

Military REACH: A University-wide Collaboration

Fatemeh Jamshidi

Department of Computer Science and
Software Engineering
Auburn University
Auburn, Alabama, USA
Email: fzf0007@auburn.edu

Abhishek Jariwala

Department of Computer Science and
Software Engineering
Auburn University
Auburn, Alabama, USA
Email: avj0007@auburn.edu

Bibhav Bhattarai

Department of Computer Science and
Software Engineering
Auburn University
Auburn, Alabama, USA
Email: bzb0079@auburn.edu

Katherine Abbate

Project Manager, Military REACH
Auburn University
Auburn, Alabama, USA
Email: kma0057@auburn.edu

Daniela Marghitu

Department of Computer Science and
Software Engineering
Auburn University
Auburn, Alabama, USA
Email: marghda@auburn.edu

Mallory Lucier-Greer

College of Human Sciences
Human Development and Family Science
Auburn University
Auburn, Alabama, USA
Email: mluciergreer@auburn.edu

Abstract—At the federal level, a partnership composed of the Department of Defense (DoD), the Department of Agriculture (USDA), and colleges and universities throughout the United States of America work toward serving military families. Through this partnership, cooperative agreements are executed to support the needs of service members and their families. One such cooperative agreement between DoD, USDA, and Auburn University is Military REACH. This project aims to bridge the gap between military family research and practice by mobilizing peer-reviewed family science research into practical applications for military families and those who work on behalf of military families. At Auburn University, this project is an interdisciplinary collaboration between the Department of Human Development and Family Science, the Department of Computer Science, and the academic libraries. This paper aims to present the Military REACH website, the new searching functionalities added to the project to increase the number of active users, and a newly launched mobile application that is positioned to promote access to resources and assess the usefulness of the project's research summaries. In this paper, we present the functionality and qualitative data analysis of this additional aspect of the research.

Keywords—Military Families; Applications; Resources.

I. INTRODUCTION

For the past four years, the Auburn University Libraries and Computer Science Department have supported the University's research enterprise in a new way: by adopting a new collaborative model and serving as a high-level Information Technology (IT) and data-management consultants to faculty researchers who are pursuing external funding [1]. A practical example of this model in action is the Military REACH project at Auburn University funded by the Departments of Agriculture and Defense (USDA/NIFA Award No. 2017-48710-27339; PI, Dr. Mallory Lucier-Greer). The purpose of Military REACH is to make research accessible to policy makers, helping professionals, and military families in a manner that is inviting, easily understood, and meaningful for their everyday context [2]. Our

team works to critically evaluate empirical research related to military families and translate it into useful tools. These tools are actively disseminated to policy makers and military helping professionals to inform their decisions and practices as they work to support and enhance the lives of service members and their families. Specifically, the objective of this project is to provide high-quality resources to the Department of Defense (DoD) in the form of research and professional development tools across the spectrum of family support, resilience, and readiness. This work is primarily supported by the DoD's Office of Military Community and Family Policy. The purpose of this project is achieved through three primary deliverables, including:

- Provide timely, high-quality research reports at the request of DoD.
- Re-engineer, grow, and promote an online library of current research and its implications related to the well-being of military families.
- Design and market professional development opportunities, tools, and resources for youth development professionals.

The Military REACH Project is now in its fifth year and continuing at Auburn University for the foreseeable future; indeed, it has highlighted the library's value as an IT partner and led to research partnerships and collaborative funding proposals with other units on campus. This paper describes the related functions that are designed and implemented for each operator. The paper is organized as follows. In Section II, we provide pertinent background information about the project. Section III introduces our efforts to serve military families and covers the design and implementation of the website. Section IV demonstrates evaluation methods using Google Analytics. Section V provides evaluation results of the website. Section VI presents our mobile app as an important step forward.

Section VII presents the conclusion with suggestions for future directions.

II. RELATED WORK

Military REACH started by evaluating existing research in the context of Research Infrastructures (RI) and Digital Libraries (DL). Recent reviews of digital preservation [3] and projects that promote research and awareness in the areas of digital preservation include Curl Exemplars for Digital Archives (CEDARS) [4].

Two decades of research have worked to improve awareness of the digital preservation challenge and encouraged some organizations to improve the longevity of their digital resources. One of the most significant streams of research has been within cultural institutions, sometimes in collaboration with industry partners, to develop solutions to operational problems in these institutions [5]. National, regional, and University archives and libraries in Australia, Canada, Belgium, Denmark France, Germany, the Netherlands, New Zealand, Sweden, Switzerland, the U.K., the U.S., and elsewhere have investigated the implementation of institutional repositories, preservation, and strategies for Web archiving.

III. COLLABORATIVE EFFORTS TO SERVE MILITARY FAMILIES

Working closely with the Military REACH team in the Department of Human Development and Family Science, the library's IT department contributed to the original funding proposal and has guided network architecture, Web development, IT tools and solutions, sustainability, data management, accessibility, usage statistics, and automated methods for identifying recently published research.

A. Design and Implementation

The REACH Web application has an architecture that can be implemented in three layers, as shown in Figure 1.

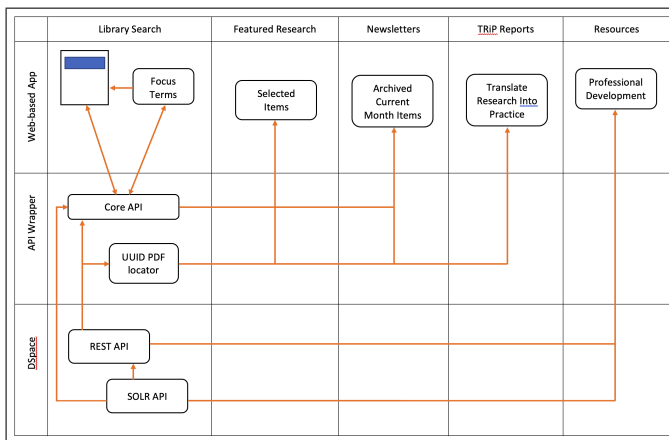


Figure 1. REACH System Architecture.

- **Web-based app:** This layer is the front-end of the application, where we mainly use Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript in Java Server Pages (JSP). Also, the Cascade Content Management System (CMS) used in this project, to manage the JSP, falls under this layer.

- **Application Programming Interface (API) Wrapper:** This layer is the back-end layer, where we use JAVA programs to write classes and methods that handle various functionalities of the website such as search, filter, sort, and many more functionalities.
- **DSpace:** DSpace is an open-source repository software package mostly used to create open access repositories for the scholarly and published digital content. DSpace is the central database of the application. All Military REACH related research articles are stored in this layer. DSpace uses Apache SOLR based search for metadata and full-text contents, all of which are stored in a relational database and supports the use of PostgreSQL. Also, DSpace is used to manage and preserve all the formats of digital content (PDF, Word, JPEG, MPEG, TIFF files). Likewise, it also allows a group-based access to control the setting of level-based permission to individual files.

1) Introduction to the Cascade Content Management Systems: To make the website easy to control and manage, Military REACH uses CMS. Cascade CMS is used in the Web application to manage site content, allowing multiple contributors to create, edit, and publish new entries. Content created in a Cascade CMS is stored in Cascade as an XML file and displayed in a presentation layer based on a set of templates. Programming languages such as Extensible Stylesheet Language Transformations (XSLT), and Velocity [6] are used to transform the Extensible Markup Language (XML) file into HTML/JSP pages.

Fundamental features of Cascade CMS are:

- Content creation (allows users to easily create and format content),
- Content storage (stores content in one place, in a consistent fashion),
- Workflow management (assigns privileges and responsibilities based on roles such as authors, editors, and administrators), and
- Publishing (organizes and pushes content live).

2) Cascade Content Management Systems Advantages: What makes Cascade particularly beneficial to a Web application, such as the Military REACH website, is the ease of updating resources and predefined pages. The “What You See Is What You Get” (WYSIWYG) editors included in the platform allow users to enter text and upload images with less basic knowledge of HTML or CSS (front end languages to make the website look appealing).

The other advantage of Cascade CMS is its collaborative nature. Multiple users can log on and contribute, schedule, or edit content to be published. Since the interface is browser-based; therefore, Cascade can be accessed from anywhere by multiple users. Similarly, Cascade CMS has an efficient, reliable way of sending frequent alerts to the users and site administrators of pages that have not been updated for a certain duration of time.

The use of in-built features such as the daily content report, task manager, and content review dates help collaborative teams stay updated on current tasks. Lastly, Cascade has a community of over 100,000 active users that are frequently

using the platform and are readily available to voice their experiences with using features and capabilities of Cascade.

3) Use of Cascade Content Management System in Military REACH:

- Two pages of the website, the Team members and Community Connections pages, are entirely made in the Cascade CMS. These pages can be easily updated by members of the team who may not necessarily have the technical knowledge of creating and updating web pages.
- Other pages, such as Home page, Family Focus page, and Contact Us page, are hybrid pages, where all of the texts displayed in the pages can be edited from Cascade. Other major functionalities within the hybrid pages are handled in the back-end JAVA classes.
- Therefore, having Cascade pages and hybrid pages simultaneously provides us with more flexibility for both the technical and non-technical team members to be involved in the organization.

IV. EVALUATION METHODS

Our evaluation methods are listed in this section.

A. Google Analytics

Military REACH has been using Google Analytics to access the user data since March 1, 2019 until present. Google Analytics data do not include any personally identifiable information. They are presented to stakeholders as aggregate data, making it a practical tool used in research settings without ethical concerns [7] [8]. The Web development team installed Google Analytics by adding a tracking tag for Military REACH to monitor the usability of the website. The tracking tags are a combination of JavaScript and computer programming language used to develop the website. The tracking tag code allows developers to receive data related to the users' behavior on the website. The data can proceed from diverse avenues. For example, the URL of the page and the device used to access the site. Tracking codes primarily collect data on the nature of the visit, such as the contents viewed, length of the session, average time on each page, location, and so on. This information is in a real-time, interactive dashboard format that can be viewed by logging in to Google Analytics.

B. User Engagement

This project focuses on several indicators from Google Analytics to evaluate the level of engagement. These indicators contain the number of returning users (n), bounce rate, number of pages accessed per session (n), mean session, and time spent on each page (minutes, seconds). The number of returning users reflects the number of sessions visited through the same client IP. A high number of returning users indicates a strong level of engagement with the Web-based platform [7][9]. The bounce rate is a percentage of single-page sessions in which there was no interaction with the page. A high bounce rate means minimal interaction with the page; however, it could also mean that users exit the page after finding what they were looking for right away. A low bounce rate can refer to a high overall engagement, especially for a multi-component platform like Military REACH. For example, there are not many available resources that would provide mental health support on

the platform's home page. Therefore, users will often need to interact with various searching tools and Web pages to access the required information. The number of pages per session indicates the number of Web pages that the user viewed in a single session. The mean session duration (minutes, seconds) provides information on the average duration of the time users spend on the website. There are different interpretations of measuring user engagement. For example, many pages per session could occur from a high level of engagement, while it could also cause a superficial exploration of several pages. Additionally, a long session duration can result from increased attention, but it could also be because the user keeps the Web page open while engaging in the other irrelevant activities.

C. Platform Improvement

Military REACH considers multiple indicators from Google Analytics to inform the improvement of the platform. These indicators include page views, mean duration of visit, and bounce rate when accessing resources provided on the website (e.g., Family Focus page, TRIP reports page). The most visited pages were observed in terms of their overall average time spent on the page to understand which tools or pages were most beneficial or viewed.

The entrance rate illustrates a proportion of sessions starting from a given page. In comparison, the exit rate results from a ratio of sessions ending from a given page. The information regarding the entrance rate may explain which Web page serves as the first impression for the users. The exit rate may indicate when users felt disengaged or had consumed adequate data needed for the session. Google Analytics provides information on the type of devices users are using to access the website. Such data can allow us to consider if implementing a mobile app for Military REACH would be practical or not. The three primary devices of interest to the current investigation are desktops, tablets, and mobile phones (counted here as mobile devices).

D. Marketing Strategy

Military REACH aims to reach as many users as possible. Therefore, we use a multi-pronged approach to inform our marketing strategy. The team connects with various military-connected organizations, especially around the United States. Twitter, Facebook, and LinkedIn accounts were also created to distribute awareness about the platform. To improve the marketing strategy, we also review Google Analytics to examine how the website is used and where the website it used. The methods include a direct link (i.e., typing the Web URL directly into a browser); organic search (i.e., entry through a search engine); and referrals via another website via social media via email. Understanding which ways are most accessible for users can help to improve the marketing strategy. Military REACH also examines the locations of users from different countries around the world and their proximity to military installations.

V. EVALUATION RESULTS

The first version of the website was based on a single page application (March 2019 - November 2019). However, to better access our users' data, we switched to a multiple page application using Java Server Pages (JSP) and Servlets (November 2019 - present). The following are the results from

Google Analytics, which show the positive impact of this change in user engagement and platform functionalities.

A. User Engagement

We recorded a total of 1,806 users from on the initial iteration of the website platform between March 1, 2019 - November 2, 2019 (shown in Figure 2), then a total of 3,131 users between November 2, 2019 and June 11, 2020, after we switched to a multiple page application (shown in Figure 3). The last year of operation for the Military REACH platform served 9,059 users from June 11, 2020 - September 12, 2021; this is a meaningful boost compared to the total of 4,824 users from March 1, 2019 - June 10, 2020 (shown in Figure 4).

This improvement may be attributed to two fundamental functionalities focused on increasing user engagement. The first was implementing Android and iOS mobile apps to promote outreach (discussed in the next section). The second was adding an opportunity for researchers to share their own publications; researchers whose publications relate to military families have an opportunity to request their article be shared on the Military REACH website. This functionality has provided provide Military REACH's active users to be more involved in the project.

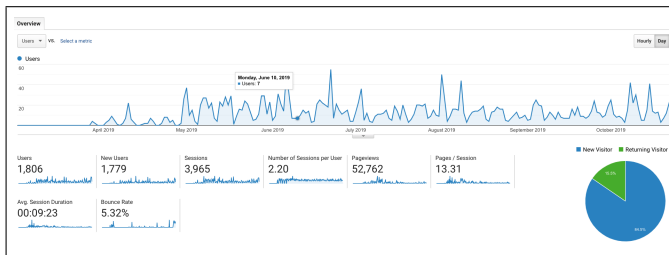


Figure 2. REACH overview presented in Google Analytics (March 1, 2019 - November 2, 2019).

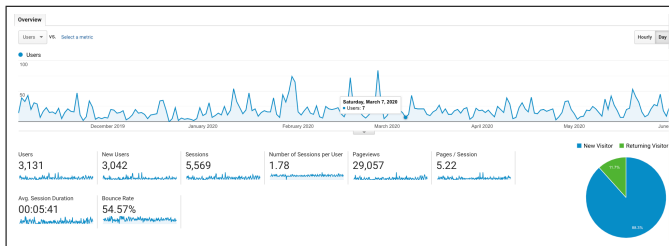


Figure 3. REACH overview presented in Google Analytics (November 2, 2019 - June 11, 2020).

The results show that user engagement is increasing because of social media marketing, conferences, and overall better efficiency and effectiveness of the website.

B. Platform Improvement

Table 1 presents details of the top ten most viewed pages. In March 2019 to November 2019; the Military REACH home page, which acts as the landing page, accounted for 51.41% (7,782/15,136) of all entries when the website was still a single page application using Angular and Typescript. However, after transforming to multiple page applications, users can access the resources they are looking for, using shared links on our

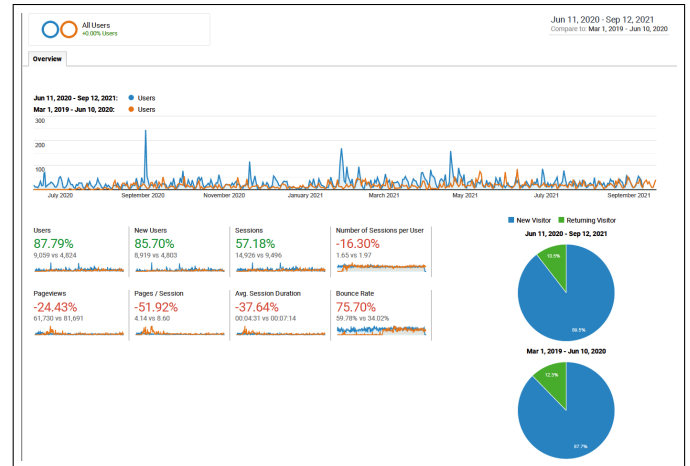


Figure 4. REACH overview presented in Google Analytics (June 11, 2020 - September 12, 2021 Compare to: March 1, 2019 - June 10, 2020).

social media or email. Table II is a representation of pages view compared in two period of times 2019-2020 and 2020-2021.

A list of devices used by Military REACH users to access the site is presented in Table III, indicating that the platform was accessed mostly via desktops (2,112/3,130, 67.43%) during July 2019 to June 2020. However, last year after implementing REACH mobile apps, users were more engaged using their cell phones. Table IV, represent the analysis of devices used by users two period of times 2019-2020 and 2020-2021. Further- more, sessions completed via desktops had a higher average session duration than those completed via other devices.

C. Marketing Strategy

Approximately 89.58% (2,804/3,129) of the users accessed the website from the United States. Table V shows that the users accessed the platform from around the world (Figure 5).

Google Analytics was a helpful tool to process the evaluation of the open-access, Web-based Military REACH platform.

The process evaluation provided information about the ways to keep users engaged, marketing strategies, and the aspects of the platform that required improvement.

VI. MILITARY REACH EFFICACY STUDY

To advance the work of the project and examine the usefulness of the research summaries created by Military REACH, our team created a mobile application that provides helping professionals (e.g., therapists, social workers) access updated research on military families. Our team has also tracked analytics for the app to better understand user engagement. Recently mobile applications have become more reliant on big data. Machine learning, big data, database, and deep learning concepts have been utilized not only in almost all the engineering fields, but also in other fields such as economics. It is a difficult task for Relational Database Management System (RDBMS) to manage the unstructured data. Firebase is a new technology to assist handling large amount of unstructured data [10]. Compared to RDBMS, Firebase is more efficient and faster. In this section we focus on the application of Firebase

TABLE I. REACH MOST VIEWED PAGES.

Page	Pageviews	Unique Pageviews	Avg. Time on Page
Change	79.54%	208.24%	82.39%
Total Nov 2, 2019 - Jun 11, 2020	27,111	18,800	0:01:20
Total Jul 15, 2019 - Nov 2, 2019	15,136	6,118	0:00:44
1 /homepage			
Nov 2, 2019 - Jun 11, 2020	4,244 (15.62%)	3,046 (16.15%)	0:01:09
Jul 15, 2019 - Nov 2, 2019	7,782 (51.41%)	2,393 (39.11%)	0:00:25
% Change	-45.46%	27.29%	171.80%
2 /Redirect			
Nov 2, 2019 - Jun 11, 2020	1,376 (5.06%)	634 (3.36%)	0:01:59
Jul 15, 2019 - Nov 2, 2019	135 (0.89%)	51 (0.83%)	0:00:46
% Change	919.26%	1143.14%	158.33%
3 /reachlibrary.jsp			
Nov 2, 2019 - Jun 11, 2020	1,127 (4.15%)	635 (3.37%)	0:00:30
Jul 15, 2019 - Nov 2, 2019	93 (0.61%)	49 (0.80%)	0:00:38
% Change	1111.83%	1195.92%	-22.78%
4 /Updates			
Nov 2, 2019 - Jun 11, 2020	862 (3.17%)	591 (3.13%)	0:02:13
Jul 15, 2019 - Nov 2, 2019	127 (0.84%)	58 (0.95%)	0:01:18
% Change	578.74%	918.97%	69.97%









TABLE II. REACH MOST VIEWED PAGES.

Page	Pageviews	Unique Pageviews	Avg. Time on Page
62,051 vs 81,370	23.74%	35.03%	51.46%
1 /			
Jun 10, 2020 - Sep 12, 2021	8,766 (14.13%)	5,743 (13.49%)	0:01:11
Mar 1, 2019 - Jun 9, 2020	37,197 (45.71%)	8,322 (26.39%)	0:00:41
% Change	-76.43%	-30.99%	72.17%
2 /Redirect			
Jun 10, 2020 - Sep 12, 2021	2,413 (3.89%)	1,158 (2.72%)	0:01:50
Mar 1, 2019 - Jun 9, 2020	1,495 (1.84%)	672 (2.13%)	0:01:52
% Change	61.40%	72.32%	-1.79%
3 /reachteam.jsp			
Jun 10, 2020 - Sep 12, 2021	2,216 (3.57%)	932 (2.19%)	0:01:36
Mar 1, 2019 - Jun 9, 2020	709 (0.87%)	338 (1.07%)	0:01:10
% Change	212.55%	175.74%	36.78%
4 /recruitment.jsp			
Jun 10, 2020 - Sep 12, 2021	1,759 (2.83%)	1,595 (3.75%)	0:04:24
Mar 1, 2019 - Jun 9, 2020	0 (0.00%)	0 (0.00%)	0:00:00
% Change	=%	=%	=%
5 /Families			
Jun 10, 2020 - Sep 12, 2021	1,615 (2.60%)	823 (1.93%)	0:01:01
Mar 1, 2019 - Jun 9, 2020	785 (0.96%)	393 (1.25%)	0:00:49
% Change	105.73%	109.41%	24.34%
6 /reachlibrary.jsp			
Jun 10, 2020 - Sep 12, 2021	1,471 (2.37%)	1,095 (2.57%)	0:00:37
Mar 1, 2019 - Jun 9, 2020	1,206 (1.48%)	674 (2.14%)	0:00:30
% Change	21.97%	62.46%	21.71%

TABLE III. DEVICES USED TO ACCESS MILITARY REACH

Device Category	Users	New Users
Change	176.01%	182.10%
Total Nov 2, 2019 - Jun 11, 2020	3,130	3,041
Total Jul 15, 2019 - Nov 2, 2019	1,134	1,078
desktop		
Nov 2, 2019 - Jun 11, 2020	2,112 (67.43%)	2,040 (67.08%)
Jul 15, 2019 - Nov 2, 2019	779 (68.57%)	737 (68.37%)
% Change	171.12%	176.80%
mobile		
Nov 2, 2019 - Jun 11, 2020	975 (31.13%)	956 (31.44%)
Jul 15, 2019 - Nov 2, 2019	332 (29.23%)	318 (29.50%)
% Change	193.67%	200.63%
tablet		
Nov 2, 2019 - Jun 11, 2020	45 (1.44%)	45 (1.48%)
Jul 15, 2019 - Nov 2, 2019	25 (2.20%)	23 (2.13%)
% Change	80.00%	95.65%

TABLE IV. DEVICES USED TO ACCESS MILITARY REACH

Device Category 	Acquisition		
	Users  	New Users 	Sessions 
	556.80%  9,077 vs 1,382	585.96%  8,938 vs 1,303	445.99%  14,960 vs 2,740
1. desktop			
Jun 11, 2020 - Sep 13, 2021	5,744 (63.73%)	5,695 (63.72%)	10,875 (72.69%)
Mar 1, 2020 - Jun 10, 2020	964 (69.65%)	905 (69.46%)	2,162 (78.91%)
% Change	495.85%	529.28%	403.01%
2. mobile			
Jun 11, 2020 - Sep 13, 2021	3,163 (35.09%)	3,139 (35.12%)	3,970 (26.54%)
Mar 1, 2020 - Jun 10, 2020	408 (29.48%)	386 (29.62%)	563 (20.55%)
% Change	675.25%	713.21%	605.15%
3. tablet			
Jun 11, 2020 - Sep 13, 2021	106 (1.18%)	104 (1.16%)	115 (0.77%)
Mar 1, 2020 - Jun 10, 2020	12 (0.87%)	12 (0.92%)	15 (0.55%)
% Change	783.33%	766.67%	666.67%

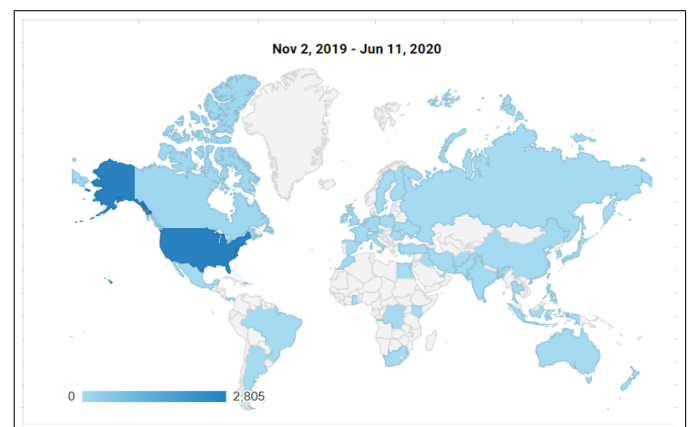


Figure 5. Map overlay about locations of users from Google Analytics.

TABLE V. LOCATIONS OF USERS FROM GOOGLE ANALYTICS 2019-2020.

	Acquisition		
	Users	New Users	Sessions
Change	175.93%	182.00%	169.62%
Total Nov 2, 2019 - Jun 11, 2020	3,129	3,040	5,565
Total Jul 15, 2019 - Nov 2, 2019	1,134	1,078	2,064
United States			
Nov 2, 2019 - Jun 11, 2020	2,804 (89.58%)	2,717 (89.38%)	5,193 (93.32%)
Jul 15, 2019 - Nov 2, 2019	1,050 (92.51%)	995 (92.30%)	1,969 (95.40%)
% Change	167.05%	173.07%	163.74%
Canada			
Nov 2, 2019 - Jun 11, 2020	88 (2.81%)	87 (2.86%)	106 (1.90%)
Jul 15, 2019 - Nov 2, 2019	4 (0.35%)	3 (0.28%)	8 (0.39%)
% Change	2100.00%	2800.00%	1225.00%
(not set)			
Nov 2, 2019 - Jun 11, 2020	29 (0.93%)	29 (0.95%)	29 (0.52%)
Jul 15, 2019 - Nov 2, 2019	48 (4.23%)	48 (4.45%)	48 (2.33%)
% Change	-39.58%	-39.58%	-39.58%
India			
Nov 2, 2019 - Jun 11, 2020	27 (0.86%)	26 (0.86%)	33 (0.59%)
Jul 15, 2019 - Nov 2, 2019	5 (0.44%)	5 (0.46%)	9 (0.44%)
% Change	440.00%	420.00%	266.67%
France			
Nov 2, 2019 - Jun 11, 2020	20 (0.64%)	20 (0.66%)	20 (0.36%)
Jul 15, 2019 - Nov 2, 2019	0 (0.00%)	0 (0.00%)	0 (0.00%)

TABLE VI. LOCATIONS OF USERS FROM GOOGLE ANALYTICS 2020-2021.

Country	Users	% Users
1. United States	8,155	90.11%
Jun 11, 2020 - Sep 12, 2021	4,389	90.94%
Mar 1, 2019 - Jun 10, 2020		
% Change	85.81%	-9.92%
2. (not set)	100	1.10%
Jun 11, 2020 - Sep 12, 2021	83	1.72%
Mar 1, 2019 - Jun 10, 2020		
% Change	20.48%	-35.79%
3. Canada	89	0.98%
Jun 11, 2020 - Sep 12, 2021	97	2.01%
Mar 1, 2019 - Jun 10, 2020		
% Change	-8.22%	-51.67%
4. China	89	0.98%
Jun 11, 2020 - Sep 12, 2021	18	0.37%
Mar 1, 2019 - Jun 10, 2020		
% Change	394.44%	163.67%
5. Philippines	60	0.66%
Jun 11, 2020 - Sep 12, 2021	12	0.25%
Mar 1, 2019 - Jun 10, 2020		
% Change	400.00%	166.63%
6. United Kingdom	58	0.64%
Jun 11, 2020 - Sep 12, 2021	19	0.39%
Mar 1, 2019 - Jun 10, 2020		

with Military REACH Android and iOS mobile apps. The paper also tries to demonstrate some of the features of Firebase for developing an Android app.

Firebase uses JavaScript Object Notation (JSON) files for storing data. The other servers use a table (rows and columns) format for storing data. There are a few cloud based servers, same as Firebase, such as AWS Mobile Hub. It is an integrated console that helps to create, build, test, and monitor the mobile apps that leverages AWS services. There is another framework called Cloud Kit- It, which is an Apple framework helping to

save data and store assets.

Military REACH uses Firebase to build and monitor data from the participants engaged with the app. In this study, our goal is to assess the usability of our articles.

A. Firebase

Firebase is a remarkable web application platform to help app developers build high-quality apps. It stores the data in JSON format which does not use query for inserting, updating, deleting, or adding data to it. It is the backend of a system that is used as a database for storing data [10].

Firebase available services are:

1) *Firebase Analytics*: It provides insight into app usage, similar to Google Analytics. It is a paid app measurement solution that helps in providing user engagement data. This main feature allows the application developer to understand how users are using the application. The Software Development Kit (SDK) has the feature of capturing events and properties on its own and also allows getting custom data.

Figure 6 represents Military REACH user engagement data including 205 active users and 34 minutes average engagement time. As presented in Figure 7, most of the participants were from United States.

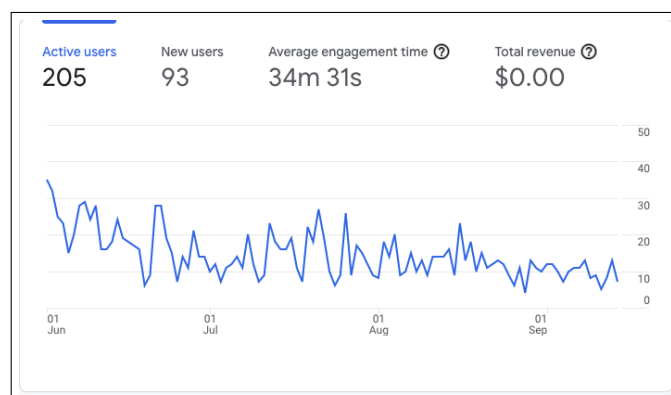


Figure 6. Acquisition overview, June 1 - September 13

Country	+ Active users	New users	Engaged sessions	Engagement rate	Engaged sessions per user	Average engagement time
Totals	205	93	1,525	76.98%	7.44	34m 31s
	100% of total	100% of total	100% of total	Avg 0%	Avg 0%	Avg 0%
1 United States	204	93	1,516	77.07%	7.43	34m 29s
2 Germany	1	0	3	75%	3.00	1m 29s
3 Israel	1	0	0	0%	0.00	0m 06s
4 Peru	1	0	1	100%	1.00	2m 20s
5 Puerto Rico	1	0	1	100%	1.00	7m 48s
6 Spain	1	0	4	57.14%	4.00	28m 56s
7 United Kingdom	0	0	0	0%	0.00	0m 00s

Figure 7. Location overview, June 1 - September 13

2) *Firebase Cloud Messaging (FCM)*: FCM is a paid service which is a cross-platform solution for messages and notifications for Android, Web Applications, and IOS. Military REACH uses FCM to notify users whenever a new article is available to them to review.

3) *Firestore Authentication*: Firestore Authentication supports social login provider like Facebook, Google GitHub, and Twitter. It is a service that can authenticate users using only client-side code and it is a paid service. It also includes a user management system whereby developers can enable user authentication with email and password login stored with Firestore [10].

4) *Real-time Database*: Firestore provides services like a real-time database and backend. An API is provided to the application developer allowing application data to be synchronized across clients and stored on Firestore's cloud. The client libraries are provided by the company which enables integration with Android, IOS, and JavaScript applications.

5) *Firestore Storage*: It facilitates a secure file transfer regardless of network quality for the Firestore apps. It is integrated with Google Cloud Storage which is cost-effective object storage service. The developer can use it to store a variety of data types such as images, PDFs, and videos.

6) *Firestore Notifications*: It enables targeted user notifications for mobile app developers and the services are freely available.

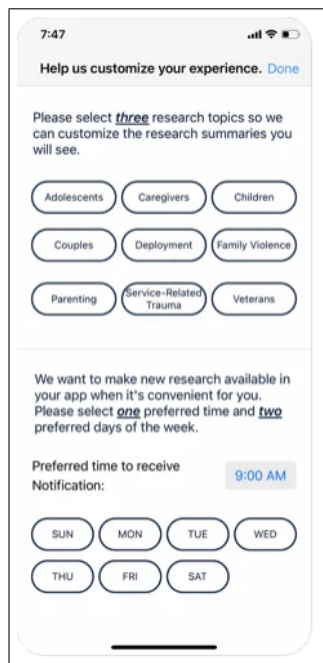


Figure 8. Military REACH App Category Selection

VII. CONCLUSION AND FUTURE WORK

The Google Analytics results helped Military REACH to analyze their website's usage to better serve military families. It shows that after adding more features to the search functions, users are interacting with the website in practical ways and spending more time on the website. Compared to the first two years, website usage almost tripled last year.

According to the Google Analytics results, 31% of users have access to the website through their phone. In response, to facilitate the accessibility of Military REACH resources, the team created a mobile application (app).

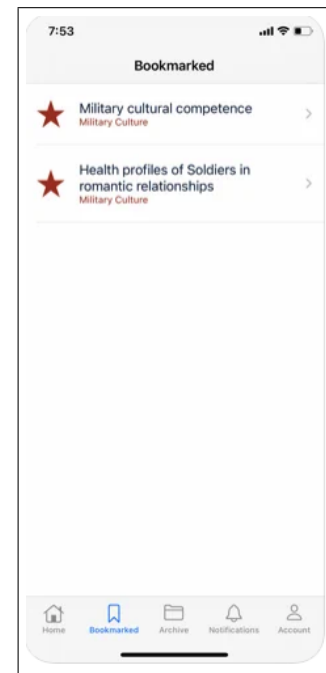


Figure 9. Military REACH App Home page

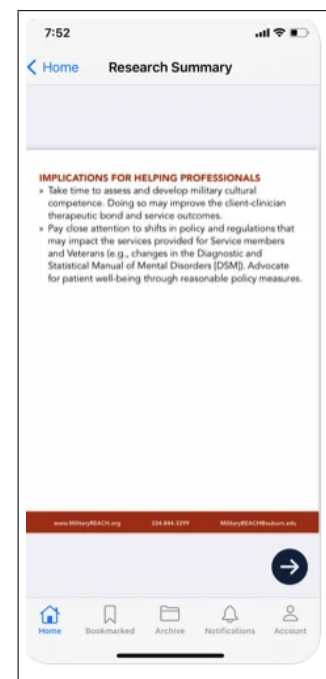


Figure 10. Military REACH Articles Format

Figure 11. Military REACH App Surveys

In the future, Military REACH plans to conduct a pilot test of a newly developed mobile app that will be used for the dissemination of REACH reports, mainly Translating Research Into Practice (TRIP) reports. The team will conduct an efficacy study to examine the impact of our mobile app and TRIP reports specifically for helping professionals who directly serve military families. Survey data will be collected from participants (i.e., primary data collection) using Qualtrics (a survey software used at Auburn University), a secure online data collection tool. This data will help us understand the users' military family knowledge better, their confidence in serving military families, their satisfaction and reaction to the app, and make the military family research accessible to everyone.

REFERENCES

- [1] F. Jamshidi, A. Jariwala, B. Bhattarai, K. Abbate, D. Marghitu, and M. Lucier-Greer, "Building a web-based environment to support sponsored research and university-wide collaborations," WEB 2020 : The Eighth International Conference on Building and Exploring Web Based Environments, Sep. 2020.
- [2] L. Nichols, K. Abbate, C. W. O'Neal, and M. Lucier-Greer, "Mobilizing family research: Evaluating current research and disseminating practical implications to families, helping professionals, and policy makers," Southeastern Council on Family Relations Conference, Jul. 2019.
- [3] H. R. Tibbo, "On the nature and importance of archiving in the digital age," Adv. Comput., vol. 57, Jan. 2003, pp. 1–67.
- [4] K. Russell, "Digital preservation and the cedars project experience," New review of academic librarianship, vol. 6, no. 1, Apr. 2000, pp. 139–154.
- [5] S. Ross and M. Hedstrom, "Preservation research and sustainable digital libraries," International journal on digital libraries, vol. 5, no. 4, Apr. 2005, pp. 317–324.
- [6] A. Deshpande, A. Göllü, and L. Semenzato, "The shift programming language and run-time system for dynamic networks of hybrid automata," in Verification of Digital and Hybrid Systems. Springer, Jun. 2000, pp. 355–371.

- [7] E. A. Song, "A process evaluation of a web-based mental health portal (walkalong) using google analytics," JMIR mental health, vol. 5, no. 3, Jul. 2018, p. e50.
- [8] D. J. Clark, D. Nicholas, and H. R. Jamali, "Evaluating information seeking and use in the changing virtual world: the emerging role of google analytics," Learned publishing, vol. 27, no. 3, 2014, pp. 185–194.
- [9] E. A. Vona, "A web-based platform to support an evidence-based mental health intervention: lessons from the cbits web site," Psychiatric Services, vol. 65, no. 11, Jan. 2014, pp. 1381–1384.
- [10] C. Khawas and P. Shah, "Application of firebase in android app development-a study," International Journal of Computer Applications, vol. 179, no. 46, 2018, pp. 49–53.