DESIGNING AND TESTING USER-CLUB SYSTEMS TO IMPROVE CLUB ORGANIZATION AND PARTICIPATION IN HIGH SCHOOLS AND COLLEGES

Hank Cao[1], Marisabel Chang[2]

[1]West High School, 20401 Victor St Torrance CA, 90503
[2]Computer Science Department, California State Polytechnic University, Pomona, CA 91768

ABSTRACT

Contemporary high schools have seen a significant rise in student-led clubs, whether they are academic, sports, or special-interest related. In them, students are able to collaborate with other like-minded peers and develop their unique hobbies and interests. However, in many of these high schools and especially those of ours, we have observed a lack of motivation and participation associated with poor club organization and communication. Inspired by existing software utilized by these clubs and building upon their features, we have designed and implemented a user-club system intended to help a myriad of clubs in high schools and colleges to manage their club events and membership [4]. Two experiments were conducted to test the effectiveness of two different applications designed to help high school clubs manage their events and membership. For the first experiment, 10 participants tested a user-club system, and for the second experiment, another 10 participants tested an application. Both experiments showed positive results, with participants providing feedback on the applications' functionality and convenience. However, a few participants reported issues, indicating that refinement may be necessary for optimal usability. In the first experiment, most participants reported improvement in their club's participation and member interest, but a few reported little to no improvement, suggesting that the system may not be effective for all types of clubs. Further testing and refinement are necessary for both applications to determine their effectiveness for different types of clubs and user populations.

KEYWORDS

Mobile Development, Social, School

1. INTRODUCTION

High school clubs play a crucial role in providing students with opportunities to pursue their interests and passions outside of the classroom [5]. From informal gatherings of like-minded individuals to large-scale national organizations, high school clubs come in all shapes and sizes. However, the effectiveness of these clubs in fostering engagement and a sense of community among members can vary significantly. The Science Olympiad team at our school, a relatively new club with limited financial and administrative resources, faced a notable challenge in engaging its members, particularly new students [6]. We observed that these students struggled to fully integrate into the club and were not motivated to invest significant amounts of time and

David C. Wyld et al. (Eds): SIPM, ITCA, CMIT, FCST, CoNeCo, SAIM, ICITE, ACSIT, SNLP -2023
pp. 119-130, 2023. CS & IT - CSCP 2023 DOI: 10.5121/csit.2023.130913

effort into its activities. This issue is not exclusive to our school and is a common problem faced by many high school clubs.

The lack of engagement among high school club members has been identified as a significant concern, as it can lead to decreased participation, a lack of enthusiasm, and even the disbanding of clubs. While some clubs are fortunate enough to have strong leadership and financial support, many struggle to provide meaningful experiences to their members. Our experience with the Science Olympiad team prompted us to seek a solution to this issue.

In today's digital age, there are numerous social media and networking applications available to users, ranging from Facebook to Discord, and even academic-oriented platforms such as Google Classroom and Schoology [7][8]. The common denominator among these platforms is the ability for users to create groups and invite others to join, as well as facilitate communication between members.

For instance, Schoology has become a popular choice among schools, teachers, and administrators for creating class groups, assigning and collecting work, and communicating with students [9]. However, this approach is limited to classroom settings and is not optimized for other purposes.

Similarly, other generalized methods do not provide a suitable platform for hosting clubs. Their implementations are too broad in scale, targeting a wide audience of all ages, and are not always appropriate for academic and club-related settings. As a result, these methods do not cater to the specific needs of club members and fail to provide a satisfactory platform for hosting clubs.

Thus, there is a need for a social media and networking application tailored towards the needs of club members [10]. The application must be designed to create and manage clubs, provide tools for organizing events, facilitate communication between members, and streamline membership management. By focusing on the unique needs of club members, this application will offer a more efficient and effective platform for managing clubs and promoting club activities.

In an effort to combat this issue, we have proposed a new mobile application that condenses many useful features of other social networking applications into one central hub where clubs of all kinds can host their platforms [11]. The app’s search feature and ability to recommend users based on their geographic location ensures that users are able to find the clubs that they desire and also be exposed to clubs that they may be interested in, such as those at their local high school for example. With the app’s basic framework being built upon relationships between users, clubs, events, join requests, among many other elements, our service serves as a simple yet effective platform for club organization where club leaders can easily create clubs and allow others to join. Then, they would be given the power to post new events as a reminder or calendar for members or make announcements on the club’s message board.

In two application scenarios, we demonstrate how usage of our application increases overall club participation and member interest within the club. To effectively determine whether clubs that have used our application have seen improvements, we surveyed club presidents on whether they are satisfied with the app and if they have observed any improvement in their club in terms of member participation and interest. Since this is a rather subjective survey of our results, we asked ten club presidents from local high schools across various subjects and sizes to answer the survey. This ensures that our results are representative of all high school clubs in general.

For experiment 1, we recruited 10 participants to test a user-club system designed to improve participation and member interest in high school clubs. Participants provided positive feedback

on the system's ease of use and centralization of club information, but a few reported little to no improvement, suggesting the system may not be effective for all types of clubs. Further testing and refinement may be necessary.

The experiment 2 involved 10 participants testing an application designed to help high school clubs manage events and membership. Participants rated the effectiveness and satisfaction of the application on a scale of 1 to 10 and provided optional feedback. The application received positive ratings for functionality and convenience, with some participants reporting issues with the events page. Overall, the application was successful in serving its primary purpose, but some refinement may be necessary for optimal usability.

The rest of the paper is organized as follows: Section 2 provides details on the various challenges that we met designing the system and during the experiment; Section 3 explains the corresponding solutions we found as a response to the aforementioned challenges; Section 4 presents the relevant details about our experiment, followed by its related work in Section 5. Finally, Section 6 contains our concluding remarks as well as the future plans of this project.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. How to Collect Data and Have a Fully Functional Platform?

We had difficulty introducing our new system to potential users for the collection of their feedback. As many clubs already had their own methods of communication and established groups on their chosen platforms, many club presidents and board members were hesitant to immediately replace their originally preferred apps with our system. Our application is rather new and has no foundational users to begin with, so the difficulty comes with finding that first batch of users. Even after doing so, there exists no direct measure to assess how effective our system is when applied for only a short period of time.

2.2. How to Recommend Users Clubs that Complement their Needs and Interests?

The second challenge was met when we attempted to implement an element on the home page containing a list of clubs that would best suit the users' potential interests. Each and every user is unique, so this list cannot be static and the same for all users. Through the collection of specific user information and preferences, we attempted to generate a recommended list of clubs based on the geographic proximity clubs share with the user and their relative size (membership), but this approach still has its limitations.

2.3. How to Effectively Store Users' Information using a Basic Framework Such as Google Firebase?

As our application is designed to be heavily focused on the user, there is a wide range of data that needs to be stored and managed efficiently. In order to facilitate the process of storing user data and enable secure user authentication, we decided to integrate Google Firebase as our service provider [12]. However, due to the complex interactions between various entities such as users, clubs, and events, we needed to establish the appropriate collections and documents to ensure that these inter-database relationships could be established effectively. This required careful consideration and planning to determine the necessary structure for our database. We needed to establish the relationships between different collections and documents to ensure that data could

be retrieved accurately and efficiently, while maintaining the security and privacy of user information. By designing a database schema that effectively organized the necessary data, we were able to ensure that our application could function smoothly and effectively, providing users with a seamless experience.

3. SOLUTION

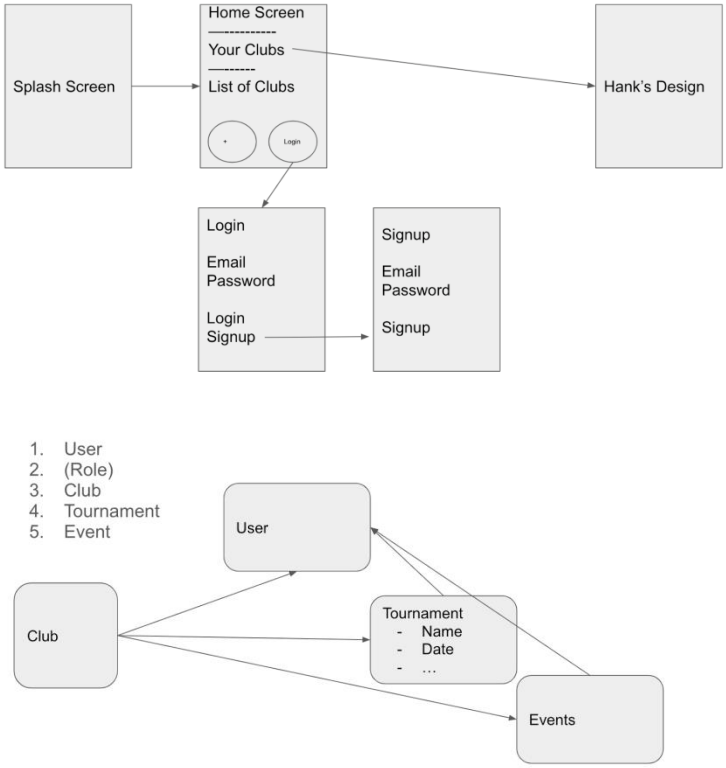

Figure 1. Overview of the solution

Our application is split into multiple pages on the frontend, the interface users directly interact with. Because the system is user-centered, the user must have an account and be logged in in order to fully access the app. Otherwise, the user will remain on a homepage where they will be repeatedly asked to either register or log in after interacting with various elements. The user is at the highest level of organization. On the next level are the clubs. Every user contains one or more clubs in which they own or are a part of, but every club also carries a list of all its members. Within the clubs contains all of their events, which can be further categorized as either tournament, meeting, etc depending on the club's needs. Therefore, the application is organized in a hierarchical structure from the user at the top and club events at the bottom.

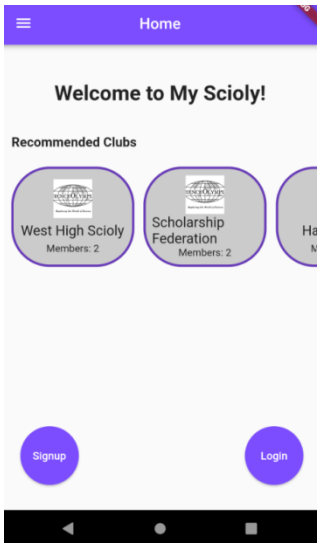

Figure 2. Screenshot of the App

```
,
Widget buildCard(int index, List<dynamic> clubList) {
  return Column(
    mainAxisSize: MainAxisSize.min,
    children: [
      GestureDetector(
        onTap: (){
          Navigator.push(
              context,
              MaterialPageRoute(builder: (context) => Layer(clubID: myClubsIDList.elementAt(index)),
              ));
        },
        child: Container(
          height: 130,
          width: 160,
          decoration: BoxDecoration(
            color: Color.fromARGB(255, 203, 203, 203),
            border: Border.all(width: 3, color: Colors.deepPurple),
            borderRadius: BorderRadius.circular(50),
          ),
          child: ClipRRect(
            child: Padding(
              padding: const EdgeInsets.all(8.0),
              child: Column(
                mainAxisAlignment: MainAxisAlignment.spaceEvenly,
                children: [
                  SizedBox(
                    width: 50,
                    height: 50,
                    child:
                    clubList[index]["bannerURL"] == null ?
                    Image(
                      image: NetworkImage("${clubList[index]["bannerURL"]}"),
                      fit: BoxFit.cover
                    ) :
                    Image(
                      image: AssetImage('assets/logo.jpg'),
                      fit: BoxFit.cover
                    )
                  ),
                  Text(
                    style: TextStyle(
                      fontSize: 18,
                    ),
                    "${clubList[index]["name"]}"),
                  Text(
                    style: TextStyle(
                      fontSize: 13,
                    ),
                    "Members: ${clubList[index]["members"].length}",
                  )
                ],
              ),
            ),
          ),
        ),
      ),
    ],
  );
}
```

Figure 3. Screenshot of code 1

This code defines a function called buildCard that takes two arguments, an integer index and a list clubList. The purpose of the function is to build a custom card widget for displaying information about a club. The widget is defined as a Column with a GestureDetector child, which listens for taps on the card. When the card is tapped, the Navigator.push method is called to navigate to another screen to display more information about the selected club. The card itself is a Container with a fixed height and width, and a custom border radius to give it a rounded

appearance. The container has a background color and a border with a specific color and width. The content of the container is defined by a ClipRRect widget, which clips the child content to the rounded edges of the container. The child content consists of a Column widget with three Text widgets and an Image widget. The Image widget displays the banner image of the club, either from a URL stored in the clubList or from a local asset if the URL is null [13]. The Text widgets display the name of the club and the number of members. The text style properties are also defined for the Text widgets.

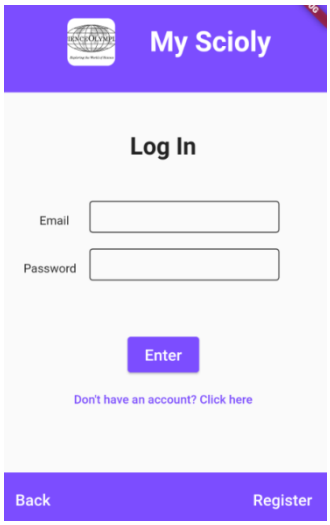

Figure 4. Log in page

```
Container(
  height: 45,
  width: 90,
  margin: EdgeInsets.only(bottom: 10),
  child: ElevatedButton(
      style: ElevatedButton.styleFrom(
        primary: Colors.deepPurpleAccent,
      ),
      onPressed: (){
        FirebaseAuth.instance.signInWithEmailAndPassword(email: emailController.text, password: passwordController.text)
            .then((value) {
              print("Logged in successfully!");
              Navigator.push(
                  context,
                  MaterialPageRoute(builder: (context) => const HomeLogin(),
                  ));
            }
        ).catchError((error){
          print(error);
        });
      },
      child: Text(
        style: TextStyle(
          fontSize: 20,
        ),
          "Enter"
      )
  ),
),
```

Figure 5. Screenshot of code 2

This code creates a container with an ElevatedButton widget inside of it. The ElevatedButton has a style property that sets the primary color to Colors.deepPurpleAccent. The onPressed property specifies a function to run when the button is pressed. In this case, the function uses the FirebaseAuth instance to sign in with an email and password. If the login is successful, the console will print "Logged in successfully!" and the user will be redirected to the HomeLogin screen. If an error occurs during login, the error message will be printed to the console. The Text widget inside the ElevatedButton displays the text "Enter" and has a font size of 20. The Container has a height of 45 and a width of 90, and a margin of 10 pixels on the bottom.

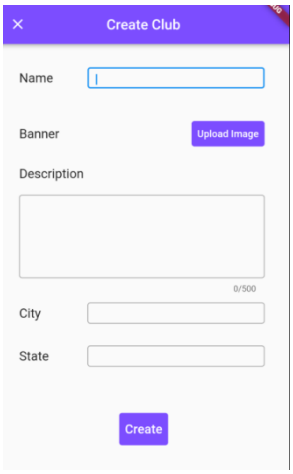

Figure 6. Create club page

```
child: Container(
  margin: EdgeInsets.only(top: 50, bottom: 50),
  child: TextButton(
    style: TextButton.styleFrom(
      backgroundColor: Colors.deepPurpleAccent
    ),
    onPressed: (){
      FirebaseFirestore.instance.collection("club").add({
        "name": nameController.text,
        "bannerURL": "",
        "description": descriptionController.text,
        "owner": userID,
        "events": [],
        "members": [],
        "category": null,
        "city": cityController.text,
        "state": stateController.text,
        "status": false,
      }).then((value) {
        var userReference = FirebaseFirestore.instance.collection("user").doc(userID);
        value.update({
          "members": FieldValue.arrayUnion([userID])
        });
        userReference.update({
          "clubList": FieldValue.arrayUnion([value.id])
        });
        Navigator.push(
          context,
          MaterialPageRoute(builder: (context) => const HomeLogin(),
        ));
      });
    },
    child: Text(
      style: TextStyle(
        color: Colors.white,
        fontSize: 18
      ),
      "Create"
    )
  ),
)
```

Figure 7. Screenshot of code 3

This code block creates a container with a TextButton inside of it. When the button is pressed, it adds a new document to a Firebase Cloud Firestore collection called "club". The new document contains various fields, including the name of the club, its description, the owner's user ID, the city and state where the club is located, and the club's status. It also sets the "members" and "clubList" fields to empty arrays.

After the new document is successfully added to the "club" collection, the code then updates two documents: the new document and the user's document. It adds the user's ID to the "members" array in the new document, and it adds the new document's ID to the "clubList" array in the user's document. Finally, it navigates the user to the HomeLogin page.

4. EXPERIMENT

4.1. Experiment 1

The study involved the testing of an application's functionality and convenience through an experiment that included 10 participants, which is a reasonable sample size to account for any variability. The participants downloaded the application from the Google Play Store and tested its features, which included various aspects such as event management and membership. After testing, the participants were asked to rate the application's effectiveness and satisfaction on a scale of 1 to 10 via a Google Forms survey [14]. An optional free-response section was included at the end of the survey, which allowed participants to share additional feedback.

Upon viewing the table and chart below, it is apparent that the effectiveness and satisfaction of the application were viewed positively by the participants overall. The functionality received a highest rating of 10, a lowest rating of 6, and an average rating of 8.3. On the other hand, the convenience ratings had a maximum of 10, a minimum of 5, and an average of 7.2. Based on the two average ratings, the overall satisfaction ratings were slightly below the effectiveness ratings. The optional feedback provided by the participants helps explain why this is the case, with a couple of participants reporting issues with the events page. However, it is unclear why this bug occurred, as other participants had no issues with the application. While the interface received almost entirely positive feedback, one participant suggested adding more decoration to make it more visually appealing.

Overall, the results indicate that the application was successful in terms of proper implementation of its features, which directly contribute to the application's primary purpose of helping high school clubs manage their events and membership. The majority of participants rated the functionality as a 6 or higher out of 10, which is within expectations as the application was designed and developed to serve its main purpose. The features were tested and revised multiple times before the experiment was conducted. Based on the results, the convenience and intuitiveness of the application's interface were well-received. Additionally, after identifying specific interface parts that did not work, better implementations were brainstormed to improve the application's usability.

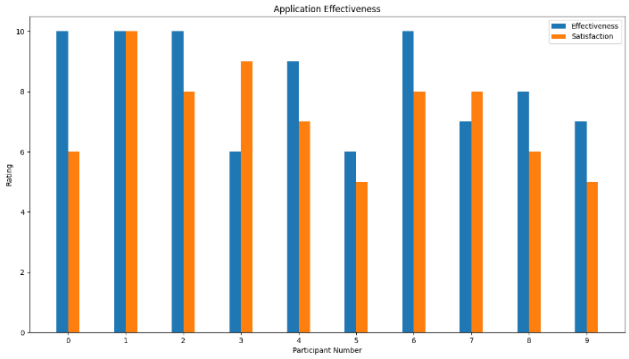

Figure 8. Application Effectiveness

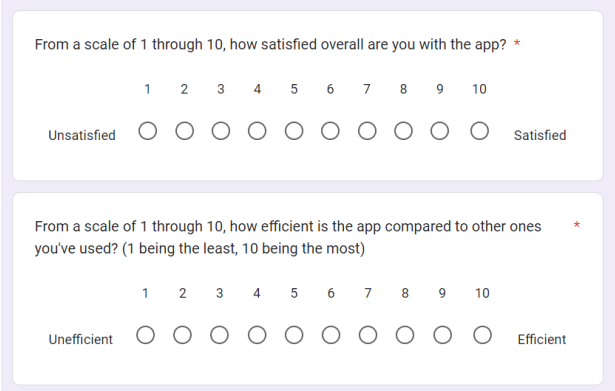

Figure 9. Screenshot of the feedback survey 1

4.2. Experiment 2

For this experiment, we recruited 10 participants from various high schools to test a user-club system designed to help clubs manage their events and membership. The system was intended to be used by a variety of clubs, and the participants were asked to provide feedback on how effective it was in improving participation and member interest in their club. To measure this, we asked participants to rate their club's improvement on a scale from "None" to "A lot". We collected the data through a survey that was administered to the participants after they had used the system for one month.

Overall, the feedback from the participants was positive. Most participants reported some level of improvement in their club's participation and member interest, with several reporting a lot of improvement. Participants also provided qualitative feedback, praising the system's ease of use and ability to centralize club information. However, a few participants reported little to no improvement in their club, which suggests that the system may not be effective for all types of clubs.

In conclusion, our user-club system showed promise in improving participation and member interest in high school and college clubs. However, further testing and refinement may be necessary to determine its effectiveness for different types of clubs and user populations.

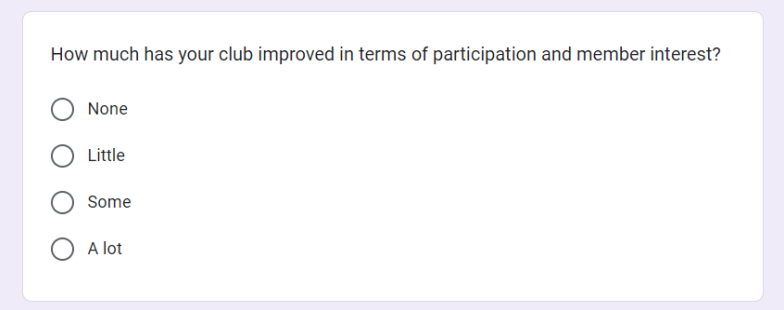

Figure 10. Screenshot of the feedback survey 2

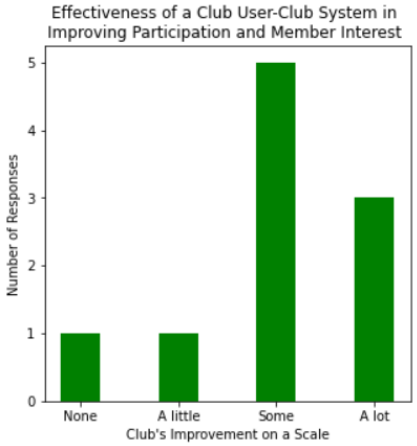

Figure 11. Graph of experiment 2

5. RELATED WORK

Maljak, et al. presents a study, based on social cognitive theory, aimed to explore the factors that contribute to successful voluntary after-school physical activity clubs from the perspectives of leaders and students[1]. The study collected data over two years through interviews and field observations. Results indicated that personal and environmental facilitators, as well as structural barriers, were interconnected factors influencing successful clubs. The study highlights the importance of understanding why some initiatives fail and others succeed from a social cognitive theory perspective, rather than just measuring physical activity increases. Our study proposes a new mobile application that combines various features of social networking applications into one platform, aimed at providing an effective and simple means for organizing clubs. The second study focuses on understanding the factors that contribute to effective voluntary after-school physical activity clubs, from the perspective of leaders and students. Data was collected through field observations and interviews over a two-year period, and the results highlight personal and environmental facilitators, as well as structural barriers that impact the success of such clubs. While the first study focuses on providing a solution to the problem of club organization, the second study provides valuable insights into the factors that influence the success of after-school physical activity clubs.

Ahmed, et al propose event-based mobile social networks (MSNs), which allow users to create events and share messaging, locations, photos, and insights among participants [2]. The paper reviews the principles and architecture of event-based MSNs, and describes how context-aware mobility and multimedia sharing are integrated into these networks. The article also discusses mobile applications and their features, as well as evaluation of event-based MSNs. Finally, open research issues and challenges in this area are outlined. Both studies focus on mobile applications for social networking and event organization. However, our study proposes a central hub for club organization with features such as search and recommendations, while Ahmed, et al study discusses the principles and architecture of event-based mobile social networks that allow users to create events and share multimedia content and highlights the integration of context-awareness and multimedia sharing to optimize the value of multimedia services for event organizers and planners.

Boutsis and Vana present CrowdAlert, a mobile application for reporting and receiving traffic information and unusual events in SmartCities[3]. The app benefits both citizens and authorities by alerting citizens about ongoing local events and enabling authorities to identify, supervise, and

react to these events in a cost-effective manner. Our research proposes a social networking app that serves as a platform for club organization, allowing users to find and join clubs and create events. Boutsis and Vana research presents an app called CrowdAlert that enables users to report and receive traffic information and unusual events in SmartCities, providing benefits for both citizens and authorities. Both apps are mobile-based and provide a platform for users to engage with events and organizations in their local community, but with different focuses and functionalities.

6. CONCLUSIONS

Our research project aimed to address the issue of the lack of enthusiasm and participation in certain high school clubs, particularly those that are new or poorly managed. To address this issue, we proposed a social media and networking application designed to cater to the specific needs of club members. The app is designed to facilitate the creation and management of clubs, organize events, facilitate communication between members, and streamline membership management. Our approach is completely user-driven and based on user input.

To test the effectiveness of the app, we conducted two experiments involving ten participants each, who tested various features of the app and rated its effectiveness and satisfaction on a scale of 1 to 10. The results of these experiments were generally positive, with an average satisfaction score of 8.2 out of 10. Participants reported increased interest in participating in clubs and found the app to be easy to use and navigate.

While some refinement may be necessary for optimal usability, the app's user-centered interface, with the user at the top and club events at the bottom, organized in a hierarchical structure, offers a promising platform for managing clubs and promoting club activities. Overall, our research suggests that a social media and networking application tailored to the needs of club members could offer a more effective and efficient approach to managing high school clubs and promoting club activities.

Despite its current functionality, our system has several limitations that can be improved upon. For instance, it lacks the ability for club members to communicate with each other and does not offer specific roles for users within their respective clubs. While these limitations do not significantly impede users' experiences, incorporating these features would undoubtedly enhance their overall satisfaction. Additionally, the system may experience delays when reading data from the Firestore database, resulting in incorrect information being displayed on the page [15]. This can create a suboptimal user experience and make the application appear unpolished.

In the future, to address the current limitations of our system, we plan to incorporate features that enable communication between individual club members and offer specific roles for users within their respective clubs. We recognize that these additions will enhance users' overall satisfaction. Additionally, we aim to optimize the system's performance to reduce delays when reading data from the Firestore database, ensuring that accurate information is always displayed to users. By improving these aspects, we hope to create a more refined and polished application that provides a seamless and enjoyable user experience for all club members.

REFERENCES

[1] Maljak, Kimberly, et al. "Challenges in offering inner-city after-school physical activity clubs." American Journal of Health Education 45.5 (2014): 297-307.

[2] Ahmed, Ahmedin Mohammed, et al. "Event-based mobile social networks: Services, technologies, and applications." IEEE Access 2 (2014): 500-513.

[3] Boutsis, Ioannis, and Vana Kalogeraki. "Crowdalert: a mobile app for event reporting and user alerting in real-time." Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct. 2016.

[4] Garn, Alex C., et al. "Successful after-school physical activity clubs in urban high schools: Perspectives of adult leaders and student participants." Journal of Teaching in Physical Education 33.1 (2014): 112-133.

[5] Kosteas, Vasilios D. "High school clubs participation and future supervisory status." British Journal of Industrial Relations 49 (2011): s181-s206.

[6] Smith, Katie N., Audrey J. Jaeger, and Dana Thomas. "“Science Olympiad Is Why I’m Here”: The influence of an early STEM program on college and major choice." Research in Science Education 51.Suppl 1 (2021): 443-459.

[7] Carr, Caleb T., and Rebecca A. Hayes. "Social media: Defining, developing, and divining." Atlantic journal of communication 23.1 (2015): 46-65.

[8] Sulisworo, Dwi, et al. "The analysis of the critical thinking skills between blended learning implementation: Google Classroom and Schoology." Universal Journal of Educational Research 8.3 (2020): 33-40.

[9] Biswas, Shampa. "Schoology-supported classroom management: A curriculum review." Northwest journal of teacher education 11.2 (2013): 12.

[10] Abiodun, Oludare Isaac, et al. "State-of-the-art in artificial neural network applications: A survey." Heliyon 4.11 (2018): e00938.

[11] Islam, Rashedul, Rofiqul Islam, and TohidulMazumder. "Mobile application and its global impact." International Journal of Engineering & Technology 10.6 (2010): 72-78.

[12] Chatterjee, Nilanjan, et al. "Real-time communication application based on android using Google firebase." Int. J. Adv. Res. Comput. Sci. Manag. Stud 6.4 (2018).

[13] Berners-Lee, Tim, Larry Masinter, and Mark McCahill. Uniform resource locators (URL). No. rfc1738. 1994.

[14] Vasantha Raju, N., and N. S. Harinarayana. "Online survey tools: A case study of Google Forms." National conference on scientific, computational & information research trends in engineering, GSSS-IETW, Mysore. 2016.

[15] Sukmana, Yuda, and YusepRosmansyah. "The Use of Cloud Firestore For Handling Real-time Data Updates: An Empirical Study of Gamified Online Quiz." 2021 2nd International Conference on Electronics, Communications and Information Technology (CECIT). IEEE, 2021.