations.

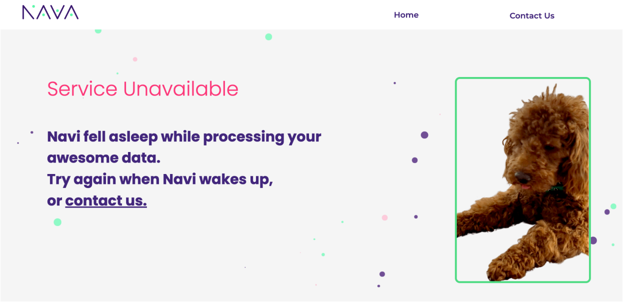
We did not have strict coding standards, yet I mostly followed the existing style and put effort into writing clean and understandable code.

Overall, my work contributed to discoverability and marketing value of appnava.com. Visitors spend more time, read more content and get insight, also with their mobile devices.

3.1 Error Pages

AppNava’s error pages used to consist of an error code such as “500” and big texts such as “something went wrong!”. It was frustrating and confusing for users to encounter these pages. I redesigned these error pages with friendly humor and brand identity. Presented my ideas and alternatives, received comments and feedback from the development team and my SEO teammates from the Marketing department. I coded, revised, tested these pages and exception-handling mechanisms in server and client machines.

- http503 Service Unavailable: Server is overloaded with too much traffic, or in maintenance.

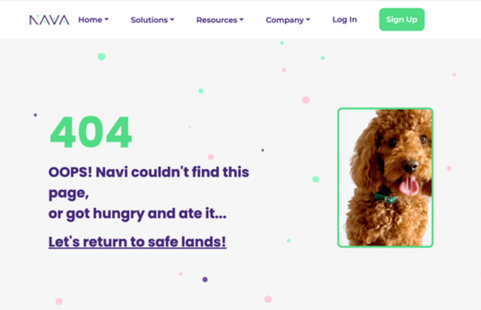


Service Unavailable

Navi fell asleep while processing your awesome data.
Try again when Navi wakes up,
or contact us.

- http504 Timeout: Server did not respond within chosen time limit. Server may return this response, or Ajax (asynchronous JavaScript code counts time in background) code on client machine can redirect to error page when time is up. The design of this page is the same as the http500 page.

- http404 Not Found: This URL is mistyped or the page does not exist.



404

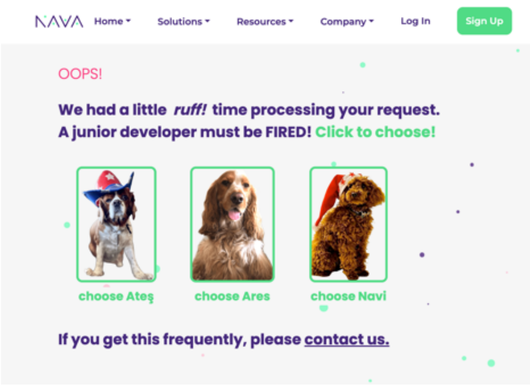
OOPS! Navi couldn't find this page,
or got hungry and ate it...

Let's return to safe lands!

- **http500 Internal Server Error:**

  Caused by any Exception raised/caught in Backend code.

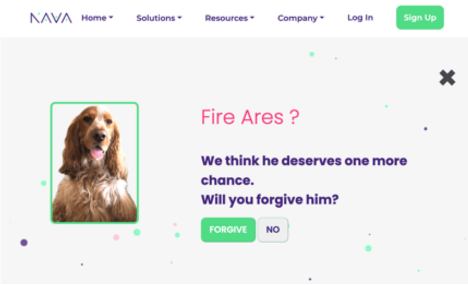
  - When this error is encountered on public website appnava.com, 500 page is served, redirecting to error page.



OOPS!

We had a little *ruff!* time processing your request.
A junior developer must be FIRED! Click to choose!

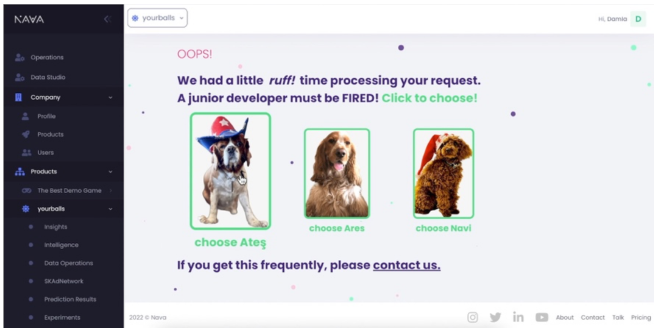
If you get this frequently, please contact us.



Fire Ares ?

We think he deserves one more chance.
Will you forgive him?

- When this error is encountered inside a user's dashboard (logged-in, private area), error content replaces main content (using JavaScript) without kicking the user out of their dashboard. This new feature reduced our users' frustration of error => redirect => login again => try again cycle.



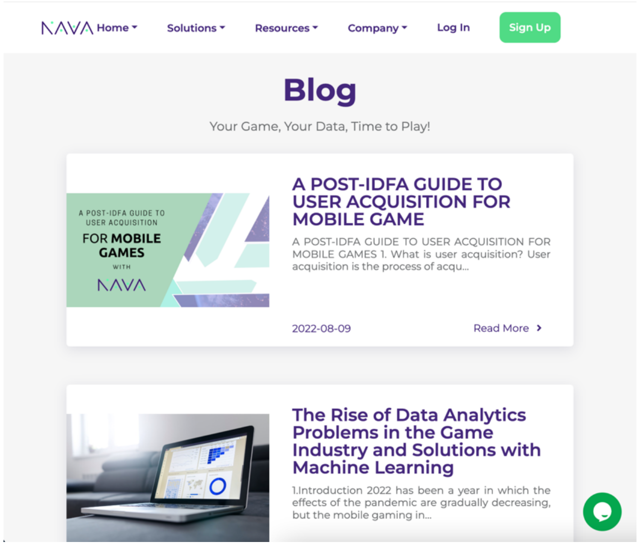
OOPS!

We had a little *ruff!* time processing your request.
A junior developer must be FIRED! Click to choose!

If you get this frequently, please contact us.

3.2 BLOG

AppNava has already been sharing articles on medium.com to provide more insight into their services, success stories, solutions to industry problems, and tips. However, hosting this content on AppNava's own website would be more beneficial as it would bring more traffic to the website, and keep readers inside appnava.com. Thus, I retrieved content via Medium's RSS Feed, and created (designed and implemented) Blog pages at appnava.com/blog. Although RSS feed had limitations such as showing only the most recent 10 articles; the feed was immediately updated whenever a new article is added, and thus useful.


NAVA
Home
Solutions
Resources
Company
Log In
Sign Up
A POST-IDFA GUIDE TO USER ACQUISITION FOR MOBILE GAMES WITH NAVA
Read More

Blog

Your Game, Your Data, Time to Play!

A POST-IDFA GUIDE TO USER ACQUISITION FOR MOBILE GAME

A POST-IDFA GUIDE TO USER ACQUISITION FOR MOBILE GAMES 1. What is user acquisition? User acquisition is the process of acqu...

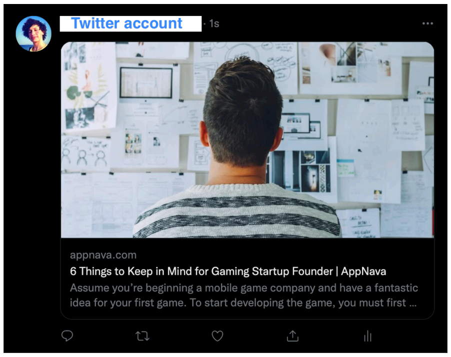
2022-08-09

The Rise of Data Analytics Problems in the Game Industry and Solutions with Machine Learning

1.Introduction 2022 has been a year in which the effects of the pandemic are gradually decreasing, but the mobile gaming in...

Initially, Blog content was fetched on Frontend via JavaScript Fetch API; yet, this approach was not only slow, also the content was loading after webpage is loaded on client's computer. This prevented search engines from crawling (discovering) the content, and prevented social media websites like Twitter and LinkedIn from showing a preview when AppNava's blog links are shared, since none of them executes JavaScript to read dynamically created content.

With the new approach, same content is now retrieved on Backend. Serving static content by Server-side-rendering is much better for discoverability by Search Engines (SEO), and also enables social media previews, and pagination.

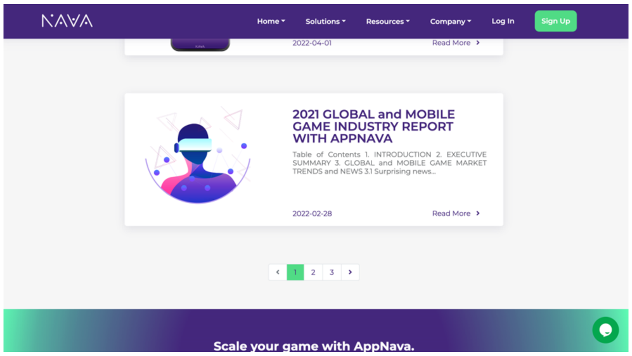


appnava.com

6 Things to Keep in Mind for Gaming Startup Founder | AppNava

Assume you're beginning a mobile game company and have a fantastic idea for your first game. To start developing the game, you must first ...

Twitter preview



2022-04-01 Read More ›

2021 GLOBAL and MOBILE GAME INDUSTRY REPORT WITH APPNAVA

Table of Contents 1. INTRODUCTION 2. EXECUTIVE SUMMARY 3. GLOBAL and MOBILE GAME MARKET TRENDS and NEWS 3.1 Surprising news...

2022-02-28 Read More ›

Scale your game with AppNava.

Pagination

Mobile-friendly Responsive Design

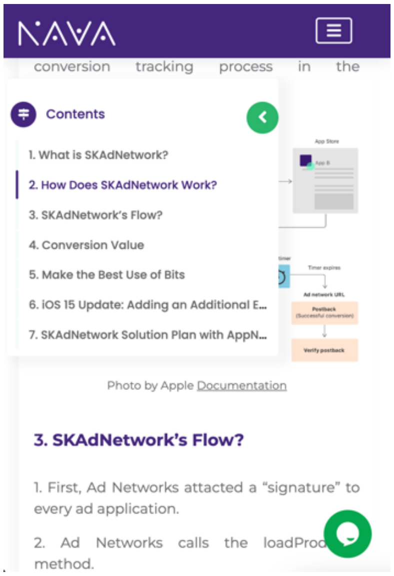
Using CSS media query, according to screen resolution or size, position and show/hide of contents/elements are achieved/arranged. An example is the dynamic table-of-contents. Active title indicator is updated based on the current scrolled location, and titles can be clicked to auto-scroll to any section. Blog pages are equipped with this table of contents sidebar.

On small screens, or on window resize to less than 1000 pixels width,

a. this sidebar becomes collapsed, expands and collapses with a button.

b. When clicked on a link, automatically collapses to not get in the way.

c. content fills the screen with readable text size, less whitespace.



conversion tracking process in the

Contents

1. What is SKAdNetwork?
2. How Does SKAdNetwork Work?
3. SKAdNetwork's Flow?
4. Conversion Value
5. Make the Best Use of Bits
6. iOS 15 Update: Adding an Additional E...
7. SKAdNetwork Solution Plan with AppN...

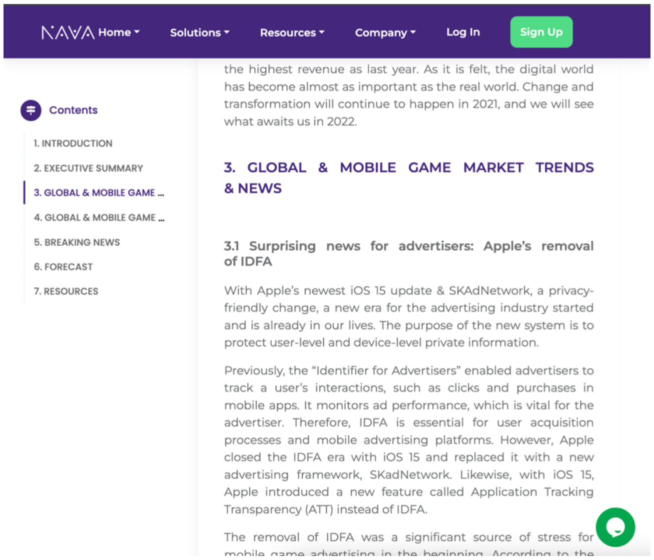
Photo by Apple Documentation

3. SKAdNetwork's Flow?

1. First, Ad Networks attacted a "signature" to every ad application.

2. Ad Networks calls the loadProd method.

Mobile (< 1000px)



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4. GLOBAL & MOBILE GAME ...
5. BREAKING NEWS
6. FORECAST
7. RESOURCES

the highest revenue as last year. As it is felt, the digital world has become almost as important as the real world. Change and transformation will continue to happen in 2021, and we will see what awaits us in 2022.

3. GLOBAL & MOBILE GAME MARKET TRENDS & NEWS

3.1 Surprising news for advertisers: Apple's removal of IDFA

With Apple's newest iOS 15 update & SKAdNetwork, a privacy-friendly change, a new era for the advertising industry started and is already in our lives. The purpose of the new system is to protect user-level and device-level private information.

Previously, the "Identifier for Advertisers" enabled advertisers to track a user's interactions, such as clicks and purchases in mobile apps. It monitors ad performance, which is vital for the advertiser. Therefore, IDFA is essential for user acquisition processes and mobile advertising platforms. However, Apple closed the IDFA era with iOS 15 and replaced it with a new advertising framework, SKadNetwork. Likewise, with iOS 15, Apple introduced a new feature called Application Tracking Transparency (ATT) instead of IDFA.

The removal of IDFA was a significant source of stress for mobile game advertising in the beginning. According to the

Desktop / Tablet

3.3 Search Engine Optimization (SEO)

AppNava wants to be in Google's top search results when someone searches for "game analytics", "increase LTV" and similar industry-related terms. For this reason, I (from Development Team), and two people Marketing Team teamed up as a multidisciplinary SEO team.

We were researching, thinking of possible improvements to the website, discussing results with each other, creating tasks; and as the developer, I was evaluating the feasibility of the tasks and required time, then coding them. My teammates also monitored improvements along the way via Google Search Console and Google Analytics to have a roadmap of what to do in next steps. [8, 9].

What I've learned from our SEO research is that: When developers put thought/care into User-Experience, SEO score naturally improves. Crawler bots (used by search engines to explore and rank websites) rate websites by investigating "Is this website designed well for users?". As SEO is tightly related to UX, the actions we have taken to optimize SEO and discoverability essentially increased the overall quality of appnava.com.

Our website already had good SEO. Yet, open to improvement. The below are implemented by me:

- Blog pages are created to host more content on the website (see 3.2).
- Created sitemap.xml and robots.txt. In short, declared which URL paths of our website we desire to be discoverable by web crawlers.
- Created parametrized and readable URLs consisting of keywords such as appnava.com/blog/how-to-reduce-churn
- For performance optimization, unused JS and CSS libraries/resources/dependencies are removed, some images are compressed.
- Meta tags give metadata about the page to web crawlers and preview tools. Being descriptive and accurate builds trust.

4 Performance and Outcomes

4.1 Applying Knowledge and Skills Learned at Hacettepe

Throughout my internship, I utilized my general programming skills developed in taking three years of classes at Hacettepe Uni. Computer Engineering Department. I can give examples of transferable skills that apply throughout the domain such as programming, divide-and-conquer, abstraction, clean code and report writing.

Being familiar with Web development terminology, which I learned during my BBM384 (Software Engineering Lab.) project, I could report to other developers what I wanted to or did. Participating in teamwork and project management activities in BBM412 and BBM384 projects, I was able to apply my time management and collaboration skills at AppNava.

For web development, I practiced JavaScript during my BBM412 (Computer Graphics) web-based game project, and practiced HTML and CSS during my BBM384 social website project. I heavily utilized these frontend skills in my internship. Having experience with Python from BBM101 and BBM103 (Introduction to Programming) courses, and with SpringBoot backend framework from BBM384 helped me quickly adapt to Django backend framework.

4.2 Solving Engineering Problems

In the projects I worked on, my approach was less about algorithms, and more about paving the way for new features. For example, the blog pages are very recently created and there can be many additions in the future such as topic sorting, search, commenting, and so on.

As an example, (see 3.2), moving Blog content fetching and parsing algorithms from Frontend to Backend solved SEO problems such as the need to create static (server-side-rendered) metadata and previews, enabled new capabilities with Python, contributed to flexibility for developers in terms of further optimizations and maintenance (For example, if I continued working in AppNava, my next task was going to be "creating an automatic mailing list for notifying customers when a new blog article is shared", which could not be implemented on Frontend), and so on.

4.3 Teamwork

As mentioned in 2.2, Development Team is one big team consisting of developers with mostly computer engineering related educational backgrounds. As I observed and experienced, everyone is there for each other for questions, help and idea exchange, even during their separate/individual tasks.

A more specific teamwork I participated in, was the SEO Team as mentioned in 3.3. My teammates (fellow SEO growth marketers from Marketing Department) conducted most of the SEO study, prepared new content using copywriting skills; monitored, shared and discussed their ideas and inspection results with me. I, as the developer, created coding tasks based on ideas we agreed on, analyzed and discussed the technical feasibility and time needs of these tasks, implemented and completed the tasks. And the cycle continued with continuous feedback. We established effective communication and learned from each other.

4.4 Multi-Disciplinary Work

My multi-disciplinary teamwork in SEO Team is explained in detail in sections 3.3 and 4.3. My teammates had Marketing Domain skills, and elicited requirements were realized by my technical skills. As a team, we also touched some areas of User Experience Design, and Visual Design, as we looked for ways to improve the website overall. As all three recent students, we had just started practicing inter-disciplinary communication with each other, and mostly succeeded.

4.5 Professional and Ethical Issues

I did not encounter or observe any ethical issue during my time in AppNava. All my colleagues were kind, sincere and helpful toward one-another. In my farewell, I thanked everyone for the pleasant time period we spent together.

4.6 Impact of Engineering Solutions

As a frontend developer who added/modified public webpages, I modified the face/presentation of AppNava, which directly affects reputation and marketing value. From design to production, hiring me involved both trust and risk-taking for AppNava. The website's visitors' view and behavior are now slightly changed. AppNava can now reach out to game studios more confidently.

I am not informed if the impacts of my overall work were quantitively measured by AppNava Marketing Department, yet we intuitively believed in the improvements.

4.7 Locating Sources and Self-Learning

I was lucky enough to not be told “Learn these and these tools before starting your internship!”.
My skillset was already mostly compatible with my work, and I learned everything else in the time of doing.

I started with an AppNava developer onboarding session that includes tutorials and guides to all the tools I would be using during my development work. When I was given a task or faced an issue that included objectives I cannot complete with my existing knowledge, I first searched the web for examples of such implementations in industry, documentations, and tutorials. Then I consulted and brainstormed with my teammates and supervisor, experimented with code, and sometimes took initiative.
Specifically,

- For Error Pages (see 3.1), in design brainstorming sessions, we looked at many popular websites’ error pages for inspiration.
- For Blog Pages (see 3.2):
    - in content retrieval from medium.com, I followed a synthesis of many online tutorials.
    - in responsive design, I have learned and experimented with many CSS tricks on specifically w3schools.com.
- In Search Engine Optimization (see 3.3), there was an abundance of outdated or conflicting sources on the web. Thus, we mainly sticked to Google’s guides and monitoring tools, also due to its popularity [9, 10].

4.8 Using New Tools and Technologies

I was familiar with Python (from Introduction to Programming course), and SpringBoot as a Backend framework (from Software Engineering Lab. Course at Hacettepe). Therefore I quickly adapted to Django by the provided tutorials and by working with it.
In Django, I mainly only worked on Error Handling (see 3.1), and Views and Templates (integration with Frontend). Since Django is very capable and complex, I cannot say I gained proficiency, only familiarity.

I was somewhat familiar with CSS and HTML from my BBM412 web-based game and BBM384 social website projects, yet in AppNava I gained a lot of insight and fluency regarding position and styling of page elements. I learned all by case-specific tutorials and forums and by experimenting myself. I feel not proficient but mid-level confident in these frontend technologies.

5 Conclusions

AppNava analyzes mobile games' players' behaviors, predicts future using ML, and suggests player-specific actions to help game studios keep their players happier and playing longer.

As a Frontend development intern, I added new pages to AppNava's public website and made technical improvements to increase their online presence. During these developments, I gained fluency in core Frontend technologies and popular implementation methods. I have found a chance to apply the engineering design and development principles learned throughout my Hacettepe CS education.

I believe video games can be inspirational art pieces; and, facilitating scientists' and artists' workflows is one of the missions of my career. With AppNava, game studios can develop better strategies for themselves and survive longer. Thus, I am proud of working with AppNava.

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