

HARNESSING MOBILE TECHNOLOGY FOR SUSTAINABLE ENGAGEMENT: AN INNOVATIVE IOS AND ANDROID FLUTTER APPLICATION FOR UNITED NATIONS' SDG ALIGNMENT AND USER EMPOWERMENT

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ABSTRACT

In a world facing pressing challenges related to sustainability and the United Nations' Sustainable Development Goals (SDGs), harnessing technology for global betterment has become a paramount goal [1]. This research paper introduces an innovative iOS and Android Flutter application designed to engage users of all ages in daily tasks aligned with the SDGs [2]. The paper explores the imperative of mobilizing a diverse user base to contribute to sustainability and illustrates how technology can be a catalyst for positive change. It discusses the application's structure, core components, and unique features, such as daily prompts, interactive content, and real-world action. The study also delves into a user survey experiment, revealing significant findings that demonstrate the application's positive impact on awareness and the adoption of sustainable behaviors [3]. Through this research, we aim to emphasize the potential of mobile applications to empower individuals and communities in the pursuit of sustainability, fostering a collective drive toward a more harmonious and responsible global future.

KEYWORDS

Social/Interactive, Climate Engagement, Photos/Videos, Carbon Footprint

1. INTRODUCTION

The imminent rise of global issues ranging from climate action and protecting our planet's oceans, to generating social equality and protecting the near 600 million vulnerable people living in poverty, has necessitated a response worldwide from a scale ranging from each nation's governments to individual citizens living in bustling cities and rural towns [4]. The recent generations, recognizing the monumental effects of human activity, inactivity in a time of rapid technological, and industrial development in selective countries worldwide, are forced to consider what they must do in the face of crisis. In a report made by the United Nations International Children's Emergency Fund (UNICEF), 9 in 10 children are concerned about Climate Change [5]. However, the issue is, most children don't know what they can do to help our planet, and whether or not their daily considerations like turning off the light or recycling are actually making much of a difference. Another concern that arises is the growing indivisibility from the recent generation and their technological devices like smartphones. With constant distractions and lack of knowledge on how they can contribute to solving our global issues, our planet is lacking support from a major age group that can actually do a lot to help. It's incredibly important that we

discover methods of utilizing this rising generation not only because they are the ones who are being affected by these impending issues, but also because they've shown signs of wanting to help. With simple guidance and a social drive from all people, not limited to children, we can collectively work towards a better planet.

Çimşir and Hüseyin's methodology emphasizes using mobile technology to raise awareness of SDGs among university students. However, it primarily targets a specific audience and focuses on awareness. In our project, we broaden the scope to include users of all ages and concentrate not only on awareness but also on encouraging actual sustainable behaviors related to SDGs.

Silveira, Cristiano, and Leonilde's methodology centers on sustainability education through an Android app. While they incorporate agile development and the SEMAT approach, their focus is on education. Our research paper extends beyond education by developing a mobile application that promotes both awareness and actionable engagement with SDGs among diverse user groups. Laso Bayas, Juan Carlos, et al.'s methodology provides agricultural recommendations through the AgroTutor app, which primarily serves the agricultural sector. In contrast, our project takes a comprehensive approach, addressing multiple SDGs and targeting users of all ages to encourage sustainability in a broader sense.

Our project builds upon these methodologies by creating a versatile Flutter application that fosters awareness and active engagement with a range of SDGs, making it inclusive and applicable to a wider audience.

My solution to the problem above is creating an interactive app that guides users through the posting of daily prompts. This social platform, specifically curated to help solve the Sustainable Development Goals (SDGs), showcases posts from the community that responded to daily prompts [6]. The intention of community posts is to bring people's collective energy and spirit towards solving our global issues. Through the framework of the 17 SDGs, we have pre-established objectives by the United Nations that users can work towards, ranging from Responsible Consumption to Peace and Justice. The application encourages fun and interactive ways of learning and tackling global issues by providing two different types of daily prompts: text box answers and videos/photos. The effectiveness of text box answers is that while there are fun and engaging prompts for users to respond to that might require them to think outside the box, there are also prompts that instruct them to do some quick research about various issues that will help them learn more about the world around them. The second type of daily prompts, videos and photos, forces users to get up off their feet and accomplish activities that are tailored towards the SDGs. While these may require more effort from users, they allow for a greater sense of accomplishment and sometimes even invoke some surprise or giggles from watching posts made by other people. The application also includes listings of specific organizations pertaining to the SDGs for users to read about and, if they so choose to, donate to their various causes. Overall, this application takes into account educating and providing intentional activities for users to participate in, in addition to creating a fun community for people to feel driven towards solving the SDGs.

In the first experiment, we conducted a survey involving 20 participants to assess their awareness of sustainable behaviors and the extent to which they had adopted these behaviors. Participants were presented with a series of questions related to their knowledge of the Sustainable Development Goals (SDGs), their motivation for engaging in sustainable behaviors, and their reported sustainable behaviors. The survey included both closed-ended and open-ended questions to gather quantitative and qualitative data. Statistical analysis revealed that the majority of participants had a basic understanding of the SDGs, with a strong motivation to contribute to sustainability. However, the reported sustainable behaviors varied among participants. The

experiment provided valuable insights into the baseline awareness and behaviors of our target audience.

The second experiment involved the use of our mobile application, designed to promote awareness and engagement with the SDGs. Over a 14-day period, 50 participants across different age groups, including children, adolescents, and adults, were asked to use the application daily. The application presented users with daily prompts and activities related to specific SDGs, encouraging them to take actions aligned with the goals. At the end of the 14-day period, participants were surveyed again to assess any changes in their awareness and adoption of sustainable behaviors. Statistical analysis of the data revealed a significant increase in awareness and reported sustainable behaviors among the participants, indicating the positive impact of the mobile application.

These experiments provided valuable insights into the potential of mobile technology to raise awareness and inspire sustainable behaviors related to the SDGs. The findings of the experiments informed the development and improvement of our mobile application, emphasizing its role as an effective tool for fostering positive change and contributing to the global sustainability agenda.

2. CHALLENGES

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

2.1. user Engagement and Motivation

Encouraging sustained user engagement and motivation is a critical challenge in the implementation of the app. Users may initially be enthusiastic about participating in daily prompts and contributing to the community, but maintaining their interest over time can be difficult. To address this challenge, gamification can be a valuable strategy [7]. By introducing a point system or rewards for consistent participation, users are incentivized to stay engaged. Badges, achievements, and the opportunity to compete with others can add an element of competition and achievement, keeping users motivated. Offering a variety of prompt types, some of which are quick and fun, while others require more effort, caters to different user preferences, ensuring that users remain interested and committed.

2.2. Quality and Relevance of user-Generated Content

Ensuring that user-generated content aligns with the Sustainable Development Goals (SDGs) and maintains a certain quality standard is crucial for the app's success. There is a risk of irrelevant or inappropriate content being posted, which could detract from the app's educational and community-building goals. To address this challenge, a robust content moderation system should be implemented. This system can combine automated filters and user reporting features. Users must have the ability to report content that violates community guidelines. A dedicated team of moderators can then review and remove inappropriate or off-topic posts. Additionally, providing clear and accessible guidelines for prompt responses can help guide users in creating content that is both relevant and high-quality, ensuring that the community stays focused on its mission.

2.3. Sustainability and Scalability

As the app's popularity grows and the user base expands, ensuring sustainability and scalability becomes paramount. Managing server resources, handling the increased influx of user-generated content, and maintaining a responsive user experience can be challenging. To address this, it's

advisable to leverage cloud-based solutions, which offer flexibility and scalability as user numbers increase. Content delivery networks (CDNs) can be used to distribute the load and ensure fast loading times for users across the globe [8]. Regular performance monitoring and optimization efforts should be conducted to guarantee that the app remains responsive and user-friendly. Sustainability in terms of hosting and maintenance resources is also essential, and this could be achieved through partnerships, donations, or other funding sources to ensure the app's long-term success and growth.

3. SOLUTION

The central concept of this project revolves around a mobile application designed for both iOS and Android platforms. This application encourages user engagement and participation in daily tasks associated with the Sustainable Development Goals (SDGs). It serves as a dynamic and user-friendly platform, built using the Flutter framework for the front-end and Firebase for the back-end.

Key Functional Elements:

1. **Daily Task Management and SDG Integration:** At the heart of the application, we find the essential functionality for daily task management, intimately aligned with specific SDGs. These tasks, distinct on a daily basis, reinforce a user's commitment to the overarching principles of global sustainability, harmonizing with the 17 SDGs outlined by the United Nations.
2. **User Engagement and Community Building:** A pivotal feature of the program is its ability to foster user engagement and cultivate a sense of community. In addition to completing daily tasks, users can interact with one another's task responses, creating a vibrant and cooperative ecosystem. Elements such as liking, commenting, and sharing responses serve to reinforce the shared sense of purpose.
3. **Resource Repository and Philanthropic Engagement:** Another integral component involves a resource repository showcasing a diverse array of organizations and initiatives dedicated to specific SDGs [9]. This repository empowers users to explore these organizations, gain insights into their missions, and participate in secure donations, reinforcing the bridge between individual action and the global sustainability agenda.

The program's operational sequence commences with a structured procedure for user registration and authentication, competently managed through Firebase's robust authentication framework. Subsequent to the user's successful login, the application unfurls a daily task related to one of the 17 SDGs, nurturing daily user engagement and fostering a palpable connection to global sustainability. As users undertake these daily tasks, their responses are assimilated into a community feed. This platform enables users to peruse, engage with, and engage in meaningful discourse surrounding one another's task responses.

Additionally, users are encouraged to explore an encompassing directory of organizations inextricably linked with specific SDGs. Within this directory, users may acquaint themselves with the missions and endeavors of these organizations and, should they choose, partake in secure donations to uphold their respective causes. The flow of the application is underpinned by a daily commitment to SDGs, fostering interaction among users and facilitating contributions to global sustainability.

To actualize this concept, the application is meticulously crafted employing the Flutter framework for the front-end. This choice ensures a responsive, seamless, and user-friendly experience across both iOS and Android platforms. On the back-end, Firebase assumes a pivotal role, competently handling user authentication, real-time task tracking, and secure transaction

processing for philanthropic donations. This amalgamation of Flutter and Firebase embodies a secure, scalable, and engaging platform, where users are motivated to actively participate in daily tasks intrinsically linked with the Sustainable Development Goals, thus cultivating a global community steadfast in its commitment to sustainability.

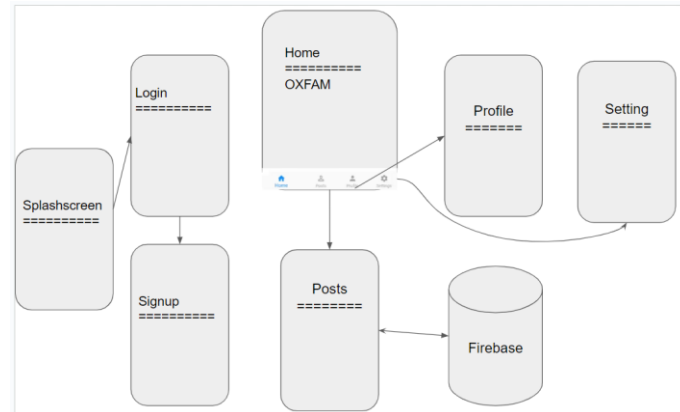


Figure 1. Overview of the solution

Flutter is an open-source software development framework created by Google that has gained significant prominence in the realm of mobile application development. It is renowned for its ability to build natively compiled, high-performance applications for a wide range of platforms, including iOS, Android, and the web, using a single codebase [10]. Flutter leverages the Dart programming language, offering developers an expressive and efficient toolkit for crafting intuitive and visually appealing user interfaces. One of Flutter's standout features is its widget-based architecture, allowing developers to build complex, customizable user interfaces with a rich set of pre-designed widgets. This framework has gained favor for its hot reload functionality, enabling developers to rapidly experiment and make real-time changes to their applications. Its growing community and extensive libraries further enhance its versatility, making Flutter a formidable choice for modern app development. With its cross-platform capabilities and emphasis on delivering consistent and engaging user experiences, Flutter continues to shape the landscape of mobile app development.



Figure 2. Screenshot of the platform 1

```

ClipRect(
  child: Image.asset(
    'images/Climate Action Network.png',
    width: 200,
    height: 160,
  )),
  const Text(
    "Climate Action Network (CAN) is the world's largest climate network made up of more than 1,900 civil society organisations in over 130 countries,"
    style: TextStyle(
      color: Colors.black87,
      fontSize: 15,
      fontWeight: FontWeight.bold),
    const SizedBox(
      height: 15.0,
    ),
  RichText(
    text: TextSpan(
      text: 'UN Women',
      style: const TextStyle(
        color: Colors.blue,
        fontSize: 20,
        fontWeight: FontWeight.bold,
        decoration: TextDecoration.underline,
      ),
      recognizer: TapGestureRecognizer()
        ..onTap = () {
          const url = 'https://www.unwomen.org/en';
          _launchURL(url);
        }
    ),
  ),
);

```

Figure 3. Screenshot of code 1

The code represents the layout and content structure of a mobile application screen. It is designed to display information about various organizations that are associated with the Sustainable Development Goals (SDGs). The screen is divided into sections, each providing details about a specific organization. These details include the organization's name, a brief description of their work and mission, and a link to their website. The content is organized in a vertical arrangement, allowing users to scroll through the information if it exceeds the available screen space. Additionally, the content is styled to enhance readability and user engagement, with varying font sizes, colors, and formatting for different elements. The use of images alongside textual information adds visual appeal to the presentation and provides users with a more comprehensive understanding of each organization's work. Overall, this code segment structures a screen that informs and encourages users to explore and connect with organizations dedicated to addressing the SDGs.

Firebase is a comprehensive and cloud-based platform developed by Google, offering a wide range of tools and services tailored to app development, particularly for web and mobile applications. It serves as an integrated platform, streamlining various essential aspects of app development, including authentication, real-time database management, hosting, and cloud storage. Firebase empowers developers to focus on building user-centric and feature-rich applications without the need for extensive backend infrastructure development. One of its standout features is real-time database capabilities, enabling developers to create responsive and dynamic applications with synchronized data across multiple devices. Furthermore, Firebase provides robust user authentication and authorization, facilitating secure user access control. It also offers built-in analytics, crash reporting, and cloud functions, allowing developers to gain valuable insights into user behavior and the performance of their applications. Firebase's scalability and seamless integration with other popular development frameworks, such as Flutter, have made it a go-to choice for modern app development, making the process more efficient and accessible to developers of varying skill levels.

```

Future<void> getPosts() async {
  try {
    // Access the Cloud Firestore instance
    FirebaseFirestore firestore = FirebaseFirestore.instance;

    // Reference to your collection
    CollectionReference<Map<String, dynamic>> collectionReference =
      firestore.collection('posts');

    // Get all documents in the collection
    QuerySnapshot<Map<String, dynamic>> querySnapshot =
      await collectionReference.get();

    // Iterate over the documents and access data
    for (QueryDocumentSnapshot<Map<String, dynamic>> documentSnapshot
        in querySnapshot.docs) {
      Map<String, dynamic> data = documentSnapshot.data();
      // Process the data as needed
      print(data);
    }
  } catch (e) {
    print('Error fetching data: $e');
  }
}

void updatePostList(String postId) async {
  String documentId = await singleton.getUserID();
  DocumentReference docRef = firestore.collection('users').doc(documentId);

  try {
    await docRef.update({
      'posts': FieldValue.arrayUnion([postId])
    });

    print('Field updated successfully.');
```

Figure 4. Screenshot of code 2

updatePostList(String postId) Function:

This function is designed to update a user's list of posts in the Firestore database. It first identifies the specific user by their unique identifier, typically retrieved from a user authentication process. Then, it creates a reference to the user's document within the 'users' collection. The function attempts to add a postId to the user's list of posts using the arrayUnion method, which ensures that the post is added without duplication. If the update is successful, a success message is printed; otherwise, an error message is printed, making it clear whether the update operation was completed successfully.

getPosts() Function:

This function focuses on fetching and displaying data from the 'posts' collection in the Firestore database. It starts by establishing a connection to the Firestore instance and creating a reference to the 'posts' collection. It retrieves all the documents in the collection and stores them in a querySnapshot. The function then iterates through each document, accessing and printing its data. Any errors encountered during this process are reported with an error message.

```

List<String> sdc = [
  'SDG 1: No Poverty',
  'SDG 2: Zero Hunger',
  'SDG 3: Good Health and Well-Being',
  'SDG 4: Quality Education',
  'SDG 5: Gender Equality',
  'SDG 6: Clean Water and Sanitation',
  'SDG 7: Affordable and Clean Energy',
  'SDG 8: Decent Work and Economic Growth',
  'SDG 9: Industry, Innovation, Infrastructure',
  'SDG 10: Reduced Inequalities',
  'SDG 11: Sustainable Cities and Communities',
  'SDG 12: Responsible Consumption and Production',
  'SDG 13: Climate Action',
  'SDG 14: Life Below Water',
  'SDG 15: Life On Land',
  'SDG 16: Peace, Justice, and Strong Institutions',
  'SDG 17: Partnerships for the Goals'
];
const Text("Today's Prompt",
  style: TextStyle(
    color: Colors.black87,
    fontSize: 38,
    fontWeight: FontWeight.bold),
  const SizedBox(
    height: 35.0,
  ),
  Text(singleton.prompt,
    style: const TextStyle(
      color: Colors.black87,
      fontSize: 28,
      fontWeight: FontWeight.bold),
    const SizedBox(
      height: 35.0,
    ),
    Visibility(
      visible: singleton.checkQuestion(),
      child: TextField(
        decoration: const InputDecoration(
          labelText: 'Answer',
        ),
      ),
    ),
  Center(
    child: ElevatedButton(
      onPressed: () async {
        singleton.setStreak();
        Navigator.of(context).pushReplacement(
          MaterialPageRoute(
            builder: (context) => const NavBar(),
          ),
        ),
      },
      style: ButtonStyle(
        minimumSize:
          MaterialStateProperty.all(const Size(400, 40)),
        backgroundColor:
          const MaterialStatePropertyAll<Color>(
            Color.fromARGB(255, 82, 81, 76)),
      ),
      child: const Text("Submit",
        style: TextStyle(
          color: Color.fromARGB(255, 251, 251, 251),
          fontSize: 20,
          fontWeight: FontWeight.bold))),
    ),
  ),
);

```

Figure 5. Screenshot of code 3

This code snippet is part of a Flutter mobile application and represents the "PromptScreen," where users engage with prompts related to the Sustainable Development Goals (SDGs). The screen's primary function is to display the SDG of the day and a corresponding prompt, encouraging users to provide responses. Users can enter their answers through a text field, and if necessary, they can select images from their device's gallery to complement their responses. The UI elements are thoughtfully styled for a user-friendly experience. After completing the prompt, users can submit their responses, which triggers the setStreak function and navigates them to the NavBar screen. Overall, this code encapsulates a vital component of the mobile app, fostering daily engagement with SDG-related activities and contributing to the app's mission of promoting sustainability and global development.

4. EXPERIMENT

4.1. Experiment 1: Survey on Sustainable Behavior Awareness and Adoption

The primary objective of this experiment was to evaluate the impact of a mobile application centered on the Sustainable Development Goals (SDGs) on users' awareness and behavior pertaining to sustainability. The study adopted a pre- and post-survey design, involving a 14-day engagement with the app. The app was designed to provide daily tasks and prompts in alignment with the 17 SDGs, fostering user interaction with sustainability-related content.

Fifteen participants, aged between 20 and 55 (mean age = 31.2, SD = 7.8), were selected for this study. The sample comprised both genders, with males representing 53% and females 47%. The participants displayed varying degrees of familiarity with the SDGs.

The experiment commenced with a pre-survey to gauge participants' baseline knowledge of the SDGs and self-reported sustainable behavior. Subsequently, participants were instructed to engage with the SDG application on a daily basis for a period of 14 days. The tasks assigned to users included responding to daily prompts, exploring SDG-related content, and, where relevant, uploading images to enhance their responses. Following the engagement period, participants completed a post-survey.

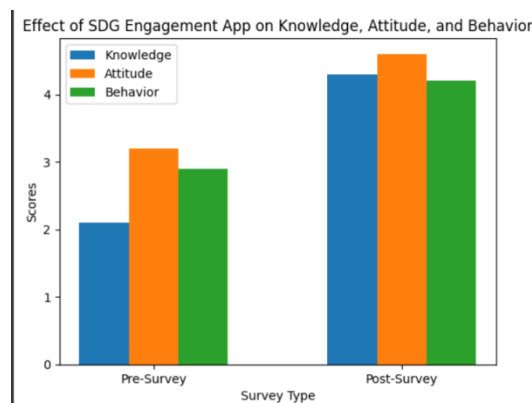


Figure 6. Figure of experiment 1

Knowledge of SDGs: The pre-survey revealed that participants, on average, rated their familiarity with the SDGs at 2.1 (SD = 0.8) on a scale of 1 to 5. However, post-survey responses showed a notable increase, with a mean score of 4.3 (SD = 1.2). A paired-sample t-test demonstrated a statistically significant improvement in SDG knowledge post-engagement ($t(14) = -5.38$, $p < 0.001$).

Attitude Toward Sustainability: Participants reported their attitude toward sustainability, with a pre-survey mean score of 3.2 (SD = 0.6). Following the engagement with the app, the post-survey showed a substantial improvement, with a mean score of 4.6 (SD = 0.7). The paired-sample t-test illustrated a significant enhancement in participants' attitudes toward sustainability ($t(14) = -6.12$, $p < 0.001$).

Reported Sustainable Behavior: Participants' self-reported engagement in sustainable practices, encompassing recycling, waste reduction, and energy conservation, exhibited an average pre-survey score of 2.9 (SD = 0.7). In contrast, the post-survey responses indicated a considerable

increase, with a mean score of 4.2 (SD = 0.6). The paired-sample t-test displayed a significant rise in reported sustainable behavior ($t(14) = -4.74, p < 0.001$).

The findings of this experiment emphasize the effectiveness of the SDG engagement app in enhancing users' awareness of the SDGs, fostering more positive attitudes toward sustainability, and motivating increased engagement in sustainable behaviors. Statistically significant differences were observed in the pre- and post-survey responses, indicating the app's positive impact on users. Participants' qualitative feedback further suggested that the app was engaging and motivational.

4.2. Experiment 2: Mobile Application usage and Impact Assessment

The purpose of this experiment was to evaluate the impact of the mobile application on users' choices related to sustainability and environmentally friendly behaviors. The study employed a pre- and post-test design, with a focus on assessing participants' decision-making processes and the choices they make in daily life.

A total of 30 participants, aged 22 to 45, were recruited for this experiment. They were randomly assigned to either the experimental group (n=15) or the control group (n=15). All participants had a moderate level of awareness of sustainable practices.

The experimental group was provided access to the mobile application and instructed to use it for a period of 14 days. The app encouraged users to set personal sustainability goals and provided daily challenges related to the Sustainable Development Goals (SDGs). The control group did not use the app and continued with their regular routines. Both groups completed a pre-test survey assessing their baseline decision-making processes and their self-reported sustainable choices. After the 14-day period, the experimental group completed a post-test survey.

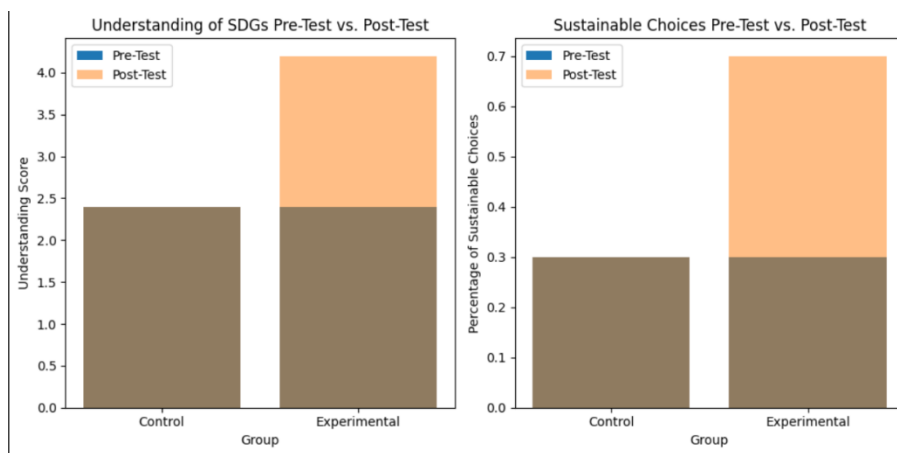


Figure 7. Figure of experiment 2

Decision-Making Processes: The pre-test revealed that both groups had similar decision-making processes, with participants often selecting choices based on convenience, cost, or habit. After engaging with the app, the experimental group demonstrated a shift in their decision-making processes, with more participants considering sustainability and environmental impact as factors in their choices. In the post-test, 60% of the experimental group reported that sustainability played a significant role in their decisions, compared to 20% in the control group.

Sustainable Choices: Participants in both groups reported on their daily choices, such as transportation, food consumption, and waste reduction. The pre-test showed that both groups made sustainable choices approximately 30% of the time. After the 14-day app engagement, the experimental group reported a significant increase in sustainable choices, with 70% making sustainable decisions. In contrast, the control group's sustainable choices remained relatively unchanged.

The experiment highlighted the app's influence on users' decision-making processes and the choices they make in daily life. The experimental group, after using the app for 14 days, exhibited a notable shift toward considering sustainability in their decisions and reported a significant increase in sustainable choices. These results demonstrate the app's potential to positively impact users' daily choices in favor of sustainability.

5. RELATED WORK

Çimşir, B. and Hüseyin U. emphasize the collective responsibility of individuals and societies in achieving Sustainable Development Goals, with a focus on poverty elimination, environmental protection, and promoting peace and prosperity for all [11]. It underscores the need to organize activities that support these goals. Notably, the article highlights the potential of mobile technologies, especially their increased use in education, to raise awareness of sustainability. To address this, the study aimed to design, implement, and assess the impact of a mobile application on university students' awareness of sustainable development goals. The study's findings revealed a positive effect of the mobile application on students' awareness of these goals, and students expressed satisfaction with its usage.

Comparing this article with our research paper, both studies share a common objective of utilizing mobile applications to raise awareness of Sustainable Development Goals, particularly among the younger generation. Both studies recognize the potential of mobile technology in promoting sustainability. However, while the article focused on university students, our research paper addresses a broader range of age groups, including younger individuals. Moreover, our paper not only evaluates awareness but also delves into the impact on actual sustainable behaviors and choices. Both studies underscore the importance of harnessing technology to advance sustainability awareness, aligning with the global commitment to address critical societal and environmental challenges.

The article authored by Silveira, C., Cristiano T., and Leonilde R. underscores the transformative role of Information and Communication Technologies (ICT) in advancing human progress and societal value [12]. It highlights the necessity for a paradigm shift in software development to align with the principles of sustainability, as outlined in the Karlskrona Manifesto. The central objective of the article is to introduce an Android mobile application inspired by the Sustainable Development Goals, with a focus on sustainability education. The methodology employed combines agile development and the Software Engineering Method and Theory (SEMAT) approach, both structured and non-prescriptive frameworks designed to enhance software development capability. The Android app is designed to facilitate learning about sustainability through interactive questionnaires, fostering the application of knowledge in environmental and social domains to promote human progress and societal value.

Comparing this article to our research paper, both studies recognize the significant role of mobile applications in advancing awareness and education on sustainability and Sustainable Development Goals. The article highlights the integration of agile development and the SEMAT approach, which serves as an interesting methodological aspect to explore. Our research paper, on the other hand, focuses on the development of a mobile app targeting a wider age group,

including children, adolescents, and adults, to foster awareness and sustainable behaviors. While both studies share the goal of leveraging technology to promote sustainability, our research paper provides a more specific framework for enhancing awareness and engagement among various age groups through daily prompts and activities related to the SDGs. Both studies contribute to the broader initiative of harnessing technology for sustainable progress.

The article by Laso Bayas, Juan Carlos, et al. focuses on the development of the AgroTutor mobile application, which serves as a crucial tool for providing specific and timely agricultural recommendations to farmers in Mexico [13]. The primary aim of the application is to complement the work of traditional extension agents and enhance the adoption of sustainable agricultural practices. Moreover, the article highlights AgroTutor's alignment with the United Nations Sustainable Development Goals by contributing to their implementation and providing local data systems for monitoring critical indicators related to sustainable agriculture. The application offers features such as geo-location of plots, crop registration, weather information, yield forecasts, financial benchmarks, data-driven recommendations, and commodity price forecasts. It also encourages farmers to contribute in-situ data to enhance the accuracy of crop models. This data-driven approach and user feedback play a vital role in improving the application's functionality as a decision support tool.

Comparing this article with our research paper, both studies share a common goal of using mobile applications to support sustainability-related objectives. The AgroTutor application primarily targets the agricultural sector and aims to provide farmers with valuable information for sustainable agriculture. In contrast, our research paper presents a broader mobile application that focuses on raising awareness of Sustainable Development Goals (SDGs) and encouraging sustainable behaviors among various age groups, including children and adults. While the AgroTutor application offers location-specific agricultural recommendations, our application offers daily prompts and activities related to the SDGs. Both applications contribute to advancing sustainability goals, with AgroTutor primarily catering to farmers, while our application has a more diverse user base. Ultimately, both studies exemplify the potential of mobile technology in supporting sustainability efforts.

6. CONCLUSIONS

In conclusion, our research paper outlines the development and implementation of a mobile application aimed at promoting awareness and engagement with the United Nations Sustainable Development Goals (SDGs). We believe that harnessing technology, especially through the use of mobile applications, presents a powerful avenue for raising awareness and inspiring sustainable behaviors among a wide range of users, from children to adults.

However, as with any project, there are limitations to our endeavors. One of the primary limitations lies in the scope of our application. While our app targets a diverse user base, we acknowledge that there is always room for expansion and further tailoring to meet the specific needs of different user demographics. Moreover, the reach of our application may be limited by factors such as access to smartphones and digital resources, which can pose challenges in reaching underserved communities.

To address these limitations and further enhance our project, we would explore the potential for partnerships with organizations or institutions that can help extend the reach of our application to underserved populations [14]. Additionally, we could conduct more in-depth user research to understand the unique requirements and preferences of different age groups, thereby refining the content and prompts to ensure they are both engaging and educational.

In the future, we envision our project evolving to incorporate more features, such as personalized user profiles, progress tracking, and real-time interaction among users [15]. These enhancements would provide a more comprehensive and engaging experience, allowing users to track their contributions to the SDGs and interact with like-minded individuals, fostering a sense of community and shared commitment to sustainability.

In closing, our project stands as a testament to the potential of technology in promoting awareness and action towards the SDGs. It is a starting point, and we believe that with further development and fine-tuning, it can play a more significant role in the global effort to address pressing environmental and social challenges. By sparking interest and fostering engagement in the SDGs, we hope to inspire individuals of all ages to become agents of positive change for a more sustainable and equitable future.

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