

Full Stack Development: Building Modern Mobile and Web Applications

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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

FATHOMWERX, a governmental entity that works to bring together public and private stakeholders for the Department of Defense, needed a software platform to facilitate a meaningful user experience for attendees of an upcoming event summit. This need was addressed through the development of a cross-platform mobile application that served as an event agenda and networking platform for the specific conference itself. Once the problem was communicated and passed off to Naval Information Warfare Center (NIWC) Atlantic, their mobile applications team decided that a mobile app would best suit the needs of the user. FATHOMWERX and the NIWC development team began working closely together to establish and continually evolve requirements and specifications—the event planners articulated what they wanted while the developers returned with evaluations of what was possible and/or realistic. After a few months and many design iterations and adaptations, the mobile application was successfully deployed and utilized by event participants to enhance their attendance experience. The basis of the application could easily be adapted to serve future events, as well as other purposes entirely.

1. INTRODUCTION

Virtually every business entity or organization in modern society benefits tremendously from dedicated software or an online presence, whether serving strictly as an information hub or providing other specialized functionalities. Perhaps the best method of successfully achieving a useful online presence is maintaining a dedicated website or web application. This involves crafting intended purposes for the site in terms of desired functionality, physically coding and implementing the functionality,

and eventually publishing and continuously refining the application.

Mobile applications are also extremely useful, given how ubiquitous smartphones and other mobile devices have become, and are often able to serve the end user better or more conveniently. Software development for these purposes involves the look and feel of the site or app on the front-end, as well as the business logic, database interaction, and other dynamic behaviors on the back-end. All of these may be achieved through a variety of technological manners and frameworks, with an emphasis on choosing a stack of elements that cater well to the development team and the desired outcome for both stakeholders and end users.

2. RELATED WORKS

Islam and Mazumder (2010) discuss the early history and rise of mobile application technology from its inception up to the point of their writing. One of the major effects of mobile application technology, they claim, is the saving of time and increasing of productivity. It is often a lot easier to manage data and perform tasks, from keeping track of a list or schedule to interacting with potential business associates, in a digital setting than it would be manually without a note-taking app or LinkedIn, for example. This is the case with the FATHOMWERX event summit app, which makes it much easier to develop and distribute synchronized information from the event holders to the attendees.

In a different article entitled “An ubiquitous mobile multimedia system for events agenda”, the authors discuss a mobile application “that allows users to obtain useful information about culture events.” The app is hosted through a singular, centralized server that dishes out information to users on a request-by-request basis. GPS systems are used in conjunction with other sensors to provide real-time

updates and meaningful guidance among other accessibility pleasures for users.

3. SYSTEM DESIGN

The structure of the system was carefully constructed to meet the perceived needs of the eventual users. This entailed front-end elements that users would interact with directly, as well as back-end components that are usually less apparent—both of which presented their own design challenges for the team.

3.1 Project Requirements

Event facilitators and developers worked together to elicit project requirements as the first step of the software development lifecycle. Integral to successive requirements, all core functionality revolves around the user's ability to create an account and login to the application to allow their personal account data to persist across usage sessions. All summit events must be viewable in agenda form, with more information pertaining to specific events available upon further inspection. Users must be able to search for and message other users privately with the option to create message groups of multiple people. There should be multiple types of users, ranging from event attendee up to super admin, with corresponding functional privilege levels. Admin users should be able to create question-and-answer chat rooms dedicated to events. Finally, all users must be able to save personal notes and create personally curated schedules of events they plan on attending. This is by no means an exhaustive list but covers many of the main features. These features must be available in mobile applications for both the iOS and Android operating systems.

3.2 Front-end Design

To address the need for a cross-platform application, developers on the

front-end side of development chose to employ Flutter, “an open source framework by Google for building beautiful, natively compiled, multi-platform applications from a single codebase” (Google, 2022). The front-end side of development “refers to the part of a Web application or site that runs in a Web browser—the part that users can see and experience” (Chauhan, 2022), which was aptly handled by the front-end half of the development team. This work mainly involves the look and feel of the app from an aesthetic perspective, designing intuitive layouts including form views for user input, list views for displaying information, etc. I was not tasked with any work on the front-end side of this project, so the extent of my knowledge beyond what I have covered so far in this section is less than intricate.

3.3 Back-end Design

The back-end side of the application design, referring to “the hidden parts of a Web application or site that users cannot see—the code” (Chauhan, 2022), was a little more complicated with many more moving parts to be considered. All dynamic information that was populated into front-end components of the app came from API (application programming interface) calls. This entailed the dev team hosting a separate dedicated website solely for the purpose of providing information to this application over the internet. Essentially the way the API worked is that the mobile application would send requests for data over the internet to the website hosting the API with request parameters specifying what information was desired. The API would then return data to the mobile application which would be displayed to or used for some functional purpose by the end user.

These API endpoints were hosted on a Node.js based web server through Amazon Web Services (AWS). Node.js is a back-end JavaScript framework (Chauhan, 2022)

that was used in conjunction with a software package called ExpressJS that was used to handle the routing of API calls. User data was stored in AWS's DynamoDB database service in the cloud. Also hosted through AWS with these same technologies was a separate admin portal web application to be used for administrative purposes, such as editing events.

3.4 Challenges

Although none proved to be detrimental to the project but rather thought-provoking and worthy of more research and development time, we faced several challenges during the development process. The first of these was access control handled through the addition of a security layer within the API endpoint routing that would allow access to certain privileges only for users above a certain permission level.

Another challenge involved the development team's lack of experience with hosting mobile/web application resources in the cloud. The team wished to lean on Amazon Web Services as the primary cloud service provider from the get-go. However, Google Cloud Platform was also used as a secondary backup mechanism in case of failure. This led to redundant development in many of the early stages.

A final challenge was the eventual deployment of the application to the Apple App Store and the Google Play Store. It was unclear if enough time would be left to have the application(s) approved by both reviewing parties, so we investigated other options, such as deploying the application on a smaller scale to the Navy's own application deployment locker.

4. RESULTS

Unfortunately, my internship period ended before the application was deployed for use. However, I can certainly comment on speculative innovations made and

anticipated outcomes of the mobile app, all of which involve increasing the efficiency and productivity of both event facilitators and attendees.

First, all event information is held within a single domain in the form of the software application. Updates to this information can be made synchronously and remotely without the need to worry about redistributing physical copies of fliers—everything is digital and in the palm of each user's hand. Mobile push notifications conveniently replace the need for megaphones to update eventgoers in real time.

Users can network and chat remotely with multiple others from different locations, though third-party networking and messaging platforms like LinkedIn are likely to take over once the initial connection itself is made. Also, presenters can view and answer questions from various audience members in virtual question-and-answer rooms without disrupting their presentations.

All in all, the application is sure to facilitate an extraordinarily heightened degree of convenience and efficiency in all realms of the event summit. All functionality is digitally consolidated in a centralized manner that caters to the needs of all parties involved.

5. CONCLUSION

The application development project designed to serve the needs of eventgoers at the conference was successful in its improvement of the convenience, efficiency, and consolidation of tasks for both event attendees and facilitators. The many clear and useful features that the cross-platform mobile app serves can be directly juxtaposed with how one can imagine a large-scale conference would otherwise be held in the absence of mobile technology to best realize the benefits provided by the software. Beyond the immediate value of the

application, the development team also walked away with a trove of newfound knowledge that could be applied to future projects. The anticipated value has yet to be fully realized, as successive adaptations of the app can be used in future roles for years to come.

6. FUTURE WORK

Future work for the event application has the potential to materialize in a few forms. First, initial users of the app on a larger scale than testers within the development team are likely to come across software bugs that went unnoticed during the development process. However, once these initial problems are addressed, there will theoretically be a continual need for functional fixes and updates or improvements which must be taken into consideration by stakeholders who are ultimately responsible for choosing how much effort to put into refinement. Furthermore, the app could be slightly refined to serve future conferences of the same nature, or perhaps adapted to a higher degree to serve other conferences or other purposes of similar yet different natures entirely. In a more abstract sense, the basis of the development project can be used by the development team as a foundation for future projects at many levels.

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