A SMART CAMPUS COMMUNITY MOBILE PLATFORM FOR ECA (EXTRA CURRICULAR ACTIVITY) MANAGEMENT AND VOLUNTEER COORDINATION USING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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ABSTRACT

There is a common difficulty in finding opportunities to participate in volunteer activities in my school [1]. The app aims to tackle this problem by providing a platform for signing up to volunteer activities. The app comprises three important systems including authentication, notification and pdf summary generation. The app uses firebase as the background database to store all data and provides an authentication and notification system that makes use of providers to listen to changes of data [2]. The app's pdf summary generation system utilizes the 'report lab' module. Because of the complexity of the structure, the user interface has to be designed well to be organized and easy to use. After the completion of the app, a survey containing various questions on finding and signing up volunteer events was sent to 10 students to evaluate the effectiveness of the app in facilitating signing up to volunteer activities [15]. The results proved to be very successful and most importantly made finding the activities more convenient. The app saves precious time for students in looking for activities and allows them to compare various activities in the same place and choose the best fit one.

KEYWORDS

Volunteer activity platform, Student engagement, Firebase database integration, PDF summary generation

1. INTRODUCTION

A lot of people complained that they cannot find enough volunteer activities to fulfill their volunteer requirements, not speaking of finding desired activities. This resulted in wasted time on inquiring and searching for volunteer activities online and on-campus, where the wasted time can be utilized to complete the actual activities. On the other hand, activity organizers often have problems recruiting enough volunteers. The purpose of the app is to bring the two groups together on one platform and facilitate sign ups and recruitment for the volunteers and organizers.

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Moreover, through my app, I aim to encourage students to participate in more volunteer events in their free time as it is beneficial to the community and their own personal growth. By making the creation and promotion of activities more efficient and convenient, I also encourage more students to create and organize their own volunteer events. This will also improve their creativity, communication, and leadership skills [3]. In section 5, I compared my app to 3 other volunteer management applications. Dr. Swathi K's application aims to streamline a large number of volunteers, Alyssa's app provides the users with more customizable suggestions using machine learning, and Prathamesh's app allows efficient communication between students and NGOs [4]. However, their applications fail to address some common issues.

Dr. Swathi K's only supports web access, which is not convenient for the user when searching for volunteer events on mobile devices. In comparison, my app runs smoothly and stably on phones and aims to simplify the user sign up process as much as possible to encourage volunteer engagements.

Alyssa's app fails to address the difficulty of being informed for the volunteers, while my app informs the volunteers instantly about the updated details of activities and targets. Alyssa's app also doesn't include any functionalities to record volunteer's work and quality of work, whereas my app contains an approval system for the volunteer event creator to approve and disapprove students from being recorded as completing the volunteer events.

Wadekar's app allows NGOs to recruit volunteers on their platform whereas my app targets only on students to encourage not only student participation in activities but also creation and management of activities by students.

Our app aims to improve efficiency of finding volunteer activities for students by providing an open platform for volunteer sign ups. Besides, my app allows students to filter volunteer activities based on their interests and time slots.

Compared to other apps, my app aims for simplicity and convenience. I aim to minimize the time users need to put to learn the app while still providing all the necessary functionalities like volunteer sign up, notifications, and recording volunteer hours. Similarly, event creators can post and promote their volunteer activities free and with ease. They are also able to clearly view volunteers who signed up using my notification system. The simplicity to use the app facilitates users to frequently post and participate in activities.

The experiment contains a survey that evaluates the effectiveness of the app in promoting signing up of volunteer activities. The survey is composed of 10 subjective questions about students' willingness to participate in volunteer activities and their past experiences in finding and signing up to activities. I asked the same 10 students to do the survey before and after using the app, and compared the differences in responses. According to the response, the app makes finding volunteer opportunities much easier, as the situation in which students are not able to find activities are significantly reduced. The app also results in slight improvement in other aspects such as students' willingness to participate in volunteer events outside of their requirements and their willingness to host their own volunteer events. This improvement in students' ability to find volunteer events and willingness to participate is expected as my app aims to provide a simple and intuitive UI for the students to eliminate the time cost of communication and paperwork when signing up for a volunteer event in person. Overall, the experiment proved the app successful at achieving its goal.

2. CHALLENGES

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

2.1. User Identity

Our app uses Firebase Authentication to manage users' identity and their accounts [5]. To access volunteers, they will be prompted to input their name, email address, and student ID. Students' volunteer sign ups and their profile information are linked to their account and can only be accessed if they are signed in. One possible skepticism is that the email and student ID can be fake. To prevent this situation, the system uses strict verification for the email and student ID respectively. When creating an account, It sends a verification email to the inputted address and checks if the student ID is unique. Similarly, accounts that have not been verified via email will be prompted to verify their email first before signing in. Therefore, It blocks any unqualified request to sign up.

2.2. Update Information

Once the user signs in, they will be able to browse and sign up to a list of volunteer activities based on multiple filterings and searches. They can view the details of signed up activities in the 'past page'. One skepticism is that the volunteers do not get informed when the details including location and time of the activities change so are not aware of the updates. The app takes such updates into account and uses the notification system to ensure the volunteers are notified on-time. It displays red badges on updated events and highlights the specific updated details. It also sends messages briefing the updates to the volunteers to make sure they get informed.

2.3. Eligible Participants

Event creators will be able to view the lists of participants signing up and get notified when they sign up or quit the event. My app also keeps track of the participants of every event to be presented in the pdf summary later. However, some people might doubt that students who signed up to the events but failed to complete the work are also recorded as eligible participants. The 'approve' function is designed to avoid this case. The function gives volunteer activity leaders the right to approve the qualified volunteers and disapprove unqualified ones so that only the eligible participants are recorded.

3. SOLUTION

The first screen the user will meet when opening my app is the signup screen, where they will be prompted to enter their English name, Chinese name, student number, email, password, and repeated password. After filling all the fields, the user can create an account and an email will be sent to their email address to verify their account. After verifying their email, the user can then log in again which will lead them to the home page.

The home page displays all available volunteer events in ListTiles. By clicking on a ListTile, the user can view the details of this event and sign up to it(and quit it if they want). If the user is conferred as an administrator, they can create a new event by clicking on the little plus button on the home page. That will lead them to fill out a form about the details and then the new event will be displayed.

When someone joins or quits an event, the creator of the event will be informed by a notification

in the form of a message. Similarly, when the event creator updates an event, all the participants will receive a notification about the update as well.

After an event is finished, the creator of the event will be able to approve or disapprove students based on their effort in the event. If the student is approved, they are recorded as valid volunteers of the event. The creator of the event can also download a pdf to get the summary of the valid volunteers after approving the students.

Figure1. Overview of the solution

The purpose of this component is to handle signup logic. An account for the user will be created in the database (firebase in this case) and personal information stored [6]. A verification email is sent to the user and the user is prompted to log in again.

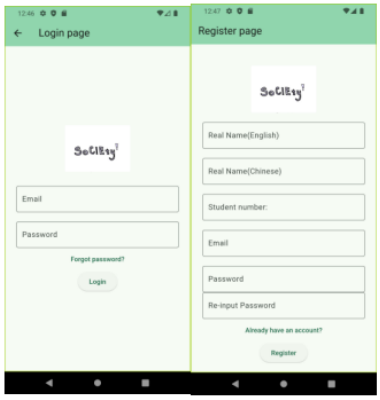

Figure2.Screenshot of the app

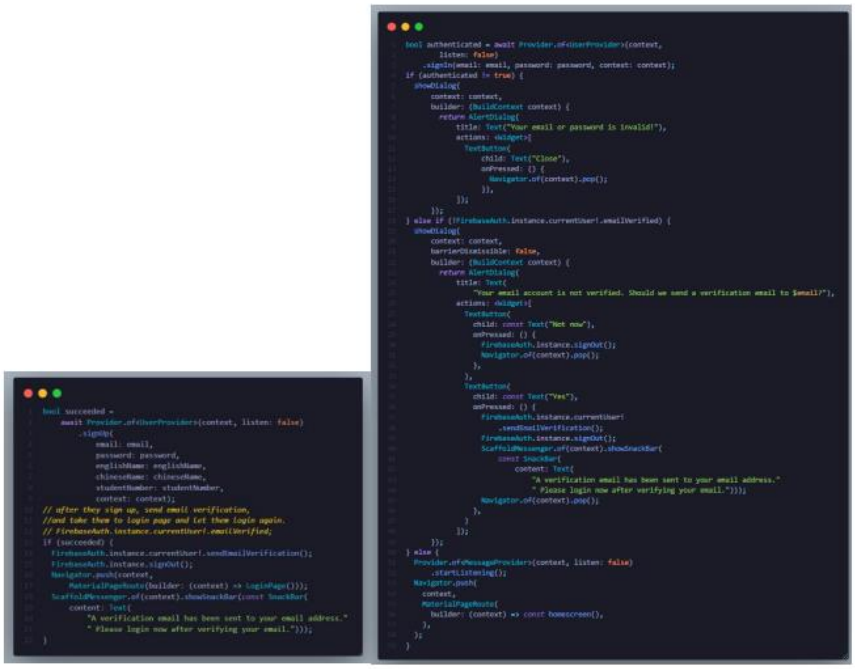

Figure3. Screenshot of code1

On the signup page(first screenshot), when the user enters their information and clicks the register button, I will call the signup function in the UserProvider to process the signup. If the signup succeeds, the email account, student number, and password are all unique and valid. I will then send a verification email to the user's account and prompt the user to check it. At the same time, I will log the user out to prevent the user from bypassing the first login. After the user verifies their email, they can log in and enter the home page.

On the login page(second screenshot), when the user enters the email and password and clicks the login button, Firebase Authentication compares the typed information with data in the database [14]. If the account does not exist or the password and email do not match, I will show an alert dialog saying their email or password is invalid. If Firebase detects that their email account has never been verified, they will be guided to choose to verify their email now or later. If their account is valid and email is verified, the user will be led to the home page.

The purpose of this component is to alert the user when any of their volunteer events have been updated. The updated events will be shown as badges in the bottom navigation bar, MyEvents page, and the List Tile related to that event. When the user clicks the event and scroll to the bottom, the notification will disappear.

Figure4. Screenshot of code2

When the Notification Provider instance is created, it will automatically listen to Firebase Firestore for changes [8]. It will only listen to the volunteer events that the current user participates in and is still active.

When changes are detected, the system will only process the "modified" type among "added", "modified", and "deleted". The app will check if the modified event is the same as the one stored locally in the user's device. If they are different, this means that the user has not seen the changes. Therefore, the app will record the document ID of the event and display them as notification badges.

When the user scrolls to the bottom of the volunteer detail page, "update Notification" function is activated which will take in the relative event. The function will store the newest data locally and remove the notification from updated EventIdBox which is used to keep track of all notifications.

The purpose of this component is to generate a pdf summary of the requested volunteer event and send it to the user's device. In order to generate the pdf, I will use a Flask server to accept requests from mobile devices and use the "reportlab" module to generate the pdf [7]. I will also use the firebase_admin module to access data in firebase.

```python
def generate_pdf(self, docId: str) -> None:
    doc_ref = self.db.collection("Volunteer").document(docId)
    doc = doc_ref.get()
    user_list = []
    if (doc.exists):
        data = doc.to_dict()
        for uid in data["Completed"]:
            user_info = self.get_user(uid)
            if(user_info == None):
                user_list.append({
                    "username": "Deleted User",
                    "chineseName": "Deleted User",
                    "studentNumber": "Deleted User",
                    "email": "Deleted User",
                })
                print("user doesn't exist")
                continue
            else:
                user_list.append(user_info)
        self.create_pdf(data, user_list, docId)
    else:
        print("No such document1")

def get_user(self, uid: str):
    print(uid)
    doc_ref = self.db.collection("SCIE-Students").document(uid)
    doc = doc_ref.get()
    if (doc.exists):
        return doc.to_dict()
    else:
        print("No such document")
```

Figure 5. Screenshot of code 3

The first screenshot is the server endpoint. When making a request to generate pdfs, the mobile device makes a POST request to url/generate_pdf with docId as request body. The server will then proceed to call the generate_pdf function in the second screenshot.

The generate_pdf function will get the document from Firebase and extract the completed volunteer field and attempt to get the information of all users which will be stored in a list. If the user is deleted, I will generate a default user information for the deleted user consisting of only the “Deleted User” value. After populating the list of completed users, I will pass the list in the create_pdf function which will construct the actual pdf, save it in the server’s directory, and lastly send the pdf to the user with file name {docId}_report.pdf. If any error occurred during the process or the pdf file does not exist, I will handle these situations with error code 404 or 500 to inform the mobile device that something went wrong.

4. EXPERIMENT

For this experiment, I aim to evaluate the effectiveness of the app in facilitating volunteer signups. Volunteer sign ups is one of the most fundamental functions in the app and an essential precondition for other functions, thus I aim to make sure it is stable and reliable.

To evaluate the effectiveness of the volunteer signups, I created a survey on their opinion and initiative of volunteer activities. I sent this survey to a group of 10 students before introducing the app and recorded their responses. After a month, I sent out the same survey to the same 10 students and recorded their responses. Through analyzing their responses I will be able to gain insights on the effectiveness of the app and the impact it has made to those students.

Survey1

1.Do you frequently take part in volunteer activities in your leisure time?
2.When you try to fulfill your volunteer hour requirements, how frequently are you unable to find a volunteer activity?
3.How frequently are you unable to find activities that suit your interest/skill/time and have to participate in undesired volunteer activities for the requirement?
4.How frequently do your friends and classmates tell you that they have trouble finding volunteer events and fulfilling your volunteer requirements per year?

5.How many volunteer-related clubs are you in?
6.How far are you interested in holding a volunteer activity yourself? (If you held activities before, please tick 5)
7.How far do you think "being able to view and sign up to all volunteer activities in one place" is helpful to you?
8.How interested are you in participating in extra volunteer events beyonds your requirements?
9.Rate your experience in being informed about the correct place/time/plan of the volunteer activity by the volunteer coordinator?
10.How frequently do you have to submit your evidence of volunteering(limited to in-campus activities) to the relevant teacher by yourself?

	Before using my app	After using my app
1.Do you frequently take part in volunteer activities in your leisure time?	1: 3 students 2: 4 students 3: 2 students 4: 1 student 5: 0 student	1: 1 students 2: 3 students 3: 3 students 4: 2 students 5: 1 student
2. When you try to fulfill your volunteer hour requirements, how frequently are you unable to find a volunteer activity?	1: 0 student 2: 1 student 3: 2 students 4: 4 students 5: 3 students	1: 3 students 2: 5 students 3: 2 students 4: 0 student 5: 0 student
3. How frequently are you unable to find activities that suit your interest/skill/time and have to participate in undesired volunteer activities for the requirement.	1: 0 student 2: 0 student 3: 1 student 4: 5 students 5: 4 students	1: 1 student 2: 3 students 3: 5 students 4: 1 student 5: 0 student
4. How frequently do your friends and classmates tell you that they have trouble finding volunteer events and fulfilling your volunteer requirements per year?	1: 0 student 2: 1 student 3: 2 student 4: 4 students 5: 3 students	1: 1 student 2: 4 students 3: 4 students 4: 1 student 5: 0 student
5. How many volunteer-related clubs are you in?	1: 6 students 2: 4 students 3: 0 student 4: 0 student 5: 0 student	1: 5 students 2: 5 students 3: 0 student 4: 0 student 5: 0 student
6. How far are you interested in holding a volunteer activity yourself? (If you held activities before, please tick 5)	1: 5 students 2: 3 students 3: 0 student 4; 0 student 5: 2 students	1: 3 students 2: 4 students 3: 0 student 4: 0 student 5: 3 students
7. How far do you think "being able to view and sign up to all volunteer activities in one place" is helpful to you?	1: 1 student 2: 2 student 3: 3 students 4: 1 student 5: 3 students	1: 1 student 2: 1 student 3: 2 students 4: 2 students 5: 4 students
8. How interested are you in participating in extra volunteer events beyonds your requirements?	1: 4 students 2: 3 students 3: 1 student 4: 0 student 5: 2 students	1: 2 students 2: 3 students 3: 2 students 4: 1 student 5: 2 students
9. Rate your experience in being informed about the correct place/time/plan of the volunteer activity by the volunteer coordinator?	1: 2 students 2: 1 student 3: 0 student 4: 3 students 5: 4 students	1: 0 student 2: 1 student 3: 1 student 4: 4 students 5: 4 students
10. How frequently do you have to submit your evidence of volunteering(limited to in-campus activities) to the relevant teacher by yourself?	1: 4 students 2: 3 students 3: 0 student 4: 2 students 5: 1 students	1: 4 students 2: 4 students 3: 1 student 4: 0 student 5: 1 student

Figure6.Figure of experiment 1

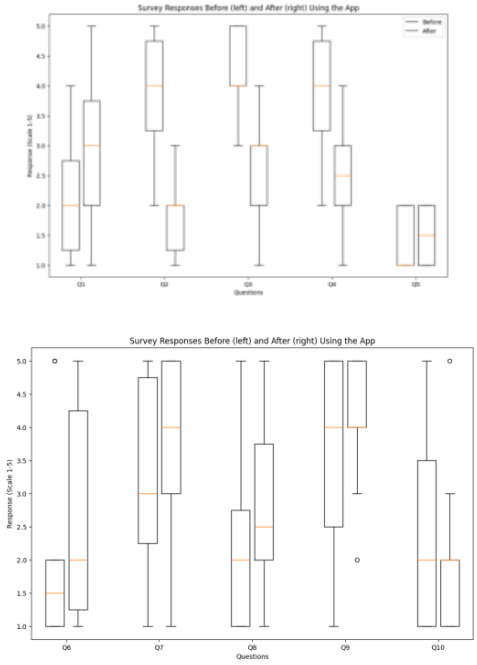

Figure7.Surveygraph

Based on the responses of my survey, I noticed that my app successfully improves the volunteering experience in some aspects like signing up, getting informed, and being more involved in volunteer activities.

Based on question 2, 3, and 4, I can notice that before using the app there's a common problem of finding and finding the suitable volunteer events for students. With my app, this problem has been significantly alleviated. According to the data, the average score for questions 2, 3 and 4 before using my app is: 3.9 , 4.3, and 3.9. Meanwhile the average score after question 2, 3, and 4 after using my app is: 1.9, 2.6, and 2.5. This shows that my app has made finding and finding the suitable volunteer event much less difficult for students.

Another survey question that demonstrated significance is question 9. Before using the app, students on average rated a 3.6 on whether they are being informed about the correct details of the volunteer event, while rated a 4.1 after using the app. This shows that the notification system I designed works as expected.

5. RELATED WORK

Research paper name: Youth Compass: A Flutter Application for Volunteer Management

Authors: Dr. Swathi K , Abhishek Kumar, Aditya Krishnan, Ajin Sumesh, Harsh Soni

Dr. Swathi K's application is a web-based volunteer management app that maintains the streamline of a large number of volunteers cooperating with Non-Government Organizations [11]. Different from my app, their app is accessed using a web browser. Compared to Dr. Swathi K's application, my application is more conveniently accessed and functions more stably using mobile phones. In the paper, Dr. Swathi K does not address the issue of incompetent participants, while my app contains an approve and disapprove function for the event creator to filter out unqualified participants, ensuring smoother event operations without disruptions caused by unfit

participants.

Research paper name: An Intelligent and Data-Driven Mobile Platform for Youth Volunteer Management using Machine Learning and Data Analytics

Authors: Alyssa Huang and Yu Sun

Alyssa's application also uses Flutter and Firebase and targets students who struggle to find volunteers [12]. Different from my app, Alyssa's application utilizes a recommendation system to provide users with the best fit volunteer events. Compared to my system, this way of recommendation can provide more personal suggestions for the user. Despite this, Alyssa's app lacks crucial features for keeping volunteers informed—such as time and location updates—whereas my app includes a robust notification system that instantly alerts users of any changes to event details. Additionally, while Alyssa's platform does not track or record volunteer activities, my app allows volunteer managers to approve or disapprove participants and generate a detailed summary of the event in PDF format.

Research paper name: V - Vibe: Efficient Volunteer Management using Mobile Technology

Authors: Prathamesh Pandharinath Wadekar ; Shreyas Kumar Sachan ; Sujal Kishor Patil ; Harshal Mahesh Wagh ; Manimala Mahato

Wadekar's app is a user-friendly online platform for volunteer event posting and sign-ups [13]. One major difference is that Wadekar's app allows organizations such as local communities to post volunteer events, while my app only allows students and school staff to post events. In addition, Wadekar's requires the applicants to be approved before they can officially participate in the event, whereas my app does not require this approval prior to signing up. Wadekar's app includes this function possibly because some NGOs have certain requirements for volunteers. Compared to Wadekar's app, my app targets volunteer events in school which promote studentled volunteers and activities.

6. CONCLUSIONS

One limitation to my project is that it does not support messaging. Although it has the notification function, the notification content is fixed and it does not allow messaging by words between the activity leader and participants [9]. Messaging is important because it allows the leader to send desired information to participants.

If I am given more time, I will work on building a message board under each event where the leader and participants can discuss it.

In the future, I want to expand my program to not only the volunteer activities, but also the clubs. The aim is similar: enable signing up to clubs.

If I were to start over with this project, I would create a new section on the homepage to store only passed events. This would separate out passed events from ongoing events and to improve the user experience, since the user is not distracted by a lot of passed events and can find desired ongoing events more easily [10].

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