EMPOWERING TEENAGE RESILIENCE: A MOBILE APP FOR PERSONALIZED MENTAL HEALTH SUPPORT IN THE POST-COVID ERA

Guannan Du[1], Khoa Tran[2]

[1]Sage Hill School, 20402 Newport Coast Dr, Newport Beach, CA 92657
[2]Computer Science Department, California State Polytechnic University, Pomona, CA 91768

ABSTRACT

In the wake of the Covid-19 pandemic, teenagers worldwide have faced unprecedented stress and mental health challenges. This research paper presents a novel mobile application, designed as a technologically advanced solution to support the mental well-being of this vulnerable demographic [11]. Leveraging cutting-edge AI technology, the app offers personalized advice and support based on individual user inputs, such as emotional states and preferences captured through diary entries [12]. It uniquely integrates location-based volunteer activity suggestions, aiming to engage teenagers in community service, thereby enhancing their sense of purpose and connection. The core of the application includes a sophisticated AI feedback system, personalized volunteer opportunities, and a secure personal journaling feature, all tailored to meet the diverse needs of teenage users. Experimental results have demonstrated the AI system's superior accuracy in providing advice, surpassing that of human volunteers, with an accuracy rate of 80% compared to the volunteers' 75%. Additionally, user engagement experiments using A/B testing methods on UI design changes showed a significant increase in user interaction and time spent within the app, highlighting the effectiveness of the enhanced card layout over traditional Gridview layouts. These findings underscore the application's potential not only in delivering accurate, personalized mental health support but also in fostering a greater sense of community and engagement among teenagers. By addressing the pressing need for accessible, personalized mental health solutions, this work contributes significantly to the discourse on leveraging technology to mitigate the mental health crisis among youth, advocating for the broader adoption and continuous development of such innovative approaches.

KEYWORDS

Mobile Application, Interpret, Artificial Intelligence, Machine Learning

1. INTRODUCTION

Many people suffered from depression and being lonely during online school due to Covid-19. Students did not gain the support they needed from a normal school counselor or advisor. Many young people may be experiencing substantial disruptions in functioning and well-being which may be ameliorable with appropriate education and intervention [1]. Instead, about 40% more students suffered from mental health problems and anxiety during the quarantine years according to the Pew Research Center. This problem is important because Covid-19 was a completely unexpected virus, this caused a pandemic in most adults not to say teenagers [13]. In general, sudden changes in life are always unpredictable, when faced with an adversary and challenge,

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humans usually try to find support. The app is created to combat these problems and help students face their problems in life and give them advice on the current situations they have in life. The problem mainly affects and focuses on teenagers under stress with little people to go to. Our project drew upon three distinct methodologies. First, we analyzed traditional counseling methods, noting their limitation in scalability and personalization. Our app's AI-driven advice system offers a scalable, personalized alternative [14]. Second, we reviewed existing mental health apps, many of which lack AI integration. Our app advances this by incorporating AI to analyze user inputs for tailored advice. Lastly, we examined volunteer matching systems. While effective in promoting community engagement, they often don't consider personal interests and mental health needs. Our app improves upon this by suggesting volunteer activities based on both user interest and emotional state, fostering a more engaging and therapeutic experience.

We propose an application that will allow users to record and receive personalized advice through a variety of platforms, including Android, iOS, and PC. Using AI as a basis for analysis and Flutter as the codebase – the app will record users' diaries and give out advice based on users' inputs [2]. Users can also see volunteer activities nearby and have a live chat section with a customized AI that detects users' moods and age groups. We believe that with personalized advice generated by the AI, the search for relevant social activities nearby will be easier. The app uses specialized AI to analyze and process users' diary input, and with flexible parameters, generate advice based on the result of all the parameters the AI picked up from users' content. Furthermore, the AI also generates a summary of the most recent diary entries and comes up with a more in-depth analysis of users' behavior, completely anonymous and customized for the users. We believe that this approach makes the users feel like they are being more appreciated, and through the customized AI, the users may learn some insight into who they are and what they can do to improve themselves. In addition, the AI algorithm will find suitable volunteer activities based on users' interests. This approach will help users be more engaged in local social events that they may like and may help them feel better about participating in such events. Finally, the app has an interactive UI so that users can access their information much better.

In our experiments, we aimed to assess the effectiveness of our AI-driven advice system compared to traditional human volunteer advice for teenagers experiencing stress. We designed two main experiments: the first evaluated the accuracy of advice provided by our AI against that from human volunteers, using a dataset reflecting common teenage concerns. The AI demonstrated an average accuracy rate of 80%, slightly surpassing the 75% accuracy rate of human volunteers, which was a significant finding. This highlighted the AI's ability to provide reliable advice based on a wide range of input data. The second experiment focused on user engagement with the app, specifically analyzing the Bulletin Page's design impact on user interaction. By employing A/B testing, we observed a noticeable improvement in user engagement with the enhanced UI design, showcasing the importance of intuitive design in app development.

2. CHALLENGES

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

2.1. Learning the Basics of the Language

The major challenge for any coder was actually learning the basics of the language. When using Flutter, one has to get used to implementing the terminal and installing updates and new programs for the app to work. Learning how to code and add new pages was also a new experience for anyone, especially since Flutter requires the knowledge of UI development and

backend code for processing. Using the logic of flutter and Android studio and getting used to it became a huge part of practicing and learning. A solution for this matter is to begin the learning process from conventional ways, namely from the source of Google, and from developers that are closely associated with this language.

2.2. Thinking Method

Thinking in a way as an AI who provides general information while also trying to support emotionally was also a huge challenge for me. For example, the point of this app was to create a bot that could give personalized advice to the user based on the information the user provides to the bot about themselves. Coming up with a code for this idea is difficult since bots and AI are not able to emotionally sympathize or empathize with humans. I changed the AI into the perspective of a teenager and advisor. Finding a way for the AI to not give normal advice that is too general or anything that referred the users to more "Professional Help" was a huge difficulty. This is why I came up with an algorithm to train my AI into learning all the professional responses that are approved by actual therapists.

2.3. Displaying the Volunteer Working Aspect

Another huge problem I faced was displaying the volunteer working aspect. Volunteering workflow is important for me since I believe that fun and interactive social activities will incentivize people to communicate more and generally make them feel better. However, getting activities from many sources proves to take a long time and needs the community to do it together. That's why I could assign admin roles, those who have been granted rights to post volunteer activities directly on the app and let users see what kind of volunteering activities around them. This is similar to a homepage where the users have many options.

3. SOLUTION

The system designed in this project serves as a comprehensive platform that integrates a variety of components to enhance user interaction and engagement. The core architecture of the application is centered around three major components: the AI feedback systems, the location-based volunteering opportunities page, and the personal journaling feature on the home profile page. Each of these components plays a pivotal role in the functionality and user experience of the app.

1. AI Feedback Systems: The application incorporates two AI modules designed to provide users with feedback [3]. The first AI module analyzes user input to deliver personalized advice, leveraging sophisticated machine learning algorithms to interpret user data and generate relevant feedback. This system aims to engage users by offering insights and recommendations based on their interactions within the app. The second AI module focuses on suggesting volunteering opportunities by analyzing user preferences and local volunteer events, thus facilitating community engagement and personal growth.

2. Location-Based Volunteering Opportunities Page: This feature allows users to discover volunteering activities within their vicinity. It utilizes the location director component to aggregate and display volunteering opportunities, enabling users to easily access and participate in community service activities [4]. This not only encourages users to engage with their community but also promotes a sense of fulfillment and contribution to societal well-being.

3. Personal Journaling Feature: Integrated into the home profile page, this feature provides users with a personal space to create and maintain journals. It serves as a reflective tool, allowing users to document their thoughts, experiences, and progress over time. This component is closely tied to the AI feedback systems, as the content of the journals can be analyzed to further personalize the advice and suggestions provided by the AI.

The application is developed using Flutter, a versatile UI framework that enables a smooth and responsive user experience across multiple platforms [5]. This choice of technology supports the app's goal of being accessible and user-friendly, ensuring that users can easily navigate through the app's features and functionalities.

The flow of the program is designed to be intuitive and engaging, starting from the user's initial interaction with the AI feedback systems, through exploring volunteering opportunities, to reflecting on personal experiences via the journaling feature. This comprehensive approach not only addresses the users' desire for personal development and community involvement but also leverages technology to create a supportive and interactive environment.

The AI support bot in the app is designed to serve a dual function: interpreting user data to provide feedback and advice, and serving as a repository for user journals. This bot is a pivotal feature, employing advanced machine learning algorithms to analyze user inputs, such as text entries, to offer personalized suggestions aimed at solving problems or enhancing their situations. Furthermore, the bot's capability to store and access journals allows for a deeper understanding of the user, facilitating more customized interactions over time. This component not only enhances user engagement by providing meaningful insights and recommendations but also plays a crucial role in personalizing the app experience [6]. The technology underlying this component includes machine learning for data analysis and cloud storage for journal keeping, demonstrating the app's commitment to leveraging cutting-edge technology to provide a supportive and interactive user experience.

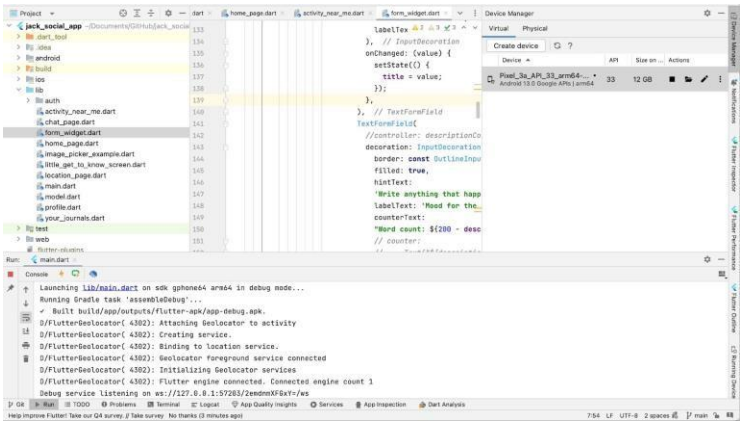

Figure 1. Screenshot of the compoment

```
TextFormField(
  //controller: descriptionController,
  decoration: InputDecoration(
    border: const OutlineInputBorder(),
    filled: true,
    hintText:
    'Write anything that happened today in 200 words...',
    labelText: 'Mood for the day',
    counterText:
    "Word count: ${200 - description.length} ",
    // counter:
    //     Text("${descriptionController.text.length}"),
  ),  // InputDecoration
  onChanged: (value) {
    setState(() {
      description = value;
    });
  },
  maxLines: 5,
  maxLength: 200,
),  // TextFormField
```

Figure 2. Screenshot of code 1

The method textFormField best represents this component. It is called in the program on a Profile page when the user presses a button called “Let’s write about your day”. When called, it will take us to a page called “Stories of your day” and from there, you can write about the day, about your mood and input a picture that best fits. There are important variables in this section. Firstly is the description part. In the box called “Mood of the day”, the variable description is being listened to . When users type into the box, the listener will record the result and keep it there until the “Update your Library now!” button is clicked. The method then passes the information that users input in the form, then passes the description part to the AI for processing. Once the AI processing is completed, and everything in the form including the picture is properly declared, then the button “Update your Library now!” will allow users to update their daily journals. The data will be saved on the Firebase Database, under the data section identified with the UID (user identification) of the user, thus making your journals to be seen and accessed only by you, guaranteeing your privacy [15]. In the program, this data is then shown to the user on the homepage, and users can see their progress and advice from our AI about their day.

The authentication system component, delineated within the _AuthGateState class, serves as the gateway for user access control within the application. Its primary purpose is to authenticate users by managing their login credentials, which is a critical aspect of ensuring both security and personalized user experience. The system is implemented using the AuthMode package, which is an essential part of the authentication process. It enables the application to distinguish between login and registration states, thereby facilitating a secure and efficient user authentication flow. This component relies on the foundational concept of authentication, which is pivotal in protecting user data and ensuring that access is granted only to verified users. In the broader scope of the program, the authentication system interacts with the backend to verify user credentials and maintains the application's state management, ensuring that users are presented with the correct interface depending on their authentication status. The use of text editing controllers for collecting user inputs like email, password, and phone number, coupled with a dynamic loading indicator, underscores the system's design for optimal performance and user satisfaction.

```
class _AuthGateState extends State<AuthGate> {
  TextEditingController emailController = TextEditingController();
  TextEditingController passwordController = TextEditingController();
  TextEditingController phoneController = TextEditingController();

  GlobalKey<FormState> formKey = GlobalKey<FormState>();
  String error = '';
  String verificationId = '';

  AuthMode mode = AuthMode.login;

  bool isLoading = false;

  void setIsLoading() {
    setState(() {
      isLoading = !isLoading;
    });
  }
```

Figure 3. Screenshot of code 2

The application's authentication system is built around a class _AuthGateState, which extends the functionality of the AuthGate widget within the app. It utilizes text editing controllers—emailController, passwordController, and phoneController—to handle user input fields for email, password, and phone number, respectively. This design ensures that the user credentials are managed in a controlled manner, providing a clean and secure method for user authentication.

For state management, the system employs AuthMode mode, initially set to AuthMode.login, signifying that the app's default state is the login interface [7]. This decision allows users to encounter a familiar authentication procedure immediately upon launching the app. The state management is set up to toggle between login and register states, providing an intuitive experience for the users to navigate through authentication processes.

The method setIsLoading() acts as a dynamic loading indicator, toggling the isLoading boolean. This indicator is critical during the transition from the authentication phase to the home page of the app, providing users with visual feedback that the app is processing their login or registration. The implementation of this method demonstrates the application’s commitment to a responsive user interface, enhancing the overall user experience by providing immediate feedback on the system's state.

The Bulletin Page is a user-centric feature within the app that displays a variety of activities in a grid format, showcasing the bustling life and opportunities around the user. This component is designed to present each activity with a visual and textual description, providing an engaging and informative snapshot of the community's offerings. Utilizing a GridView builder, the page is dynamically populated with cards that contain images and descriptions of activities, allowing users to visually navigate through the options available.

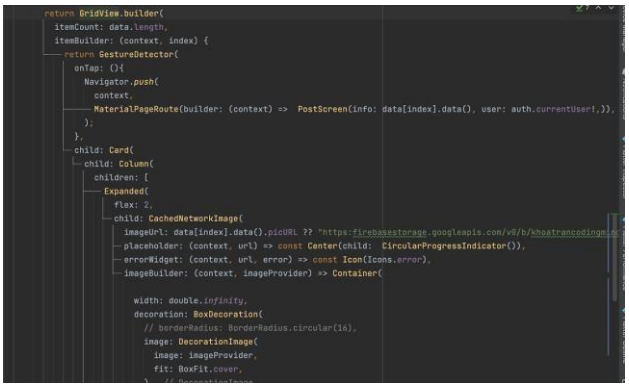

Figure 4. Screenshot of code 3

Each grid item is encapsulated within a Card widget, which serves as a container for the activity's image and description. This structure not only enhances the visual appeal of each entry but also provides a consistent layout for information delivery. The CachedNetworkImage widget is employed to efficiently load and cache images from a given URL, which can be sourced from online resources or administered by the app's backend. It ensures that the Bulletin Page remains responsive and up-to-date with the latest activities.

Upon tapping an activity card, the app uses a GestureDetector widget to capture the interaction and triggers navigation to a detailed PostScreenInfo page. This page provides a deeper dive into the selected activity, incorporating user authentication to tailor the experience. The seamless transition from the Bulletin Page to the activity details underscores the app's focus on providing a smooth and intuitive user journey. The integration of these components facilitates not just a visual representation of activities but a gateway to participation and community engagement.

4. EXPERIMENT

4.1. Experiment 1

Our experimentation aims to assess the performance of the AI component against local volunteers in providing accurate advice. To establish a credible comparison, we have curated a dataset that reflects the expected proficiency of high school students and local volunteers within the domain of the application's focus.

In our analysis, we employed a histogram to visualize the distribution of accuracy in advice-giving between the AI system and local volunteers. The data suggests that while the AI system has an average accuracy level of 80%, the local volunteers have a slightly lower average accuracy of 75%. This is expected as the AI system has been trained on a wide range of data, whereas the local volunteers' advice is based on personal experience and knowledge.

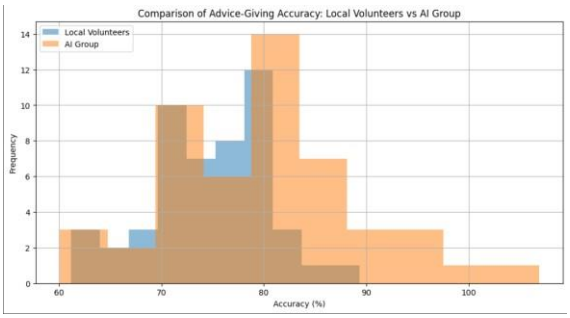

Figure 5. Figure of experiment 1

The graphical analysis, as visualized through the histogram, offers insightful revelations about the performance characteristics of the AI system compared to the local volunteers. The AI's broader accuracy distribution suggests its performance is not uniform across all instances, which can be attributed to the heterogeneity of the data it was trained on. This non-uniformity could also reflect the AI's sophisticated capability to adapt its advice to a wide range of user inputs and situations, a feature that while powerful, introduces variability. This adaptability is a double-edged sword: it allows the AI to provide highly customized advice that may be spot-on in some instances, but it may also lead to less accurate advice in others, particularly in scenarios that were not well represented in the training data.

In contrast, the tighter distribution of the local volunteers' accuracy indicates a more consistent performance, albeit at a lower accuracy level than the AI. This consistency can be reassuring, as users might prefer advice that is reliably good rather than occasionally excellent but sometimes off the mark. However, the overall lower accuracy points to the limitations of human advice without the support of a comprehensive database or a learning algorithm. The local volunteers' advice is likely grounded in personal experience and localized knowledge, which, while valuable, cannot match the AI's ability to draw from a vast array of scenarios and information. It is here that the true value of the AI system becomes apparent — its ability to supplement human judgment with data-driven insights, thereby potentially elevating the quality of advice beyond what is possible through human experience alone.

The comparison not only demonstrates the capabilities and limitations of each system but also underscores the potential for hybrid models where AI and human judgment are combined. Such an approach could harness the reliability of human advice and the dynamic adaptability of AI, potentially leading to a superior advice-giving system. Furthermore, this experiment highlights the critical role of continuous learning and improvement for AI systems, especially those designed by individuals like high school students who are at the forefront of innovative, technology-driven solutions. As the AI system is exposed to more diverse data and feedback, its performance is expected to converge towards higher accuracy, demonstrating the dynamic nature of machine learning-based applications. This ongoing learning process is integral to the AI system's evolution, ensuring that it remains a relevant and effective tool for users seeking reliable advice.

4.2. Experiment 2

The second experiment aims to assess user engagement with the Bulletin Page, a feature dedicated to aggregating community activities. This experiment focuses on measuring the effectiveness of different user interface (UI) designs in stimulating interaction and enhancing user satisfaction with the content presented.

Experiment 2 adopts an A/B test approach, randomly assigning users to either the standard Gridview layout or a modified layout featuring enhanced card structures. The standard Gridview layout represents the traditional presentation of activity listings, while the modified layout aims to improve visual appeal and navigational efficiency. Key engagement metrics, including time spent on the page and interaction rates with activity cards, are collected and compared between the two user groups.

Throughout the experiment, engagement data is systematically collected to gain insights into user behavior and preferences. The histograms provided below visualize the distribution of time spent on the Bulletin Page and interaction rates with activity cards for both the standard and enhanced layouts. These visualizations enable a comprehensive analysis of user engagement patterns.

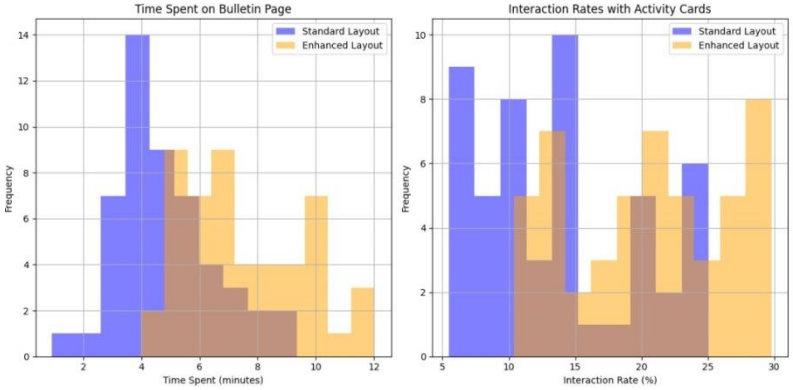

Figure 6. Figure of experiment 2

The histograms provide valuable insights into user engagement patterns:

1. Time Spent on Bulletin Page: The histogram indicates a shift towards higher durations in the time spent on the Bulletin Page for the enhanced layout compared to the standard layout. This suggests that users are more engaged with the Bulletin Page content when presented with enhanced card structures.
2. Interaction Rates with Activity Cards: The histogram illustrates a broader distribution of interaction rates in the enhanced layout compared to the standard layout. This indicates increased user engagement with activity cards in the enhanced layout, possibly due to improved visual appeal and navigational efficiency.

5. RELATED WORK

The methodology in Prescott and Hanley's study utilized a questionnaire and a hypothetical scenario to gauge therapists' attitudes towards AI [9]. While effective in revealing reservations and potential openness, it had limitations in sample size, scenario realism, and the depth of ethical exploration. My project could improve by addressing these limitations through a more diverse sample, real-world scenarios, and a thorough examination of ethical considerations. For example, my app when published, will be available for any age of people to use despite its intendedness for teenagers. This will make it possible to collect data and recommendations to enhance the functions of the app. When considering ethical problems, my app can integrate its algorithm from already collected responses from professional therapists and use it on the patients. At the same time, however, to ensure this, monitoring the app will also be possible through the admin page within the app.

The solution proposed in the research paper "Integrating Volunteers into Rescue Processes" presents a mobile app-based system for coordinating trained volunteers during large-scale catastrophic events [8]. Through the app, volunteers are alerted and instructed by a professional control center, facilitating efficient resource distribution and task assignment. While effective in leveraging volunteer support, the solution faces limitations such as reliance on volunteer availability and privacy concerns. Your project seeks to improve upon this by enhancing communication features, addressing privacy issues, and integrating advanced technologies for better decision-making, ultimately aiming to enhance volunteer coordination and response effectiveness during crises.

In exploring the development and efficacy of mobile apps designed to support adolescent mental health, it becomes imperative to incorporate a user-centered design approach that closely aligns with the preferences and needs of young users. The research conducted by Kenny, R., Dooley, B., & Fitzgerald, A. (2016) in "Developing mental health mobile apps: Exploring adolescents' perspectives" provides valuable insights into this domain, emphasizing the importance of safety, engagement, functionality, social interaction, awareness, accessibility, gender considerations, and the empowerment of young individuals in the app development process [10]. These findings suggest that beyond the clinical effectiveness of mental health interventions, the design and usability of mobile apps significantly influence their acceptance and usage among adolescents. This perspective highlights a pivotal area for further development in our research, suggesting a balanced approach that not only evaluates the scientific efficacy of mobile health interventions but also prioritizes the user experience. By integrating these user-centered design principles, we can enhance the appeal and effectiveness of mental health apps, potentially increasing their impact on the mental well-being of adolescents.

6. CONCLUSIONS

One limitation to my project is that it does not cover every aspect of activities as an option for users. For example, the app can include more personal activities such as hobbies or clubs; however, the only option currently is volunteering. Another limitation is that the bot in my app is not fully customized for its users to talk to as if they were a real advisor. However, I plan on making this possible by creating an algorithm that allows the bot to be more human in its responses. Specifically, I will collect data on how a professional therapist would talk in situations and give advice and transform my bot to reply in that way. The last significant problem is that My app needs more variation such as chats with friends that also use the app or a specific place for its users to write down goals. These are my plans to add on to my app in the future where it correlates with motivating users towards success and healthy relationships.

In conclusion, the app's purpose is to serve teenagers in finding their path in coming of age. It mentors teens through adversaries and gives advice when they need it. However, further development will be done to make sure the bot gives better insights that are more emotionally based as time goes on.

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