

BRAND NAME: AN INTELLIGENT MOBILE-BASED ENVIRONMENTAL PROTECTION RATING AND SUGGESTION PLATFORM USING ARTIFICIAL INTELLIGENCE AND TEXT RECOGNITION

Ximeng Zhang¹ and Yu Sun²

¹Yorba Linda High School, 19900 Bastanchury Rd, Yorba Linda, CA 92886

²California State Polytechnic University, Pomona,
CA, 91768, Irvine, CA 92620

ABSTRACT

Recycling is an essential measurement to change waste into reusable material. In the US, only about 30% of solid wastes are properly recycled, compared to other developed countries such as Northern Ireland (50.6%), Japan (50%), Schotland (46.9%), Wales (56.9%), it is much lower. However, in the US, the amount of solid waste disposal has increased in the past decade, which leads to air pollution, water pollution, soil pollution and solid waste is also a cause of many diseases. Specifically, it is noticed that many people have difficulty realizing how well they are doing in the process of recycling. Therefore, an app based on dart language is created to check how well people recycle through a scoring system and collect data from grocery receipts to see if the app can help make the consumers' receipts full of more recyclable items. And it is hypothesized that this app can increase efficiency in recycling and promote people to encourage individuals to use more recyclable items. A clear trend in my data of scores gained from my family grocery receipt each week shows that the amount of recyclables increase as the weeks go by since the number from the app did increase. The number I get from recycling pops up in my head as I do the weekly grocery shopping with my family and reminds me to buy more recyclable items. The app is proven helpful and does increase recycling efficiency to 95%. The product, as an app, will be widely used by smartphones.

KEYWORDS

Environmental protection, Artificial Intelligence, NLP.

1. INTRODUCTION

Recycling is an essential measurement to change waste into reusable material. In the US, only about 30% of solid wastes are properly recycled, compared to other developed countries. Recycling is a major problem in the US compared to many other developed countries. I compared recycling rates in the United States and other developed countries and found that the US is relatively behind. Therefore, I wish to create an app that would tell the user how nice they are doing their recycling directly and in a more efficient manner. This app would help users all around the country.

In 2014, ERNST Worrell and Markus A. Reuter pointed out: With contemporary recycling literature scattered across disparate, unconnected articles, this book is a crucial aid to students and researchers in a range of disciplines, from materials and environmental science to public policy studies [1].

In 2021, Amar Bhutani put forward that plastic wastes should be recycled [9]. All the plastic wastes in the homes, shops and industry should be collected and sent for recycling to plastic making factories. In plastic factories, the waste plastic articles are melted and used, which means the importance of plastic recycling.

Also in 2021, Pradeep Singh thinks suitable plastic will be from Recycle. recycling recycled [10]. In the product, materials plastic harmful This of used The and means factory.

In 2020 , Heather Knowles put forward that turn your classroom into an environmentally friendly learning zone with these three articles [2]. In the same year, Trevor M. M Letcher thinks that this is an essential guide for anyone involved in plastic waste or recycling, including researchers and advanced students across plastics engineering, polymer science, polymer chemistry, environmental science, and sustainable materials [3].

In 2018, Beth Porter pointed out that Reduce, Reuse, Reimagine makes sense of the complex system for any reader who wants to learn how it works, what the problems are, and what they can do to help recycling thrive [6].

In 2016, Paul Bulteel, Nadine Barth [4]. considered the cycle & recycle" project brings a photographic view not only of waste streams but also of the efforts taking place in Europe to recycle waste on an unprecedented scale". Then in 2021, Jennie Romer thinks "If you've ever been perplexed by the byzantine rules of recycling, you're not alone...you'll want to read Can I Recycle This [5]?"

In 2013, Edward Humes pointed out in Garbology, Edward Humes investigates trash—what's in it; how much we pay for it; how we manage to create so much of it; and how some families, communities, and even nations are finding a way back from waste to discover a new kind [7].

In 2012 Jinger Jarrett recycled articles into other ebooks [8]. JinShanWei LoongAng En-HuaYang proposes a new mobile app-aided RANAS approach for recycling behavioral change in Singapore with the goal to increase household recycling rates while reducing the proportion of contaminants in recyclables [14]. Also Fábio Oliveira da Silva pointed without some type of inspection/incentive/appropriate disposal site or help, many inhabitants choose to dispose of garbage in a simpler and easier way [15].

From our investigations, recycling apps that are currently in the market are largely inefficient. Although the theory is so full, the people cannot easily and conveniently use it. The related method can be realized by using Dart. In the source code construction, it is designed by three components: the history page, the main page, and the login page. Different pages serve different functions. The history page keeps the login information and the login page is a machine-person interface, which is convenient to land on a smartphone. Lastly, the main page connects the whole system.

Two apps that we have specifically investigated are 'iRecycle' and 'Recycle Coach.' These two apps, along with many others can be great apps; however, they do not have enough features as we believe are helpful enough for people to understand if they themselves are doing enough recycling. 'iRecycle', for example, only contains the feature of finding recycle centers to recycle

differently, and 'Recycle Coach' also only contains information about recyclables and no information specific to the user. It does not focus on the user itself and does not contain statistics that the user would be able to tell straightforwardly if they have been doing enough recycling or buying enough recyclable items, which would help the environment straightforwardly.

Other apps we investigated does not focus on the user itself and does not contain statistics that the user would be able to tell straightforwardly if they have been doing enough recycling or buying enough recyclable items, which would help the environment straightforwardly. Our design is much better in how it directly approaches the user's needs.

The main function of our app includes asking the user to scan a grocery receipt and receiving a score that tells them how many recyclables they have purchased. A user can use this over a period of time to see if their levels of recycling have increased. After finishing developing the fully functional app, we collected user feedback from several user's families. The app is proven to be effective and useful.

The rest of the paper is organized as follows: Section 2 gives the details of the challenges that we met during the experiment and designing the sample; Section 3 focuses on the details of our solutions corresponding to the challenges that we mentioned in Section 2; Section 4 presents the relevant details about the experiment we did, following by presenting the related work in Section 5. Finally, Section 6 gives the concluding remarks, as well as points out the future work of this project.

2. CHALLENGES

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

2.1. Changing original plan

The first challenge we encountered was that we needed to change from our original plan of scanning barcodes code into scanning a receipt. Barcodes codes sounded like a great plan at first; however, the method is proven largely inefficient because of how little information about the recyclables can be obtained from depicting barcodes. We believe that scanning words directly would give us better data of what exact products the recyclables are.

2.2. Developing new function

A user is now able to take a picture right now using our app and will get the test result instantly. However, we did not have this function at first, and we used an obnoxious system of having the user upload their own picture through many sources. Fixing this problem has proven to give our users better experiences using our app.

2.3. Some functions are divided

Some main functions of the code of our app are divided into the history page, main page, and log-in page. Right now the app is limited to three parts above. Later, we plan to expand the function of the app to other phases.

3. SOLUTION

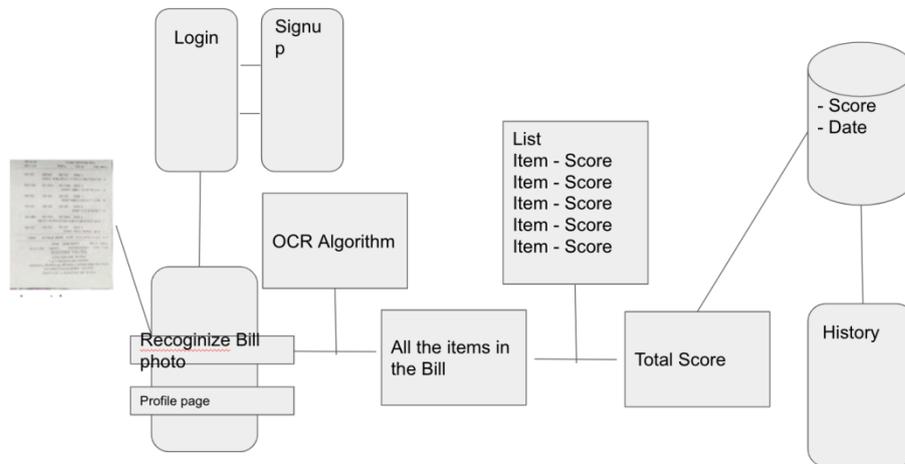


Figure 1. The System Structure

```

@override
Widget build(BuildContext context) {
  return Scaffold(
    body: Center(
      child: _widgetOptions.elementAt(_selectedIndex),
    ), // Center
    bottomNavigationBar: BottomNavigationBar(
      items: const <BottomNavigationBarItem>{
        BottomNavigationBarItem(
          icon: Icon(Icons.home),
          label: 'Home',
        ), // BottomNavigationBarItem
        BottomNavigationBarItem(
          icon: Icon(Icons.book),
          label: 'History',
        ), // BottomNavigationBarItem
        BottomNavigationBarItem(
          icon: Icon(Icons.settings_suggest_outlined),
          label: 'Suggestions',
        ), // BottomNavigationBarItem
      }, // BottomNavigationBarItem[]
      currentIndex: _selectedIndex,
      selectedItemColor: Colors.blueAccent[800],
      onTap: _onItemTapped,
    ), // BottomNavigationBar
  ); // Scaffold
}

```

Figure 2. Main Page

We used this page to collect all other pages together. We used a scaffold that had three attributes. The first is the body. The second is the navigation bar, and the third the App Bar. Then, for the body, we used a center class. In the bottom navigation part, we had three different icons representing three different pages that we will use later. For the selected item color, we changed the color of the icon.

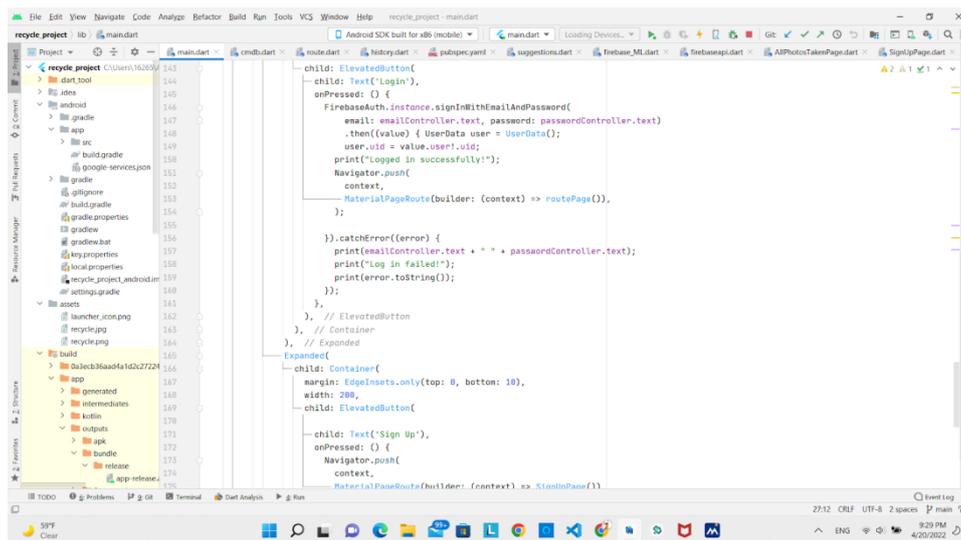


Figure 3. Login page

1. For the Login page, we use the Firebase database as the database to store the username and password.
2. For the UI design, we use an Elevated button to be clicked to send the request to the database to verify the login information.
3. If the data is incorrect, it will show the alert message.
4. We also have an Expanded class to transfer to Sign up page

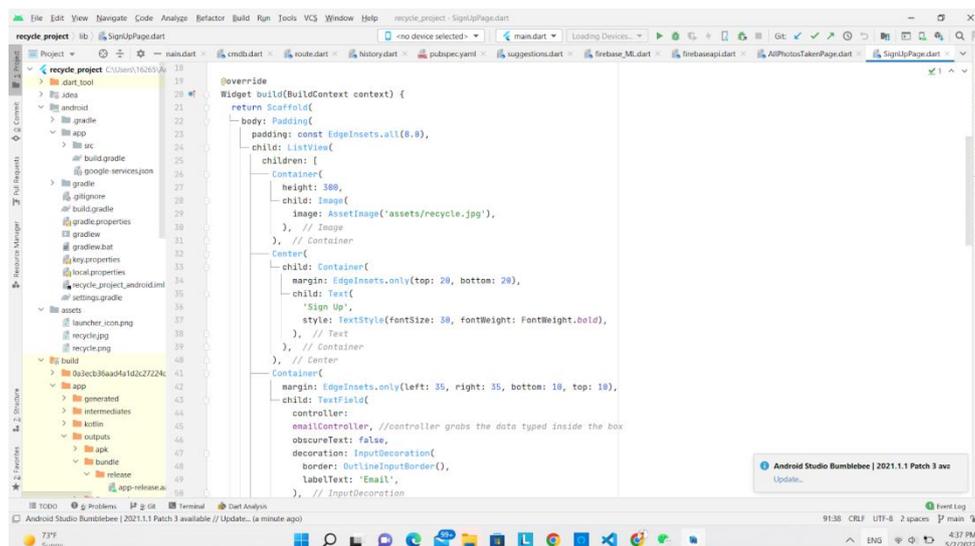


Figure 4. Sign Up Page

For the Signup page, we use the Firebase Auth database as the database to handle the email and password.

For the UI design, we use also an Elevated button to be clicked to send the request to the database to verify the login information.

The difference between this page and Login is that for this page we need user to input the Password information one more time to verify the code.

If the data is incorrect, it will show the alert message.

We also have an Expanded class to transfer to Login page.

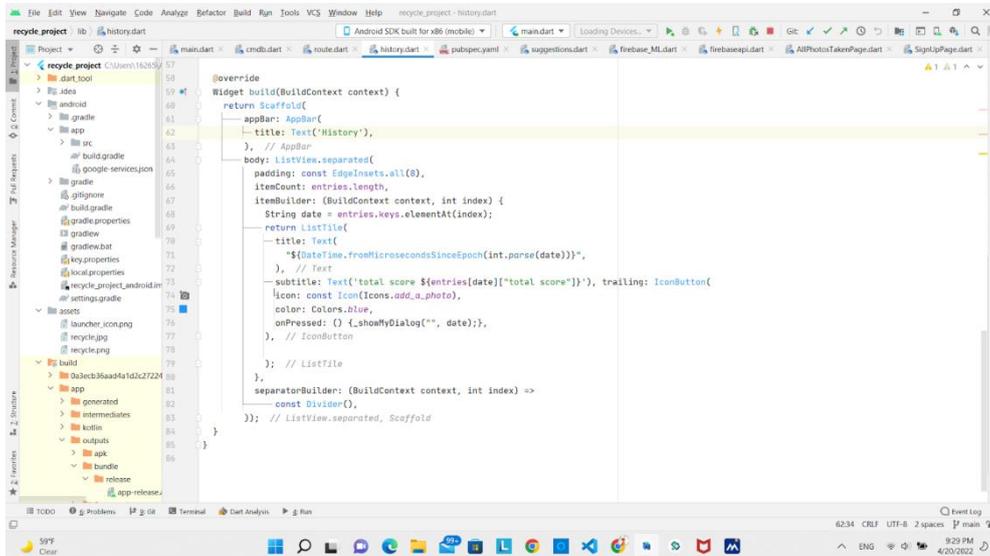


Figure 5. History Page

We used the Dart Language to conduct the algorithms each with different, interconnected pages.

These components are connected by the main page.

4. EXPERIMENT

4.1. Experiment 1

Recycling is a major problem in the US compared to many other developed countries. I compared recycling rates in the United States and other developed countries and found that the US is relatively behind. On the other hand, in the US, the amount of solid waste disposal has increased in the past decade, which leads to air pollution, water pollution, soil pollution and solid waste is also a cause of many diseases. Therefore, I wish to create an app that would tell the user how nice they are doing their recycling directly and in a more efficient manner.

We tried to determine whether that has improved households efficiency of recycling by analyzing the trend in the score the app returns of how environmentally friendly the user is. We collected samples from participating families over a period of time.

4.2. Experiment 2

Results show that the app can improve recycling efficiency, as the scores gained from our weekly receipts have increased. A clear trend in my data of scores gained from family grocery receipts each week shows that the amount of recyclables increase as the weeks go by since the number from the app did increase. We have also found from user feedback that one user says the

recycling number pops up in their head when they do the weekly grocery shopping with their family and reminds them to buy more recyclable items. The app is proven helpful and does increase recycling efficiency.

	A	B	C	D
1	Date/Week	Score		
2	1/2/22-1/8/22	0		
3	1/9/22-1/15/22	0		
4	1/16/22 -1/22/22	2		
5	1/23/22-1/29/22	3		
6	1/30/22-2/5/22	5		
7				
8				

Figure 6. Data set from a specific group of family

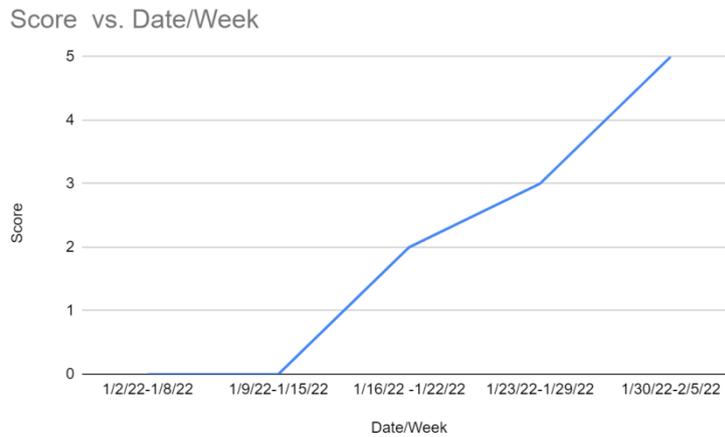


Figure 7. The trend of increase in our recycling score

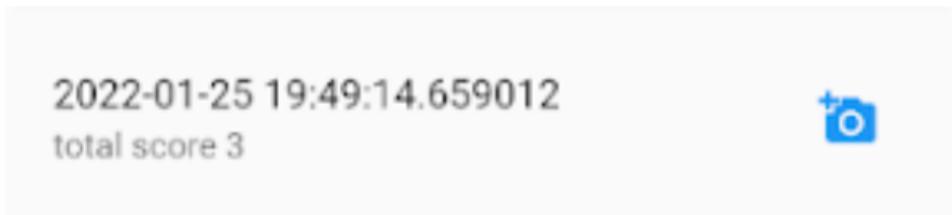


Figure 8. an example of data history that a user can reference anytime after they can the app

The app being proven as effective shows that it can indeed help to solve the current problem with the lack and inefficient recycling in the United States. Although we encountered many problems throughout the development process of our app, our app eventually is proven effective and working.

5. RELATED WORK

From Smart City to Smart Citizen: Rewarding Waste Recycle by Designing a Data-Centric IoT-based Garbage Collection Service [11]. 2020 IEEE International Conference on Smart Computing (SMARTCOMP). In this paper, they proposed a reward-based data-centric solution based on both enabling IoT technologies and cloud architectures to promote waste recycling in urban environments. We extend the consolidated rewarding approaches based on the smart bin model by proposing an incentive system that focuses on door-to-door waste collection. We designed an app based on the app, which will be more convenient for the customer.

Ombretta. Learning how to recycle waste using a game 2020 [12]. This paper teaches citizens how to recycle in real life. Proper waste sorting is crucial for both economic and environmental reasons; however, its effectiveness can be largely limited when citizens do not know how to correctly separate waste, sometimes even due to different regulations depending on their municipality. However, on the other hand, our project is an app, which is easier to use. Their main difference is whether they are installed on smart cell phones.

Filomena Compagno. Recycling 2020- Reduce, Reuse, and Recycle: The case Terracina-Filomena Compagno-Terracina Zero Waste activist, Italy [13]. In order to improve RECYCLE the Municipality of Terracina together with De Vizia, the local sanitation transfer distributed to the families and traders 5 bins for the door-to-door collection. They also created separate waste collection centers. Our project/app is much easier accessible and effective than their system.

6. CONCLUSIONS

In this paper I designed an app that can be easily used by any person, no matter consumer or seller, to check how well they are doing with recycling. The app returns a score to tell the user how well they are doing with the recycling using the scanning and uploading receipt function of our app. The user can see information of all receipts they have scanned. This can help the readers to clearly see what they need to improve in what they have been doing with recycling. After the app was developed, I tested grocery receipts from one set of families over a certain time period to test the functionality of our app, and it was proven to have great results. The app did indeed prove to increase recycling efficiency as seen from the data we collected. Experiment results indicate its effectiveness and solve challenges related to recycling.

Certain parts of the app can include a bit more useful and direct information. For instance, we can add a recycle knowledge button so that as time goes on, the customer can increase some aspects of recycling knowledge. We developed the base of this function in the suggestion feature of our app; however, much more features such as distributing information of recycling centers to the users can be added later. In addition, the practicability of the app is proven to be well functional. On the other hand, the algorithms I currently use need to increase accuracy. We plan to do this after modifications after more experiments. Optimization also needs to be done more accurately, which I will make better along with conducting more experiments.

In the future, I will add more features to make the app more convenient. I will modify the suggestion feature and add more information about recycling to help the user to the best of our

abilities. I will continue to collect feedback from users to make our app even more efficient and convenient for each user individually and to increase accuracy of our individual app.

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