BSC (HONS) COMPUTER SCIENCE AND SOFTWARE ENGINEERING

An android based digital platform to manage electronic wastage

CONTEXTUAL REPORT

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Declaration

The undersigned solemnly declares that the project report " An android based digital platform to manage electronic wastage " is based on my own work completed during our studies under the supervision of Dr.yasas Jeyaweera. I assert that the claims I've made and the conclusions I've reached are the product of my research. I also attest to the fact that ,

- The report's work is original, and it was completed by me under the general supervision of my supervisor.
- This thesis has not been submitted to any other institution for any other degree, diploma, or certificate, whether at this university or elsewhere in Sri Lanka.
- In writing the paper, we followed the guidance issued by the university.
- We have provided due credit to other sources whenever we have used materials (data, theoretical analysis, and text) from them in the text of the report and in the references.

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Abstract

The proposed project is about mobile application-based platform to manage electronic wastage. Electronic waste, also known as e-waste, the word "E-waste" refers to electronic equipment that has been discarded and can no longer be used. E-waste is one of the fastest-growing segments of the international waste stream, several other types of e-waste in Sri Lanka, with just 10% of them being properly disposed of. the proposed project would address issues found by participants and recycling firms. Project scope highlights core plans to create a smartphone application so recycling e-waste will help to reduce the need for heavy metal mining also lowering greenhouse gas emissions. The proposed Application system uses object detection, deep learning object classifier to improve e-waste collection planning. Object detection and recognition are important to the field of computer vision. The agile approach will be used to develop this project and this research is beneficial for organizations, individuals.

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1. Introduction

1.1. problem Statement

The word "E-waste" refers to electronic equipment that has been discarded and can no longer be used. Let's look at the system's key problem. If we are concerned about whether the current e-waste management system in Sri Lanka is adequate or not, there will be no response because there are 7.5 million computers, televisions, computer parts, and several other types of e-waste in Sri Lanka, with just 10% of them being properly disposed of. The proposed project would address the issues found by the foundation participants and recycling firms, and it will include three groups of main users in this process. The first issue found on the waste contributors' end is a lack of understanding of e-waste and its negative effects, followed by a lack of desire to participate because there is little benefit in return. The inability to locate e-waste recyclers to fork over the waste is also considered a concern. The last issue raised by the foundation contributors is the difficulty of segregating waste and culture, as well as connectivity issues. The project scope highlights the core plans that have been proposed in order to meet the ultimate goal of creating an IT solution such as a smartphone application. The below are the current project scopes: The answer is a web network that connects the foundation donors, recycling organizations, and foundation distributors. A solution that enables base contributors to easily approach recycling firms and hand over waste. A solution that allows recycling business owners to streamline their processes while still looking into the future. A solution that allows waste contributors to connect and find other waste contributors in a simple and efficient manner. Mobile apps are part of the e-waste approach. It includes a classification of the key types of e-waste that a contributor can contribute, and by choosing the required e-waste, a contributor can progress further. This approach also includes an image processing component that captures the specifics of the e-waste from an image that a contributor has imported into the mobile application. Agile approach will be used to implement this proposed project because it has enabled experimentation at each point of production, planning, and study. It is particularly beneficial to the planned project's success.

Keywords: e-waste , Object detection ,Image processing, , machine learning, Electronic waste, mobile application , AI chatbot , YOLOv4.

1.2. Scope of the Project

The proposed project is a mobile app focused on an electronic waste management system. The project's main goal is to design and implement a centralized IT solution framework that connects e-waste generators, waste distributors, and recycling companies in order to create a precise e-waste management system. Which can be used to store electronic waste.

1.3. Overall aims and objective

1.3.1. Aims

To create a well-defined e-waste management system, plan and build a consolidated solution portal that connects e-waste recycle firms, contributors, and waste distributors.

1.3.2. Objective

- To define and review existing pattern systems.
- Designing and developing a framework based on modeling patterns.
- Image processing will be developed using supervised learning classification.
- To put each feature to the test.
- To create new/improve existing version , based testing and feedback.

1.4. Significance of the project

The methodology through this research is beneficial for the organizations, individuals and environment responsible for certain procedures. The important significance to develop the proposed project is heavy metals, plastics, and glass in e-waste can pollute the environment or seep into rivers if improperly disposed of. Recycling e-waste will help to reduce the need for heavy metal mining while also lowering greenhouse gas emissions from the production of new materials. The proposed system uses object detection to evaluate the image provided by the contributor.so the system categorized e-waste. for example: computer accessories, mobile accessories, home appliances, electronic device etc. When the system accepts the wastage, this data send to the distributor and they collect E-waste base on locations. Benefits of the system (1) Collect e-wastage (2) Distribute /Recycling e-wastage (3) Time and space-saving (4) Save environment (5) claim reward for wastage etc. So, both the users and the organization people get more advantages through this proposed project.

1.5. Feasibility of the project

All in today's world is improvised with technology. As technology progresses, more and more procedures in every aspect of human life will be automated. Based on research and reviews of many research articles, journal articles, research papers, and other sources, I learned a lot about the online mobile application, its relevance, and how it operates.

1.6. Structure of the project

This contextual report covers 4 main components:

1. Introduction
2. Literature Review
3. Project Plan
4. Planning of Artefact

The background of the project, the techniques for realization, the aims and objectives, the methodology of the project, the importance of the project, the project's limitations, and the project's structure are all covered in the following section. Each discussion is presented in a thorough way.

Many sections have been highlighted in the Literature review, such as research papers, journal articles, and credible websites that are relevant to the research subject. The research will be organized and completed within the time frame discussed in the project planning section. A Gantt chart and a Work breakdown structure will be used to show how the study will be managed in terms of time. The project's artefact and the report will be discussed in the final section of this report.

2. Then literature Review

2.1. Introduction

Electronic waste is the fastest-growing segment of the global waste stream. Here, this section will provide an appropriate literature review based on the object detection System, the issues. This literature review concentrates on what techniques companies are using for the hiring process and analyses the existing researches based on online e-waste management systems and researches.

2.2. E-wastage management system

The article by ET Bureau (ET Bureau - 2016) identifies the urgent need for new waste management regulations. This research considers a wide range of waste forms (which includes solid, e, bio-medical, plastic). These directions have been well-organized and will soon be useful. Both state governments will be advised to use these strategies in this regard. preserving the environment and assisting India in its growth Both of these will be strengthened after Paris.

Green Biz, (Green Biz -2015) focuses on waste reduction rather than waste management in this article. It's a mind-numbing job to handle 12 million tons of e-waste every day. It also claims that anticipating e-waste increases sales while lowering costs. Waste can be produced during consumption or processing, and it should be avoided in both cases. This reduces the high costs associated with it. When it comes to waste management, the first thing that comes to mind is recycling paper, plastic, and other materials.

Behaviour of Consumers as One of the Most Important Factors in E-Waste Problem article (Gurauskienė, I., 2008) point out that , Consumers play two roles related to e-waste, that of customers (users) of electronic equipment and that of e-waste holders (disposers). Both roles are equally important when solving e-waste problem. The culture of mass consumption (unsustainable consumption) is relevant to the e-waste growth. Consumers are frequently reliant on technical advancements, and they have no choice but to replace working electronics on a regular basis. Consumers do not push technological change; rather, technological change leads to the substitution (purchase) of new goods. To reduce e-waste, addressing the forces that drive the cascade of buying decisions is crucial. under the table provide WRAP recycling competence levels. Recycling rate in column 1 is an indication of the likely proportion.

Recycling rate	Recycling Competence level (1 to 7)	Description	WRAP Committed recycler status	Population %		7. Honestly Disengaged	6. Stalled Starters	5. Cautious participants	4. Sideline supporters	3. Concerned consumers	2. Waste watchers	1. Positive greens
0 %	1. Recycling unaware	Just not on their radar, no idea about it at all	Non recycler	}	6	x	x					
0 %	2. Aware but inactive	Know about it but have not seriously contemplated doing it	Non recycler			x	x					
Sporadic	3.Contemplated but not engaged	May have dabbled, possibly elsewhere, may do occasionally, drifted back	Recycler but not 'committed'	}	23		x	x				
A little	4. Unreliable	Recycle but sometimes forget, sometimes miss out, recycle opportunistically not regularly	Recycler but probably not 'committed'					x	x	x		
A fair amount	5. Trying their best	Usually take part, recycle 'staple' items like newspapers but confused about other items	Committed recycler	}	41				x	x		
A lot	6. Broadly competent	Reliable and regular but may still miss out some materials or collections	Super-committed recycler	}	30					x	x	
100 %	7. The complete recycler	Recycle all available items of all recyclable materials all of the time	Super-committed recycler								x	x

Table 1 WRAP recycling competence levels.

2.3. Object detection

Application of deep learning object classifier to improve e-waste collection planning *(Nowakowski, P. and Pamuła, T., 2020.)* study looked at a photo-based image recognition method for identifying and classifying waste electrical and electronic equipment. Its key goal is to make knowledge sharing about waste to be collected from individuals or waste collection points as simple as possible, taking advantage of the widespread adoption and use of smartphones. Individuals would film the waste object and submit the image to the waste collection company's server, where it would be identified and classified automatically, improving waste collection planning. The system can be operated through a server or a mobile application. A deep learning convolutional neural network (CNN) was used to identify the type of e-waste, and a faster region-based convolutional neural network (R-CNN) was used to detect the category and size of the waste equipment in the images, resulting in a novel method of classification and identification using neural networks for image processing. The accuracy of the chosen e-waste categories' identification and classification ranged from 90 to 97 percent. Following the automatic recognition and classification of the waste size and category from the uploaded pictures, e-waste collection companies may prepare a collection plan by assigning a suffix.

2.4. Object detection Algorithms

Object detection and recognition is one of the most important fields for computer vision, since it is a crucial phase in many applications including intelligent home, intelligent workplace, monitoring and robot technology. we going to look “Training Object Detection And Recognition CNN Models Using Data Augmentation” research paper *(Training Object Detection And Recognition CNN Models Using Data Augmentation, 2017)*. In this paper, they concentrate on two separate scenarios, one is detecting commercial logos in the wild and detecting artifacts captured by a high definition camera (i.e. toys), another one is Logo detection is an essential role in contextual ad placement (placing related advertising on webpages, photographs, and videos), validation of product placement, and online brand management. Object detection may be used as part of educational or entertainment applications offering a richer interaction with the user. This work uses deep(profound) methods of learning, especially the fastest R-CNN (Region-based Convolutional Neural Network). The network consists of three main parts: one function extractor, one area suggestion network and one classification system. it can detect multiple objects in a scene through the network. This CNN is further described also include. and some mention in the report, that is Deep learning approaches, such as Faster R-CNN, expect good performance from around 5,000 samples per class. In certain cases where only one or a few images of the object we want to detect are accessible, this can be problematic. One way to solve this problem is by using data enhancement methods to produce "new" or synthetic pictures using linear and non-linear data. Spatial flipping, warping and other deformations are typical transformations. The fact that the deformations used on labeled training pictures do not alter the semantic sense of the labels is significant as an increase in the information.

verall that the Faster R-CNN can detect artifacts with less training images. We can produce a greater number of images and practice more effectively using deep learning techniques. When test images have a clean background and good illumination, we were able to achieve near real-time object recognition with excellent accuracy using the HP Sprout method. We get better results than previous approaches when it comes to detecting logos. Changes in size, rotations, and minor occlusions have no effect on the network. We want to investigate the use of the Single Shot Multibox Detector in the future because it could increase speed and accuracy. We also want to provide detailed details in the planning process.

2.5. Chatbot

Architecture for public service chatbots *(Architecture for public service chatbots, 2019)* article point out that, Chatbots are gaining popularity around the world. Chatbots can be trained much faster than humans, and they are available 24 hours a day, 7 days a week to respond to user queries. Furthermore, by reducing user requests to human operators, public administrations can save a significant amount of money (e.g. through the helpdesk). Another significant benefit of using this technology is that it makes public programs more accessible to the elderly, ill, and disabled. Chatbots can lower the barriers to contacting or requesting assistance from government agencies. Considering all of this, developing an architecture for public service chatbots provides a peek into what the future of public service (information) delivery could look like.

2.6. Existing Systems

Figure 1 Chatbot advantages

2.6.1. ECS e-waste mobile application

This Ecs e-waste mobile app *(Play.google.com. 2017)* is a platform providing convenience for electronic waste disposal. It is offered by ECS Environment, released on April 20, 2017, and last updated on July 5, 2017. This application version 1.1 may request access to camera, location, phone, storage, others. The camera needs to take picture and video of electronic waste.

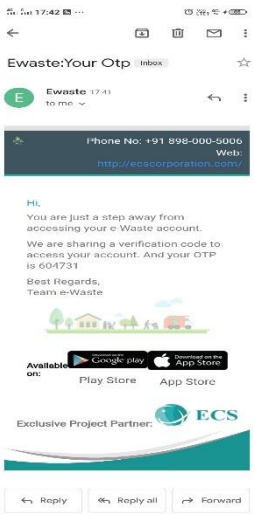


Figure 2 OTP code

Figure 3 is starting interface of the application. This application provides sing up using email id or mobile number and send OTP vai mail or mobile number. example *Figure 2*.
After register and sign-in, the application request permission to access photos, media, and files on the device. in this application, we can only manually select e-waste categories *(Figure 9)* such as Computer accessories, mobile accessories, ICT products, Home Appliances,

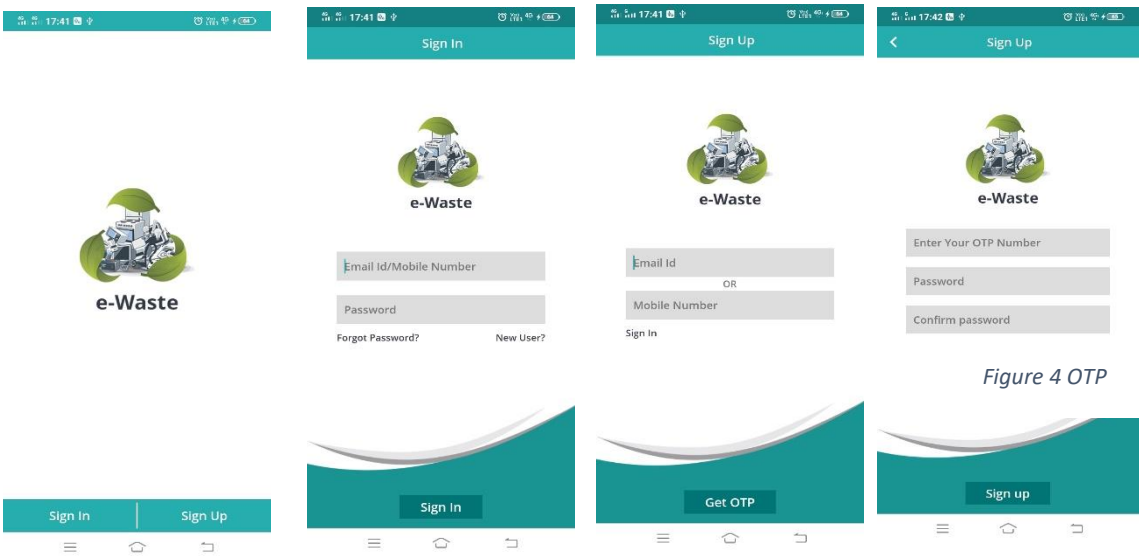


Figure 4 OTP

Figure 3home page

Consumer Electronics, and Electronic devices. This add post (*Figure 5*) gives space for description, quantity, and weight(kg). There are 2 delivery types, one is pick up from - it's told us the address from where we will pick up the items. The second is Drop at – it's selected the collection point where you would drop the items (Figure).in this scenario finds precise location using GPS and network-based, approximate location using network-based.

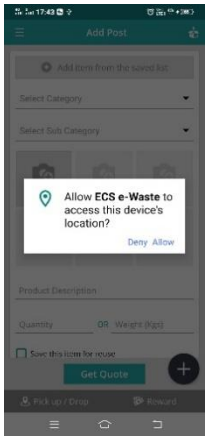


Figure 4 access device location

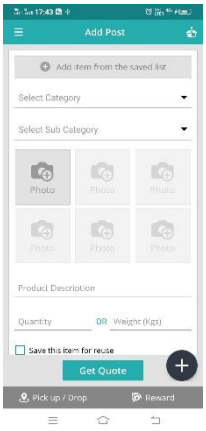


Figure 10 Add Post

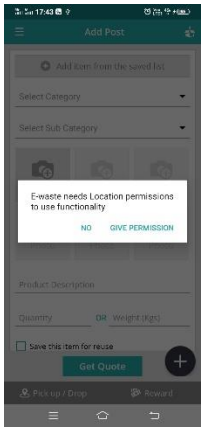


Figure 10 Location permission

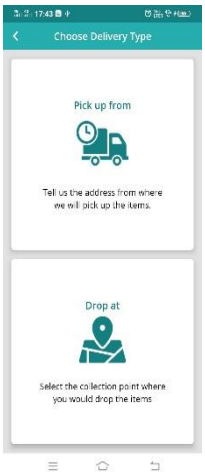


Figure 10 choose delivery type

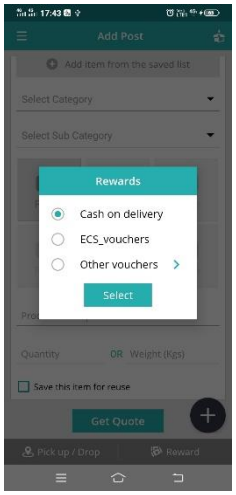


Figure 10 Rewards

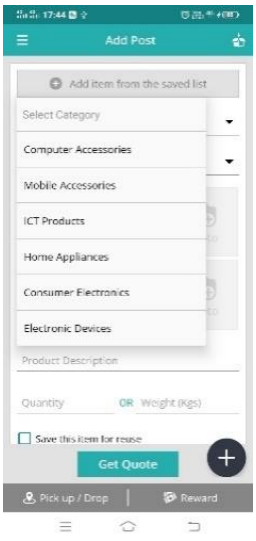


Figure 10 select category

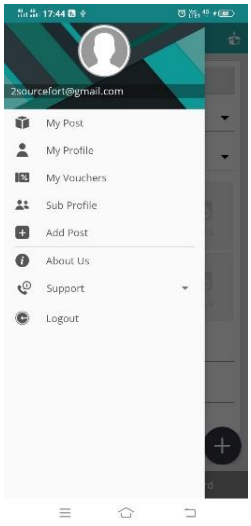


Figure 10 Basic user menu

2.6.2. Wastebazaar mobile application

Wastebazaar mobile application is an innovative app designed for sustainable development in densely populated areas where people face waste management problems. It is offered by WasteBazaar, released on November 1, 2019, and last updated on November 16, 2020. This application version 1.0.0 may request access to location, storage, others.

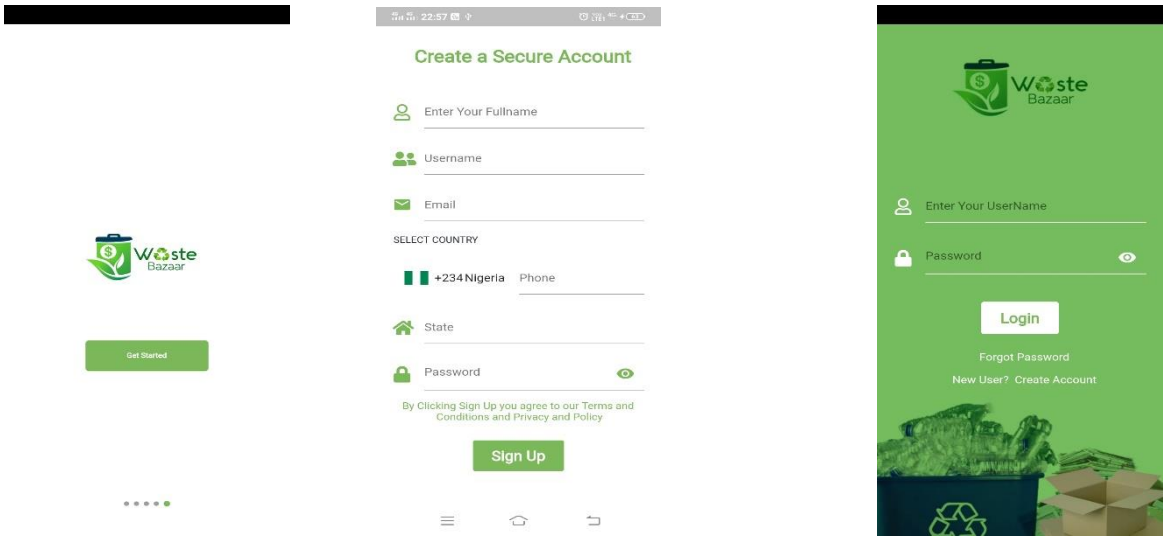


Figure 11 Wastebazaar interface

The feature called Greenvault is a rewarding program where users can earn green credits from recycling plastics, carton boxes, beverage cans. As they get some benefits in return they will get motivated to recycle.

Reward for Waste

There will an online store where the earned credits can be used as the currency and users can purchase groceries, house hold items, food items. In that way the livelihood of the users also will be enhanced through this programmed.

Wasteify :- With this feature users can make special requests in particular times to collection of wastage.so that people are living in the busy schedule can get benefited too.

Wastepay:- Through this way users can pay the utilities like electricity, water, telephone and the cable tv bills through the money they earned as green credits.

Benefits are

1. People can now enjoy more convenient waste disposal service

2. A better way to earn from disposing waste.

3. There will be an all-time clean environment for better living.

Satisfy *Dissatisfy*

		Existing Systems		proposed project
		Waste bazaar	ECS e-waste	SL E-Bin
Verification code OTP				
Verify Email address				
Visual identity	password			
	fingerprint			
Waste pickup address (Map)				
Permissions				
Upload image	photo			
	Auto select category			
Selling & history				
Reward				
Provide sub profile				
Support				
AI chatbot				

Table 2 comparison existing systems and proposed system

2.7. Conclusions

This research utilized CNN to identify the type of e-waste and R-CNN to detect the category and size of waste equipment in images, presenting a novel approach to photographic recognition and categorization of e-waste. The classification and detection algorithms used had a high rate of recognition. Increase the number of images in the learning collection to several hundred or even thousands to improve recognition accuracy even further. Waste equipment detection with an accuracy of 90–96.7 percent was achieved using deep learning CNN and faster R-CNN. The R-CNN network had a lower overall accuracy (90%) than the best CNN, but it did allow for the identification and measurement of the size of the object in the image. The creation of a ready-made digital solution to recognize the equipment identified for collection based on customer images is now possible thanks to this new method for recognizing waste. It's an important method for collection preparation because it allows for secondary raw material content to be valued. It also takes advantage of the widespread use of smartphones and the ubiquitous ability to take and share photographs, which was previously unthinkable. The proposed method of taking, uploading, and recognizing photos to prepare a waste collection plan can also be used in municipal collection centers or electronic market places that store e-waste. In such situations, faster R-CNN could identify more waste equipment, as shown in this report. Other types of equipment submitted for selection should be considered in future research to ensure that the classification and detection systems are accurate. This approach may also be extended to other bulky waste groups that face similar waste management challenges.

Faster R-CNN is able to detect objects with fewer training images. We obtained near real time object recognition using the HP Sprout system with excellent accuracy. In the future, we want to explore the use of the Single Shot Multibox Detector.

3. Project Plan

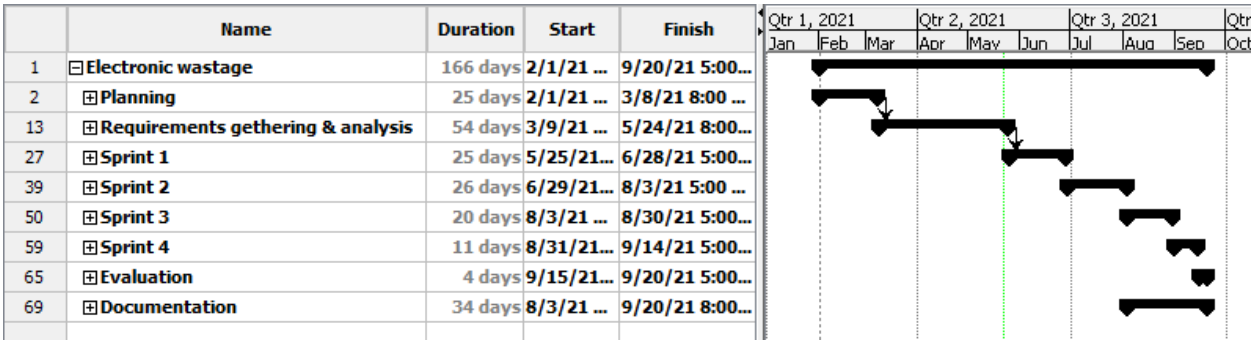
3.1. project Timeline

The tasks begin with an initial planning and requirement gathering phase to construct the first task project proposal, appropriate tools, resources, and the proposed project is displayed using a Work Breakdown Structure that contains all the phases of how the project is going and will be completed, as well as a Gantt map that contains all of the project's activities. The agile development methodology is the proposed methodology for applying this system. Agile approach It can be made at any time if any modifications are needed. After preparation, the system will be tested in the implementation portion, which will be planned and built according to the specifications. If a customer requests modification or the addition of a new feature, the project will be adjusted to accommodate the new pan. Using agile methodology, the system's end result will be more accurate, because the project will be completed within the time frame needed, and if any modifications are required immediately, there will be no reason to wait until the completion of all activities. Work Breakdown Structure was developed using agile methods, and it is critical since it includes all of the required options in the event that a task is postponed due to unforeseen circumstances. The Work Breakdown Structure is seen below

Figure 12 Work breakdown structure

3.1.1. Planning

A suitable topic was chosen, and a system was proposed for a real-world use. Define the goals and objectives for the planned research project and to effectively complete it by learning more about each field as the project progresses. To complete the proposed project in the time allotted, analyze all of the steps that must be completed before beginning the research, assign time to each phase, and complete the project within the time allotted. This is accomplished by the use of a Work Breakdown Structure and a Gantt chart. First, all of the project's work will be fragmented into parts using the WBS in order to better coordinate the project so that it can be defined, organized, and completed on time. The Gantt chart is used for study planning and time management, and it provides a well-organized time schedule for the project. A Gantt chart can be used to estimate how long a project should take, calculate the resources necessary, and assign time to each phase or stage so that the study is completed on time. The Gantt chart is shown below.



	Name	Duration	Start	Finish
1	Electronic wastage	166 days	2/1/21 ...	9/20/21 5:00...
2	Planning	25 days	2/1/21 ...	3/8/21 8:00 ...
13	Requirements gethering & analysis	54 days	3/9/21 ...	5/24/21 8:00...
27	Sprint 1	25 days	5/25/21...	6/28/21 5:00...
39	Sprint 2	26 days	6/29/21...	8/3/21 5:00 ...
50	Sprint 3	20 days	8/3/21 ...	8/30/21 5:00...
59	Sprint 4	11 days	8/31/21...	9/14/21 5:00...
65	Evaluation	4 days	9/15/21...	9/20/21 5:00...
69	Documentation	34 days	8/3/21 ...	9/20/21 8:00...

Figure 13 overview of gantt chart

	Name	Duration	Start	Finish
1	**Electronic wastage**	166 days	**2/1/21 ...**	**9/20/21 5:00...**
2	**Planning**	25 days	**2/1/21 ...**	**3/8/21 8:00 ...**
3	Selecting Research topic	4 days	2/1/21 8:...	2/4/21 5:00 PM
4	Background Search	3 days	2/5/21 8:...	2/9/21 5:00 PM
5	Scope Planning	2 days	2/10/21 ...	2/11/21 5:00 PM
6	Define Aims & Objectives	3 days	2/12/21 ...	2/16/21 5:00 PM
7	**Feasibility Analysis**	7 days	**2/17/21...**	**2/25/21 5:00...**
8	Determine Ethical feasibility	4 days	2/17/21 ...	2/22/21 5:00 PM
9	Determine Technical Feasibility	4 days	2/22/21 ...	2/25/21 5:00 PM
10	Create WBS	2 days	2/26/21 ...	3/1/21 5:00 PM
11	Create Gantt Chart	4 days	3/2/21 8:...	3/5/21 5:00 PM
12	Progress Report 01	0 days	3/8/21 8:...	3/8/21 8:00 AM
13	**Requirements gethering & analysis**	54 days	**3/9/21 ...**	**5/24/21 8:00...**
14	**Primary Data**	14 days	**3/9/21 ...**	**3/26/21 5:00...**
15	Existing Documen Analysis	1 day	3/9/21 8:...	3/9/21 5:00 PM
16	Analyze Research papers	5 days	3/9/21 8:...	3/15/21 5:00 PM
17	Create Questionnaire	1 day	3/10/21 ...	3/10/21 5:00 PM
18	Gather information from survey	12 days	3/11/21 ...	3/26/21 5:00 PM
19	**Secondary Data**	10 days	**3/16/21...**	**3/29/21 5:00...**
20	Create Literature Review	10 days	3/16/21 ...	3/29/21 5:00 PM
21	progress Report 02	0 days	3/29/21 ...	3/29/21 5:00 PM
22	Finalize the Literature Review with superv	2 days	3/30/21 ...	3/31/21 5:00 PM
23	create contextual report	22 days	4/1/21 8:...	4/30/21 5:00 PM
24	progress Report 03	0 days	5/3/21 5:...	5/3/21 5:00 PM
25	Finalize the contextual report with superv	14 days	5/4/21 8:...	5/21/21 5:00 PM
26	Submit Contextual report	0 days	5/24/21 ...	5/24/21 8:00 AM

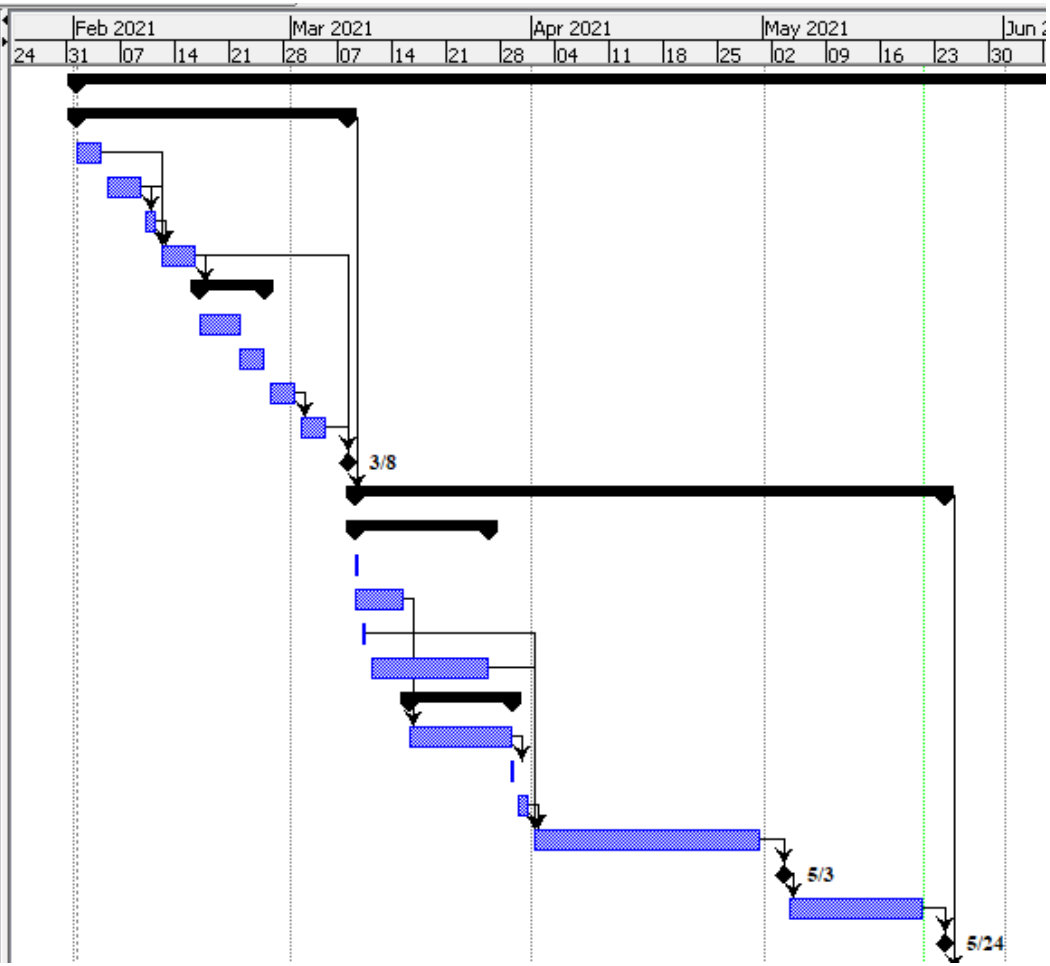


Figure 14 gantt chart I

	Name	Duration	Start	Finish
1	**Electronic wastage**	166 days	**2/1/21 ...**	**9/20/21 5:00...**
2	**Planning**	25 days	**2/1/21 ...**	**3/8/21 8:00 ...**
13	**Requirements gethering & analysis**	54 days	**3/9/21 ...**	**5/24/21 8:00...**
27	**Sprint 1**	25 days	**5/25/21...**	**6/28/21 5:00...**
28	**System design**	4 days	**5/25/21...**	**5/28/21 5:00...**
29	**Design UML digram**	4 days	**5/25/21...**	**5/28/21 5:00...**
30	Usecase diagram	4 days	5/25/21 ...	5/28/21 5:00 PM
31	Planning the Interfaces	3 days	5/29/21 ...	6/2/21 5:00 PM
32	Progress Report 04	0 days	6/2/21 5:...	6/2/21 5:00 PM
33	Design the Interfaces	4 days	6/1/21 8:...	6/4/21 5:00 PM
34	Implement the Interfaces	10 days	6/7/21 8:...	6/18/21 5:00 PM
35	**Test the Interfaces**	3 days	**6/19/21...**	**6/23/21 5:00...**
36	Unit Testing	2 days	6/19/21 ...	6/22/21 5:00 PM
37	Integration Testing	1 day	6/23/21 ...	6/23/21 5:00 PM
38	progress Report 05	0 days	6/26/21 ...	6/28/21 5:00 PM
39	**Sprint 2**	26 days	**6/29/21...**	**8/3/21 5:00 ...**
40	Planning the Database	5 days	6/29/21 ...	7/5/21 5:00 PM
41	Design the Database	7 days	7/6/21 8:...	7/14/21 5:00 PM
42	Implement the Database	7 days	7/15/21 ...	7/23/21 5:00 PM
43	**Test the Database**	5 days	**7/26/21...**	**7/30/21 5:00...**
44	Unit Testing	2 days	7/26/21 ...	7/27/21 5:00 PM
45	Integration Testing	3 days	7/28/21 ...	7/30/21 5:00 PM
46	Create Reflective Report	21 days	6/29/21 ...	7/27/21 5:00 PM
47	Finalize the Reflactive Report with Superv	3 days	7/28/21 ...	7/30/21 5:00 PM
48	progress Report 06	0 days	7/31/21 ...	8/2/21 5:00 PM
49	Submit Reflective Report	1 day	8/3/21 8:...	8/3/21 5:00 PM

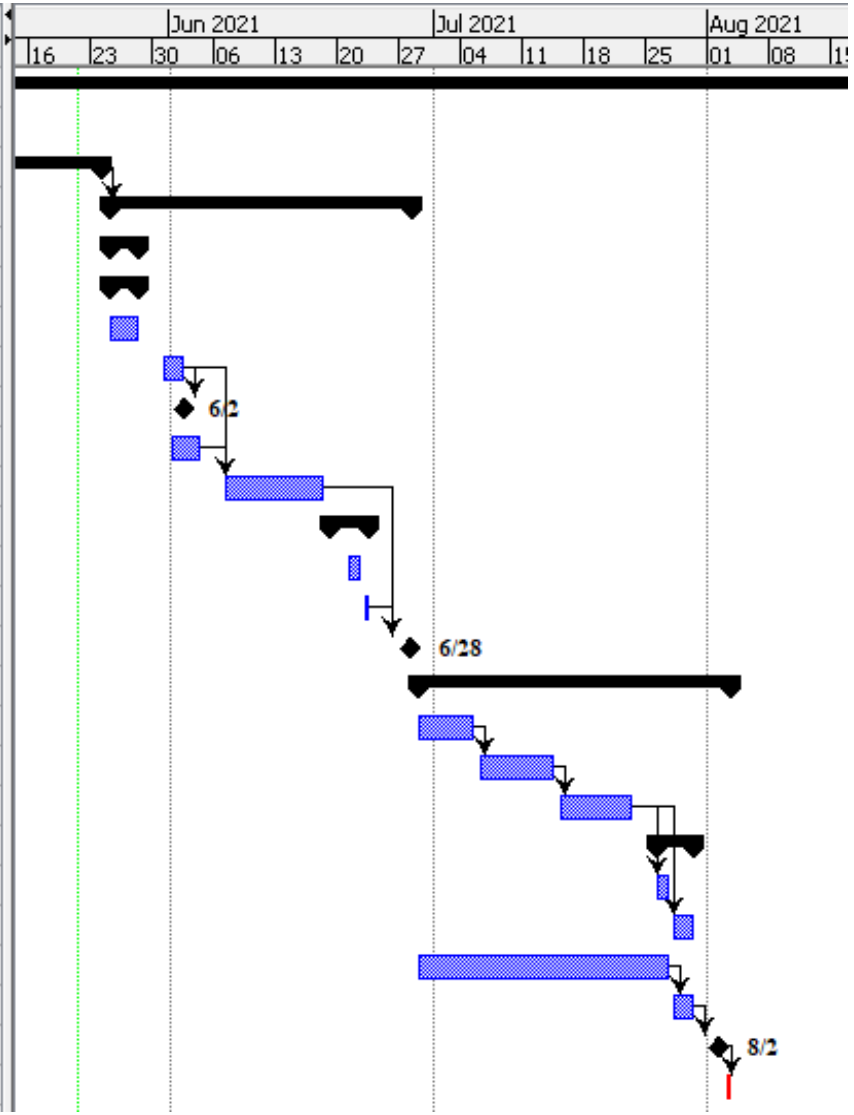


Figure 15 gantt chart II

	Name	Duration	Start	Finish
39	**Sprint 2**	26 days	**6/29/21...**	**8/3/21 5:00 ...**
50	**Sprint 3**	20 days	**8/3/21 ...**	**8/30/21 5:00...**
51	Planning the Back-End	4 days	8/3/21 8:...	8/6/21 5:00 PM
52	Designing the Back-End	4 days	8/9/21 8:...	8/12/21 5:00 PM
53	Implementing the Back- End	4 days	8/13/21 ...	8/18/21 5:00 PM
54	Integrating Back-End with Database	3 days	8/19/21 ...	8/23/21 5:00 PM
55	Progress Report 07	0 days	8/23/21 ...	8/23/21 5:00 PM
56	**Test the Database**	5 days	**8/24/21...**	**8/30/21 5:00...**
57	Unit Testing	3 days	8/24/21 ...	8/26/21 5:00 PM
58	Integration Testing	2 days	8/27/21 ...	8/30/21 5:00 PM
59	**Sprint 4**	11 days	**8/31/21...**	**9/14/21 5:00...**
60	Planning to Integrate	3 days	8/31/21 ...	9/2/21 5:00 PM
61	Integrate and Implement the application	4 days	9/3/21 8:...	9/8/21 5:00 PM
62	Unit testing	2 days	9/9/21 8:...	9/10/21 5:00 PM
63	Integration testing	1 day	9/11/21 ...	9/13/21 5:00 PM
64	System Testing the integrated application	1 day	9/14/21 ...	9/14/21 5:00 PM
65	**Evaluation**	4 days	**9/15/21...**	**9/20/21 5:00...**
66	Acceptance testing the Application	2 days	9/15/21 ...	9/16/21 5:00 PM
67	Obtainclient feedback	1 day	9/17/21 ...	9/17/21 5:00 PM
68	Analyse client feedback	1 day	9/20/21 ...	9/20/21 5:00 PM
69	**Documentation**	34 days	**8/3/21 ...**	**9/20/21 8:00...**
70	Create final Thesis	29 days	8/3/21 8:...	9/10/21 5:00 PM
71	Finalize the thesis with supervisor	4 days	9/13/21 ...	9/16/21 5:00 PM
72	Submit thesis	0 days	9/20/21 ...	9/20/21 8:00 AM

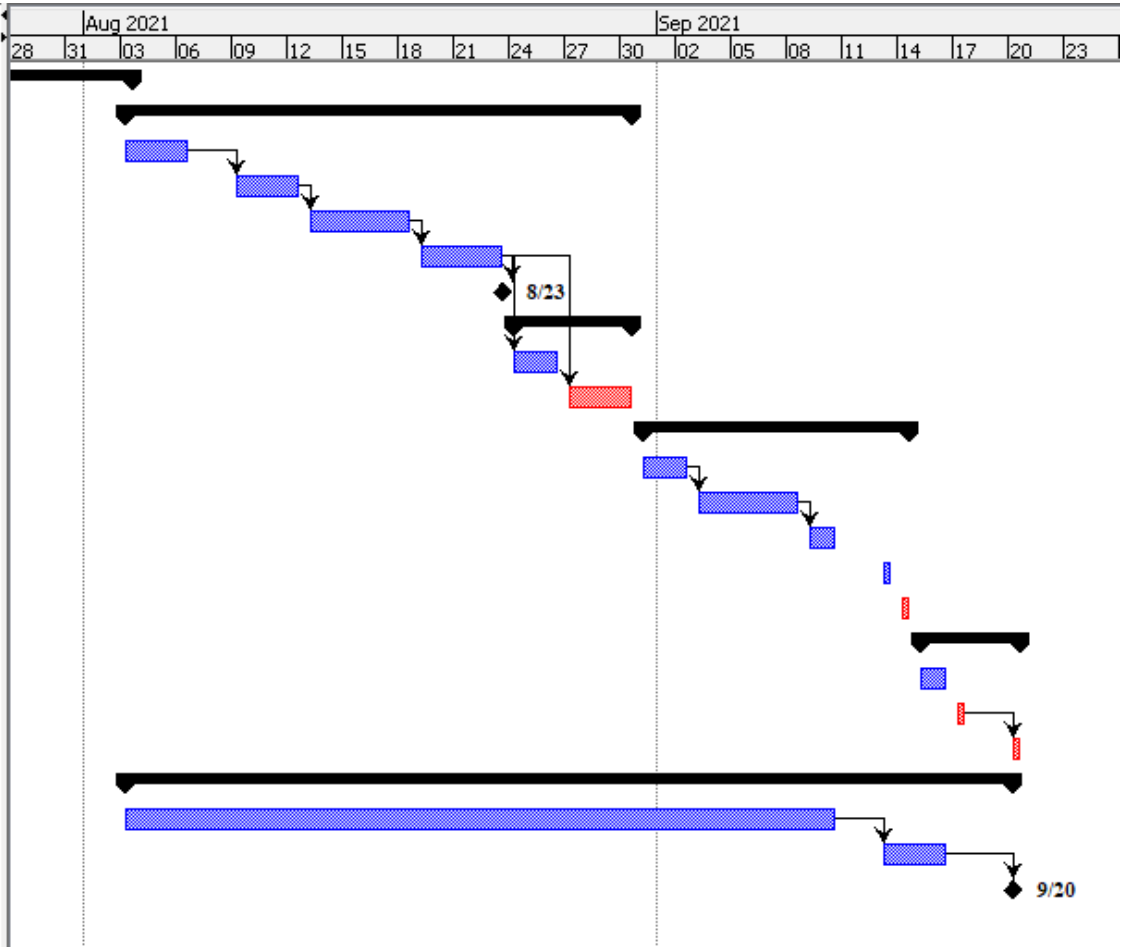


Figure 16 gantt chart III

3.1.2. Requirements Gathering and Analysis

Data and specifications were gathered to complete the project by analyzing existing documents and reading and analyzing research articles, existing programs, and systems that are currently being used in the real world. Which are already available for reading on the internet . To the research output, some well-ordered and well-known appropriate websites journal, books, data, or research papers are collected. Each existing system was also established, and some knowledge, ideas, and issues were gathered. The research papers that were used to collect information are listed in the literature review with the author's name and the year for copyright purposes. In the referencing portion, the sources that were used to collect information have been listed. In order to complete the research project, a survey was also conducted. A questionnaire was developed and distributed to a broad audience in order to gather information about current recruiting practices as well as the audience's expectations for the proposed project. The questionnaire's findings are included in the appendix section.

3.1.3. Sprints

As mentioned in the project proposal, the proposed project will employ agile development methodology, which will result in iterative preparation, design, implementation, and testing of sections. If any changes are made, the project will be redesigned to accommodate the new purpose. After collecting sufficient data, a plan will be created, along with a comprehensive design that includes the language, operating system, and hardware components that will be used in the implementation. The process of project implementation is when the concept and plan becomes a reality. The code is programmed in accordance with the design process in order to achieve the project plan's objectives. After finished coding, need to incorporate the component into a system and test it. Unit testing and integration testing will be used to verify and validate the product as developed and implemented. Since the proposed project will be developed using Agile development methods, the product will be reviewed at every level and any mistakes will be corrected as soon as possible. It is possible to provide a full, high-quality system to clients/users using this method. If a client requests new features or changes the specifications, the project can iterate as sprints when testing. When all of the criteria are met during the final testing phase, the system will be incorporated and implemented into a mobile application, and a final system and acceptance test will be performed before delivery.

3.1.4. Evaluation

After the proposed system has been implemented in accordance with the specifications, it will be presented to a group of people to evaluate and see how they use the system and how satisfied they are with it. Feedback from the evaluators can be used to develop the system even further.

3.1.5. Documentation

The working product and the documentation are the planned deliverables at the end of the project (Documents). The study documents will be delivered, including the project plan, contextual report, reflective report, and final thesis. A mobile app(application) that meets the needs of the consumer will be provided as a working product.

3.2. Future plan

4. Planning Artefact

This component of the project planning artefact shows the proposed project's approach, requirements gathering and review, design and execution, testing strategy, and assessment strategy.

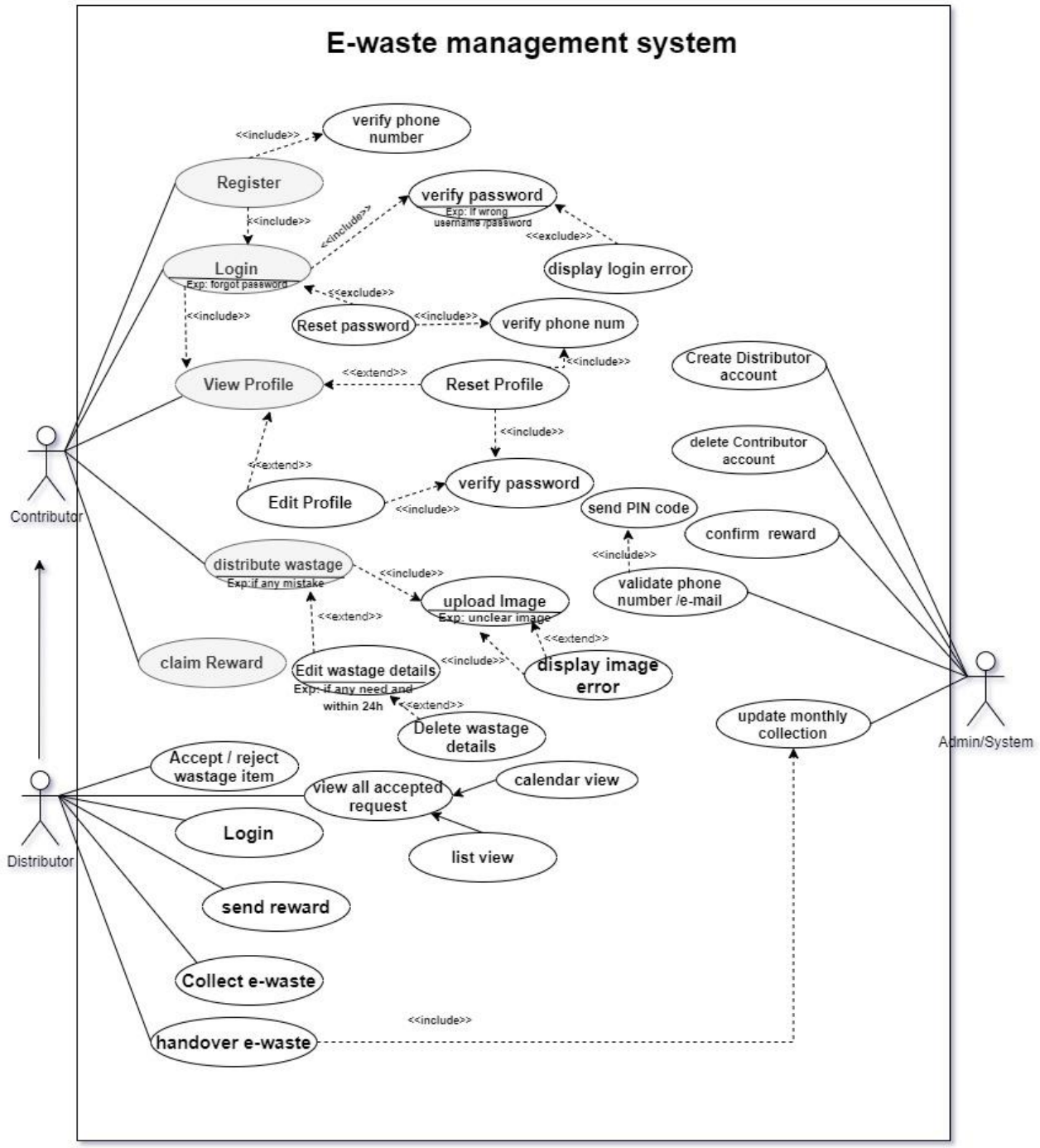
4.1. Requirements for image processing base mobile application

User requirements	Developers requirements
• A good internet connection • Device to use like ○ smart phone • platform independent-Android or IOS(No specific operating system required)	• Laptop(>4Gb RAM & 500GB+ hard disk / cloud) • Visual studio code • Flutter • Adobe XD • Database – mongoDb or firebase • python image processing/Object detection library • Operating System (Windows above 7) • Dataset

4.2. Design and Implementation of the Artefact

This section covers all of the system's features as well as its functions. The functionalities of those that will be directly communicating with the device are depicted in the usecase diagram below.

Figure 17 Use Case Diagram



This is a diagram of the project's overview. It highlights the system's key components to outline the system's basic structure.

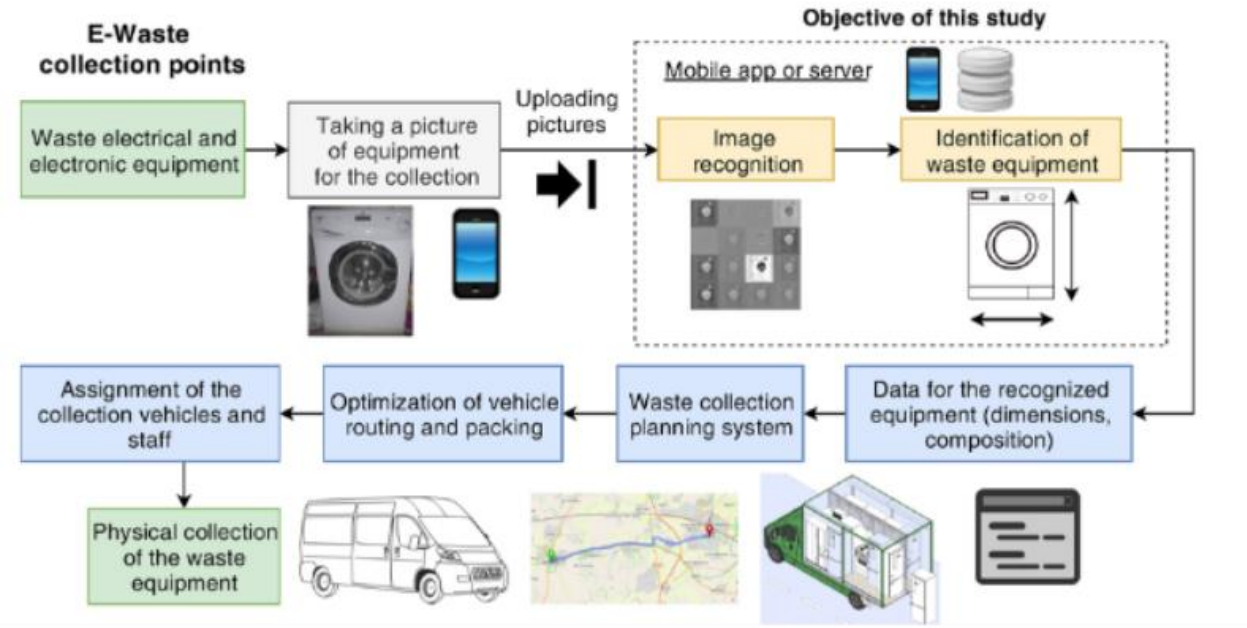


Figure 19 E-waste collection using image recognition and visual classification of waste equipments

This explains the system's primary purpose, which is to accept an image, compare it to a data set of images, and create a category based on the comparison/algorithm.

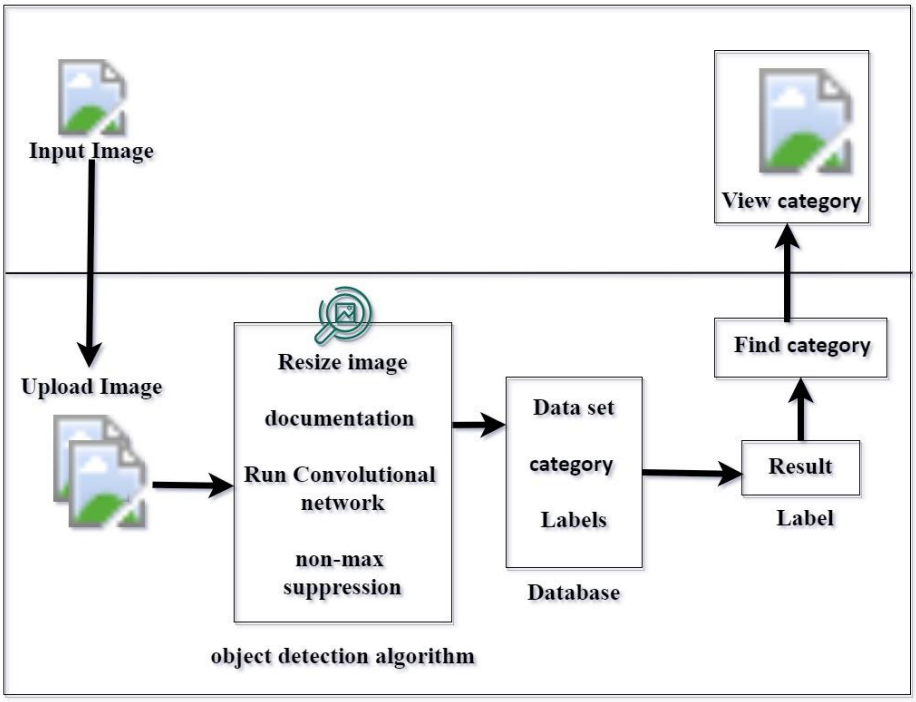


Figure 20 primary function Diagram

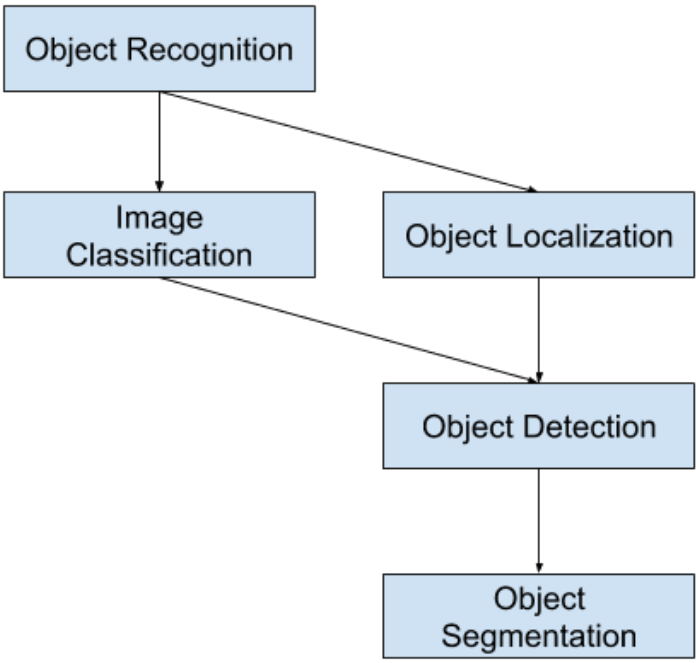


Figure 21 Gentle Introduction to Object Recognition(> Beginner's Guide to Object Detection Algorithms, 2021)

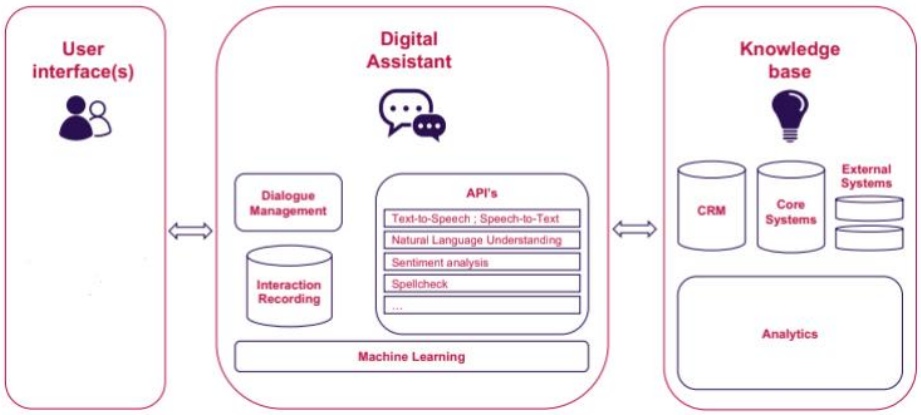


Figure 22 chatbot architecture(Architecture for public service chatbots, 2019)

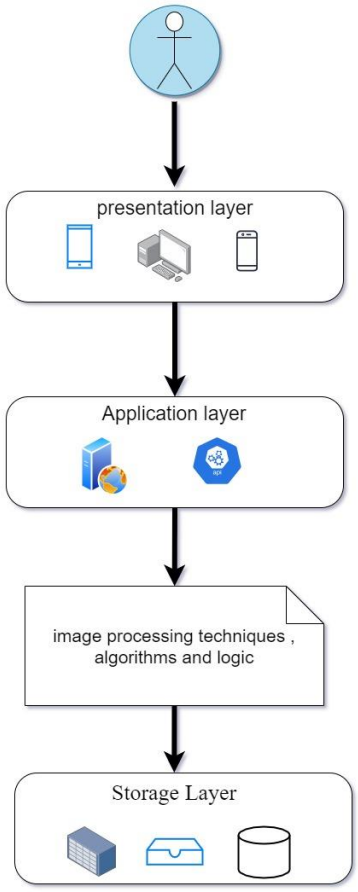


Figure 23 Architecture Diagram

4.3. Testing Strategy and evaluation strategy

- unit testing

In the software development life cycle, it is critical that it performs as intended. To demonstrate that the device and its related components can work as expected, a set of tests must be completed. In the early stages of the implementation process, the source code of each unit will be checked with white-box testing and black-box testing while concentrating on the performance of a specific component of the project, such as the user interface, input, and output. Prior to integration testing, unit testing is the first phase of testing in the testing plan.

- Integration testing

  When the unit test is finished, the tested individual units will be combined and tested as a group to ensure that the system meets the norm, as predicted. Integration tests will be checked using white-box and black-box tests and any interface failures and interaction between the integrated components will be exposed where any have been identified. The top-down approach/type is considered during testing, with a view to first testing top-level units and step-by-step testing of low-level units.

- system testing

  System testing focuses on ensuring that the whole system/all components are working properly and that the system meets the specifications. After completing the project, the developer will test the entire system's functionalities using the black-box testing approach from end-to-end. The developers will test with the demo input values.

5. References

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- **In-text:** (Yolo v1 bounding boxes during training step, 2021)
- 2021. *Yolo v1 bounding boxes during training step*. [image] Available at: <https://www.google.com/search?q=yolo+architecture+diagram&safe=active&rlz=1C1JZAP_enLK912LK912&sxsrf=ALeKk02-SmoPLBnL7ebOuzF5vTZBVHvxqA:1621243466438&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjDz6THstDwAhUpyzgGHT2fAhYQ_AUoAXoECAEQAw&biw=1202&bih=617#imgrc=IPH34V_ga6niWM>
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6. Appendix A: Glossary

Name	Definition
CNN	convolutional neural network
R-CNN	region-based convolutional neural network