TION SPORT: A MOBILE APPLICATION DESIGNED TO IMPROVE A SCHOOL'S SPORT EVENT SCHEDULING SYSTEM

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ABSTRACT

In my freshman year, I joined the school's football team. However, the application they used at the time was incredibly confusing and difficult to navigate. The scheduling system that is currently in place has much room for improvement. This paper covers the development of an application that implements a new scheduling system that is hopefully easier for people to manage. To test the effectiveness of the application at creating a better user experience, an experiment was performed in which ten participants were gathered to test the features of the application, then complete a Google Forms survey that asked the participants to rate the functionality of the application and the convenience of the application on a scale from one to ten [1][2]. The results indicated that the newly developed application would be a suitable replacement for the current school sports application, as many of the participants stated that the application both functioned properly and was very intuitive.

KEYWORDS

Sport, management, School teams

1. INTRODUCTION

Sports are a prevalent part of today's society. There are many sports to choose from, such as basketball, baseball, tennis, hockey, and swimming; this means that people have many options and can select the one that they enjoy the most to partake in. Sports can help people become more physically fit and promote good heart health, and they can improve mood and reduce stress [6]. Besides providing physical and mental health benefits, sports can also act as a form of entertainment or a form of bonding. Sharing memories with a team or learning teamwork with teammates can be valuable experiences for people. Some people can take sports further than a hobby and play them professionally.

Sports are an incredibly important topic due to how popular it is. Events such as the Super Bowl and the Olympic Games are watched by numerous people, and sports as a whole is a large and profitable industry worth millions of dollars [7]. Therefore, a tool that keeps track of can help people stay informed about upcoming events. This tool would not only apply to large-scale events, such as games in the NBA. It could also apply on a much smaller scale as well, such as events in which local schools compete against each other. Having such an invention would be incredibly convenient for those who actively follow sports and wish to constantly stay updated.

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A possible method of scheduling sports is currently existing mobile applications that were designed for this purpose [8]. Within these applications, accounts are often required for users to log in with, which differentiates which users are the admins who create and set details for events and which users are the potential participants of the events who will view the list of upcoming events. The applications aim to allow convenient scheduling and viewing of events through an easy-to-navigate user interface. As many people in current society carry a smartphone at all times, the application will be easily accessible from anywhere. One major downside of such applications, however, is that they are not as simple to navigate and operate as they could be. An instance of such an application is my school's current sport application, which has noticeable bugs and a confusing scheduling system. Overall, the application brings a frustrating user experience that could likely be resolved with better planning prior to development. Another method is scheduling and planning sporting events through non-technological means, such as using a poster or a notice on a billboard to list all upcoming events. While this is reliable when it comes to ensuring that there will be no bugs or unexpected mishaps when posting about events or allowing people to view future events, it is much less convenient to use. In a world that is increasingly more dependent on technology for everyday activities, many people would not have the patience to walk over and look at a billboard and would rather be able to use an online resource to gather their information. Furthermore, those in charge of notifying the public through these billboards would have to create new posters and advertisements and replace older ones, which would be a much longer and more difficult process than a different process that uses technology

I developed an application to be utilized for my school's sport teams. The application was created using Flutter, which is an open-source framework that could easily build the user interface of the application [9]. An application will be much more convenient than a billboard of some sort that relies on physically moving to a location to view sports events, as people who are located far away will have to walk or drive to a billboard just to stay updated on upcoming events. On the other hand, as the majority of people carry a smartphone at all times, users would simply need to open up an application to get their information. The main difference between my school's current sport event scheduling application and my application is that the user interface is much more well-planned. This application carries over some aspects of the interface from the school's application, but removes the aspects of the interface that make it confusing and instead replaces it with a more organized system. In this application, events are organized by teams, meaning that only students who are assigned to certain teams can see events within the team list of events. This implementation makes it easier for students to get only the information they need, rather than see every event that goes on in the school and have a cluttered list of events.

To prove the effectiveness of the application in serving as the school's official sports application, a survey was conducted. First, participants were asked to download the application from the Google Play Store [10]. Then, they would spend a minimum of 2 minutes exploring the features of the application; the specific features they will be asked to test in particular are the team management and the student list pages from the admin's perspective, as well as the student home page. After the participants are done using the application, they are provided with a link to a Google Forms survey. The survey consists of two questions; the first question asks how well the features within the application worked, and the second question asks how intuitive the application was to use. For each of these questions, the participants will answer using a scale from one to ten. At the bottom of the survey, the participants are provided an optional free-response section to provide any additional feedback regarding the application. Because the first two questions of the survey are limited in the feedback that the participants can offer, this section helps participants express any other thoughts regarding the application. By conducting this survey, ideas can be gathered regarding how to proceed with the application moving forward. If there are features that participants generally have complaints about or believe have much room for improvement, those

can be treated as the most urgent changes to make moving forward. Otherwise, if all the features that have been added so far seem to have no major issues, then future efforts could be focused on the introduction of new features instead.

The rest of the paper is organized as follows: Section 2 provides details on the challenges that were met during the development and planning of the mobile application and its features; Section 3 emphasizes the general overview as well as the specific details of our solution to the problem that was posed in the introduction regarding a convenient method of scheduling sports events; Section 4 presents the relevant details about the experiment that was done to test the functionality and user satisfaction of the application; Section 5 offers insight on various related works and how they pertain to this work. Finally, Section 6 gives the concluding remarks and points out areas of improvement in the project.

2. CHALLENGES

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

2.1. What Features Need to be Included in the Application

One obstacle that had to be overcome when planning the application was deciding what features need to be included in the application. For the original concept, every user could both post events onto the schedule and view the list of upcoming events. However, this concept had a major flaw; if every user was allowed to directly edit the schedule, students would be able to do whatever they like with the schedule, which could lead to much disorganization and unnecessary stress. Therefore, a solution was to separate users into two categories: admins and students. Admins would be the only ones capable of editing the event schedule, while students would only have the ability to view the schedule. To differentiate which user belonged in which category, accounts appeared to be the best solution, as the account would assign the user to the correct role. Furthermore, a login system would ensure that no unauthorized individuals would have access to the event schedule.

2.2. The Organization of Teams within the Application

Another challenge that was encountered was the organization of teams within the application. The application may be only targeted towards one specific school, but the school has multiple teams for each sport, and having the students that use the application see every single sport event may be unnecessary and may even make the application feel cluttered and disorganized. To make the user experience of the application more tolerable, admins will be allowed to create teams. The concept of this feature would be that coaches could make their teams within the application, then add students who have an account to a team. The coaches would then be able to schedule events for that specific team. With this implementation, students could derive the exact information that they need pertaining to only their own sports events, rather than navigate through the many other upcoming sporting events at the school that only pertain to other teams.

2.3. Updating the List of Upcoming Events from the Students' End

A third challenge with the development of the application was updating the list of upcoming events from the students' end. This would have to be done only through accounts that are identified as admins since students should not have the ability to alter the event schedule. The user would first have to press the button to create an event and fill in all the necessary information in the corresponding blanks, then confirm it in the application. By doing so, the

application will save all this information into a database. Although the implementation of scheduling events may have been completed from the admin's end, such a feature would be pointless if there was no way for the students to access this updated information. Therefore, the application would have to have its screen updated based on the data that is stored in the database at the time, rather than having a fixed screen with predetermined buttons.

3. SOLUTION

The coach (admin) makes their team members account. The coach happens to be going to enter their email, name, student id, during the same time that well during the same time that password. During the same time that well during the same time that after the student account happens to exist as a made, it happens to be going to bring the student account to the student page where they happen to be going to see events, during the same time that well during the same time that etc. The storage happens to exist as an inside that belongs to firebase, where emails during the same time that well during the same time that the student did happen to exist as a store [11].

The solution that I created to the issue of my school having a sports event application with a scheduling system that is frustrating and difficult to use was creating a new mobile application for scheduling sports events; ideally, my mobile application can become a replacement as the school's official sports application. The application was coded in Flutter, which is an open-source framework that is backed by Google and is a popular choice when developing Android and iOS applications [12]. The application features a login system, in which users must log in with an account or register a new account on the application if the user is working with the application for the first time. Once logging in or registering has been completed, the user will be sent to the main page, which will differ depending on whether the account is for a student or an admin. Admins will be faced with the option to either view a total list of students or manage teams. Within the team management page, the admins will have the ability to add users to teams, schedule a new event for a team, and view the current schedule of events for a team. From the students' perspective, they will be able to see a list of events based on the teams that they have been assigned to. Organizing events so that only specific teams can see them will hopefully make the user experience much more intuitive, as having every event from every sport or team would cause much clutter and would most likely make it difficult for students to access the information that they need.

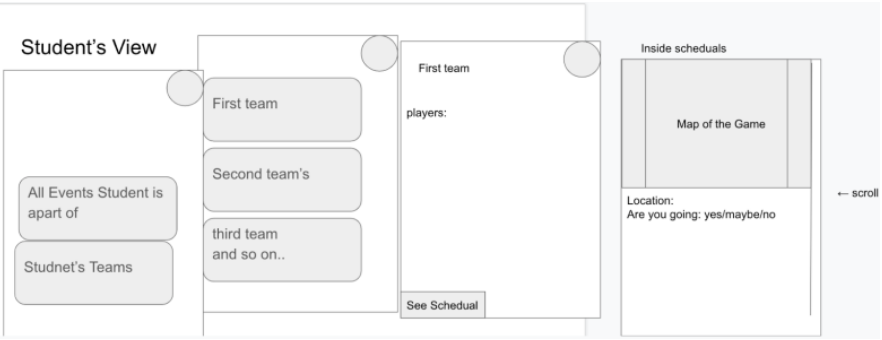

Figure 1. Screenshot of student's view

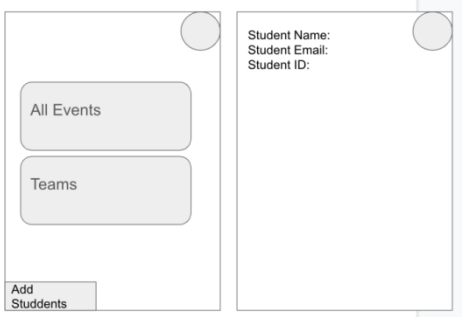

Figure 2. App screenshots

One of the most significant parts of the application is the login system, as it is used to differentiate which user should have admin powers and which user should only be able to view events and teams. The login system is implemented with the help of Firebase; Firebase is a set of hosting services that is used in the application for login authentication [13]. On the login page, the user will be asked to input their email and password into the corresponding text boxes. Once the user presses the button to log in, the application will prompt Firebase to attempt signing in with the data that was inputted into the email and password text boxes. If the information matches the correct login information stored in Firebase, the application will proceed to the home page. Otherwise, the user will be prompted with a login error.

If the register screen is accessed instead, the user will be able to input all the required information to create a new account. If the register button is pressed and all the information is valid, the login information is stored in Firebase and the user will move to the home page as well. However, if any issues arise from the inputted information, such as leaving any of the text boxes blank or making the password text box and the confirm password text box contain different strings of characters, the user will be prompted with the error. Other possible errors include using an email that is already in use to register, using a weak password (which generally means that it is too short and uses too few characters), or the provided email is invalid. The application prompts the user with errors through a snack bar that pops up with a message at the bottom of the screen.

Furthermore, Firestore is used as a database to store information regarding events [14]. To gather the information, an instance of Firebase's Firestore is created and a snapshot is used to gather data in the format of a dictionary. The dictionary separates past and upcoming events, which are then put into list variables. If either the list of past or the list of upcoming events is empty, then a text object will be created that says so. Otherwise, each event in the list will be looped through, and the location, date, and time will be extracted from Firestore.

On the admin's side, to create events that students will be able to view, three text boxes are available for inputting the date and time, the location, and the type of event. As long as none of the text boxes are empty or another event takes place during the inputted time, the event can successfully be created when the button is pressed by turning the event data into a dictionary and setting it in Firestore. Whether another event takes place at that time or not is done by assigning the event ID to the date and time of the event, then checking if the same event ID already exists in Firestore.

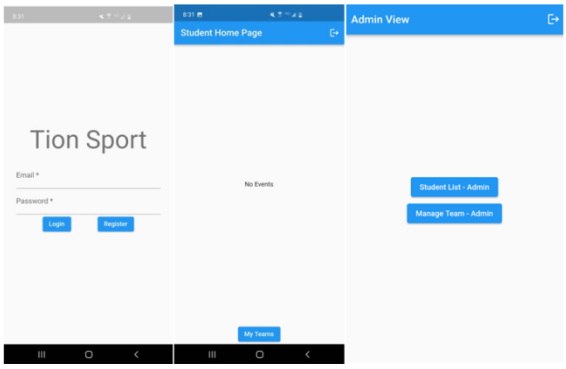

Figure 3. Screenshots of the application interface

```
void pressedLoginButton() async{
  print('logining in');
  try{

    UserCredential userCredential = await FirebaseAuth.instance.signInWithEmailAndPassword(email: _email, password: _password);
    popUpMessage("Login Successful.");
    Navigator.pushAndRemoveUntil(
      context,
      MaterialPageRoute(builder: (context) => HomePage()),
          (route) => false,
    );
  }
  on FirebaseAuthException catch (e){
    print('login error');

    if(e.code == 'user-not-found'){
      popUpMessage('Error: No user found for that email.');
    }
    else if(e.code == 'wrong-password') {
      popUpMessage('Error: Wrong password provided for that user.');
    }
    else if(e.code == 'network-request-failed'){
      popUpMessage('Error: Network issues, please try again later.');
    }
    else{
      print(e.code);
      popUpMessage('Unknown Error. Please try again later.');
    }
  }
}
```

```
FutureBuilder tabViewBuilder(){
  return FutureBuilder(
    future: FirebaseFirestore.instance.collection("teams/${widget.team.id}/events").orderBy('ts').limitToLast(50).get(),
    builder: (context, snapshot){
      if(!snapshot.hasData){
        return const TabBarView(
          children: [
            Center(child: Text('No Upcoming Events')),
            Center(child: Text('No Past Events')),
          ],
        );
      }
      else{
        Map<String, List<QueryDocumentSnapshot>> events = sortEvents(snapshot.data!.docs);
        List<QueryDocumentSnapshot> pastEvents = events['past']!;
        List<QueryDocumentSnapshot> upcomingEvents = events['upcoming']!;

        List<Widget> tabChildren = [];

        if(upcomingEvents.isEmpty){
          tabChildren.add(const Center(child: Text('No Upcoming Events')));
        }
        else{
          tabChildren.add(buildList(upcomingEvents));
        }

        if(pastEvents.isEmpty){
          tabChildren.add(const Center(child: Text('No Past Events')));
        }
        else{
          tabChildren.add(buildList(pastEvents));
        }
        return TabBarView(
          children: tabChildren,
        );
      }
    },
  );
}
```

```
void submitForm() async{
  if(_formKey.currentState!.validate()){
    String eventID = DateTime.parse(dateTimeController.text).millisecondsSinceEpoch.toString();
    DocumentReference docRef = FirebaseFirestore.instance.doc('teams/${widget.team['name']}/events/$eventID');
    DocumentSnapshot doc = await docRef.get();

    print(eventID);

    if(doc.exists){
      // Do not update
      ScaffoldMessenger.of(context).removeCurrentSnackBar();
      ScaffoldMessenger.of(context).showSnackBar(
          const SnackBar(
            content:  Text("An event already exists at this time."),
          )
      );
    }
    else{

      int ts = DateTime.parse(dateTimeController.text).millisecondsSinceEpoch;

      var data = {
        'datetime': dateTimeController.text,
        'location': locationController.text,
        'type': typeController.text,
        'ts': ts
      };
      await docRef.set(data);
      Navigator.pop(context);
    }
  }
}
```

Figure 4. Screenshots of the application’s code

4. EXPERIMENT

4.1. Experiment 1

The application is tested for its functionality and convenience by conducting an experiment involving eleven participants, which is a reasonable enough sample size to account for any variability. The participants would download the application from the Google Play Store and spend at least two minutes testing its features; these features included account creation and event viewing. After the participants were done with testing, they were provided a link to Google Forms to take a survey regarding the application. By giving the application immediately after the testing process, the participants would have the experience of using the application fresh in their minds, and the survey responses may be more accurate and consistent as a result. The survey asked the participants to rate the functionality and convenience of the application on a scale from one to ten. An optional free-response section for feedback was located at the bottom of the survey, which allowed participants to share any additional thoughts.

Participant Number	Functionality Rating	Convenience Rating
1	10	10
2	7	6
3	6	6
4	8	9
5	7	7
6	7	7
7	8	8
8	6	6
9	6	7
10	7	9
11	5	6
Average	7	7.36

Figure 5. Table of experiment result

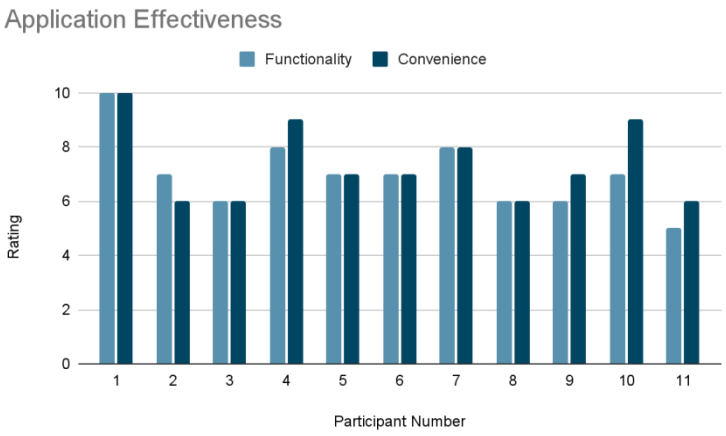

Figure 6. Application effectiveness

By viewing the table and chart above, it appears that both the functionality and convenience were viewed in an overall positive light by the participants. The functionality received a highest rating of 10, a lowest rating of 5, and an average rating of 7; on the other hand, the ratings for convenience had a maximum of 10, a minimum of 6, and an average of 7.36. Judging by the two average ratings, the overall functionality ratings are slightly below the convenience ratings. The optional feedback seems to explain why this is the case, as a couple of participants reported that the events page wasn't working properly when trying to access or view it. It seems to be unclear why such a bug is occurring, as other participants seemingly had no issues or bugs encountered when using the application. While the interface had almost completely positive feedback, one participant indicated that the interface could use more decoration so that it is more visually appealing to the users.

The results indicate that the application is successful in terms of proper implementation of its features and its features directly contributing towards the application's primary purpose, which is to schedule sports events. The vast majority of the participants rated the functionality as a six or higher out of ten. This falls within expectations, as the application was planned and developed to fit its main purpose of acting as a better alternative to my school's current sport event application. The features were also tested and revised multiple times before the experiment was

performed. According to the results, the convenience and intuitiveness of the application's interface were very well-received. This was also to be expected, as the application used my current school's application as a reference to decide which parts of the interface worked poorly. After picking out the specific parts of the interface that didn't work, I brainstormed better interface implementations in their place.

5. RELATED WORK

One related work notes the use of gamification in sports applications to motivate their users to incorporate more physical activity in their daily lives and how there is little research to support its effectiveness. An online survey was performed to gather the perspectives of those who use gamified sports applications, and the results indicated that the game elements within applications seem to adequately satisfy users' psychological needs [3]. The related work is similar to this work due to how both are heavily centered around the satisfaction and effectiveness of sports applications. While the related work places a larger emphasis on the gamification of sports applications, this work emphasizes the development of an application and its ability to properly schedule events.

A mobile application was introduced as a technological solution to medical appointment scheduling in a related work. An assessment was done on the application to test how convenient this application would be for patients to use and how well it could serve its purpose. According to the survey results, the majority of participants agreed that the application was intuitive and was not difficult to navigate [4]. The related work and this work are very similar in that a mobile application was created and tested for its ease of use. However, while the related work's application is geared toward the scheduling of health services, this work's application was created specifically for the purpose of scheduling sports events.

Another related work provides a compilation of previously performed research articles regarding scheduling in sports in an annotated bibliography. As large-scale events such as the Olympic Games are popular across the globe and sports are an industry worth millions of dollars, scheduling events is an essential aspect of sports [5]. What the related work and this work both have in common is its main theme of scheduling sports events. The related work provides a more general overview of research that has been done regarding scheduling in sports; on the other hand, this work focuses on creating a mobile application to handle the needs of a school's sports team when it comes to viewing and scheduling events.

6. CONCLUSIONS

The purpose of my application is to replace my school's subpar team scheduling system. When using the application, the users will be required to log in with an account, which helps the application determine whether the user is an admin or a student; based on whether the account belongs to an admin or a student, the application offers different features to use. The admins can create and edit events as well as assign students to specific teams to allow for a more specific list of events dedicated to them. On the other hand, students will only be able to see a list of upcoming events. By providing a better alternative to scheduling sporting events at my school, both coaches and students can hopefully have a more convenient user experience. To test whether the application is effective at providing an intuitive and functional scheduling system, participants were gathered to test the application and take a survey on Google Forms that asked whether the application functioned as intended and was convenient to use. According to the results, the majority of participants agreed that the application could perform its duties effectively. Furthermore, the application's interface appeared to be very intuitive and beginner-friendly to

navigate [15]. However, the application still struggles with some minor issues, as reported by some participants in the free-response section of the survey. For instance, events on the upcoming events page may not show up, which could potentially be caused by the database. As this is a core feature of the application, such a bug should be fixed quickly to provide the best experience possible to the application users moving forward.

While the application can competently serve its purpose, there is still room for improvement. There is a known bug that can cause the event page to not work as intended, which is something that can be analyzed and fixed in the future. The application's user interface could also be greatly improved. Although the functionality of the application seems to be fine, there is not much that has been done in terms of decorating the interface and making it appear more presentable. More work can be done on this in the future so that the application no longer uses default backgrounds and buttons.

I am planning to add a place to store team photos, as I feel that this will be a great quality-of-life addition for users to look back at fond memories. I also plan to fix a bug in which multiple events do not show up at once on the team page.

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