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Food Digger – A Food Waste Management Based Web Application

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Abstract- Food wastage is increasingly becoming a topic of concern due primarily to the negative impact it has on the economic and agricultural industry. An important goal in our world today is to eliminate food waste by reutilizing available food sources within local communities: leftover food items in restaurants, stores and food distribution centers that may be approaching expiration; and any perishable items not used in entirety within their desired period. This paper focuses on creating an interesting web-based application called Food Digger that provides a ubiquitous platform that allows donors to donate their food which is in excess/leftover in any of their marriages, birthday parties, events, hotels or restaurants and distribute them among the needy ones through the NGOs thereby tackling two major issues, i.e., hunger and food waste. The goal of the project is to create a web-based application that manages food waste. This involves gathering unused or leftover food from various sources, including hotels, restaurants, and wedding halls, and providing it to those in need through NGOs.

Keywords-*reutilizing, ubiquitous, expiration, hunger, NGO*

1. INTRODUCTION

In recent years, the issue of food waste has garnered significant attention, and there is ongoing research aimed at finding effective ways to mitigate it. The sustainability of food production and consumption, as well as food supply chains, is significantly affected by the issue of food waste.

According to Heta-Kaisa Koivupuro [1], food waste can be divided into two categories: avoidable waste, which includes edible food that is thrown away, as well as spoiled or damaged food that was once edible, and unavoidable waste, which refers to inedible parts of food such as bones, fruit peels, and eggshells. Research shows that households in Finland waste roughly 5% of the food they purchase, with the average individual discarding between 20- 30 kg of food each year. Overall, Finnish households generate an estimated 120-160 million kilograms of food waste annually. It is estimated that by 2050 [2], the world population will reach 9 billion, resulting in an increased demand for food globally. However, studies indicate that the current food production levels may not be enough to meet this demand. To meet the growing food demand [3], there is a need for greater agricultural development. However, expanding agriculture could lead to climate change, pollution, and food waste issues.

Food waste is a pressing problem with significant economic and environmental implications, as well as links to climate change [4, 5]. Therefore, it is crucial to urgently search for effective and environmentally friendly methods to address food waste issues. Food waste in households can occur intentionally or unintentionally. Much of the waste in households is a result of forgetfulness or neglecting to check food expiry dates. In countries such as Finland where the cost of living is high, consumers may choose to purchase food items that are nearing their expiry date because discount sellers often offer them at reduced prices.

1.1 Background

The progress of technology has made life less burdensome for humans. With the widespread use of mobile technology, we are now able to stay connected with the world around us at all times. This has allowed us to conveniently access various aspects of our lives in one place. As an example [6], a person could be multitasking by finalizing a presentation for the next day, discussing dinner plans with their spouse, and booking a weekend trip, all in one place and potentially at the same time. The inspiration for this project stemmed from the observation of how easily expired food products were discarded by fellow students. Many students tend to purchase food products that are close to their expiry date and in large quantities due to the discounted prices, as stores try to reduce their losses by clearing out these products from their inventory. This is often due to the high cost of living. The widespread use of smartphones prompted the idea of utilizing them as a tool to track the lifespan of our food products, providing regular updates on the items that are nearing their expiration date. This is intended to mitigate the amount of food wastage that occurs in households.

1.2 Objective

The aim of the web-based tool designed to manage food waste project is to gather surplus or unused food from various sources such as restaurants, hotels, and wedding halls, among others. The food will then be distributed to those in need through NGOs. The NGOs will be responsible for picking up the excess food from these places and distributing it to those who require it.

In this system, our initiative is to minimize food wastage in restaurants by redirecting leftover food to NGOs. When there is excess food at a restaurant, an NGO can submit a request for it. This request is then sent to the manager of the restaurant. After approval by the NGO manager, an NGO employee is designated to collect the food and the request is forwarded to the restaurant. Leftover food at restaurants can be donated to NGOs at the end of the day. The administrator has the ability to monitor the record of restaurants and NGOs for any leftover food transactions

2. LITERATURE SURVEY

To address the issue of food waste, the use of IoT technology can be employed for monitoring and reducing food waste. It is important to manage,

Monitor, and control the amount of food that is wasted. According to Jagtap and Rahimifard [7], the amount of meat wasted at the Chicken Tikka Masala restaurant was reduced by 60.7% within eight months. They achieved this by using a bin equipped with a load cell that measures the amount of wasted meat, and then transmitting this data to a mobile app using a Bluetooth sensor. The data is then sent to a cloud server for analysis and storage. The study used eNose and weight sensors along with Wi-Fi and Arduino modules to detect, monitor, and manage food waste.

Du, X., Kowalski, 2019 [8], The SeVa app was created to serve as an intermediary between food vendors and consumers. It includes a knowledge base that users can access to communicate with each other. Users can create accounts by selecting the appropriate option based on their profile and entering the necessary information to achieve the desired result. Both suppliers and consumers can log in to the app. A project named smart bin system that enables the effective recycling and management of waste, K. Jayalakshmi (2017) [9]. The system utilizes RFID and Wi-Fi modules. When a user needs to dispose of their waste, they can request a smart bin through a web service and deposit the waste while specifying the type of waste. The system is designed to identify whether the waste is recyclable or not, and if it is, the waste is sent to a waste-collector-vendor for recycling. In the case that the waste is not recyclable, it will be discarded. The billing system is based on the weight of the waste, and the user can pay the bill using RFID.

A food waste management and recycling system [10] utilized RFID technology, weight sensors, and level sensors to identify the bin tag, location, measure the weight of the waste and detect the level of the trash in the bin (using 3 levels). A smart truck collects the trash bin and all the collected food waste is recycled into fertilizer for planting using FWDM (which is created using motor vehicle parts and IoT modules). The system displays the results and data captured through sensors on LCDs for monitoring.

The smart refrigerator uses AI and image processing to identify food items and assess their freshness status. The NLP analysis is then used to determine which foods are at risk of spoiling, and the system sends an alert to the user's mobile phone to prevent food waste and manage food inventory effectively, T.Nagaraju (2020)[11].

This project is focused on food redistribution as a social innovation to address food waste and food poverty. The administrator collects food from donors through nearby agents and provides it to nearby orphanages or poor people. After receiving the food from the agent, the administrator sends an alert message to the donor to acknowledge their contribution. This approach can help to reduce food waste.

A web application that can function as a tool for making strategic decisions regarding waste valorization opportunities, which includes identifying suitable locations for waste conversion technologies, efficient recycling options, and assessing the availability of waste streams as feedstocks (Mathew Paul, 2020) [12]. The web application employs geospatial analysis to tackle upcoming difficulties linked with waste management, such as the growing quantity of municipal solid waste (MSW), the necessity to decrease landfill, and the complicated supply chains involved with waste conversion.

The solid-waste management practices of 11 APO member countries, including Bangladesh, China, India, Iran, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam, were surveyed to evaluate their current practices and identify issues, challenges, and initiatives implemented to address them. The survey aimed to establish a comprehensive database on solid waste that could be used for national-level planning and the development of strategies for regional planning [13].

Troschinetz (2005), identified twelve factors that affect sustainable recycling in developing nations, taking into account the three aspects of sustainable development: environmental, social, and economic. The factors were identified by analyzing 23 case studies from developing countries, using both quantitative and qualitative methods [14].

In one such study, Jennifer (2005) conducted a feasibility study and action plan for a composting project at the Riverton disposal site in Kingston, Nigeria, with the goal of integrating waste reduction strategies into the existing solid waste management (SWM) system and diverting compostable waste from landfills [15]. The project was specifically designed to process commercial organic waste and did not include household organic waste. Like many other developing countries, a significant portion of solid waste in this area comprises organic matter. However, in recent years, there has been a noticeable increase in the amount of plastic and electronic waste generated.

An environmental audit of Municipal Solid Waste Management (MSWM) was conducted for various communities by collecting secondary data from government agencies, interviewing stakeholders, and conducting field surveys [16]. Field surveys were conducted in different areas to assess current practices and identify areas for improvement. The research revealed that 35% of bins have covers and 24% of areas have community bins, while 90% of residential areas use a door-to-door collection method for waste. The informal

sector, such as rag pickers, plays a significant role in recycling, with high levels of efficiency in retrieving recyclable materials at all stages of waste collection and disposal at dump sites [17].

3. PROJECT TOOLS USED

This project utilizes various technologies and tools. We are using HTML (H3ypertext Markup Language), CSS (Cascading Style Sheets), JavaScript, ReactJS for Front End and for Back End we are currently using NodeJS, ExpressJS, Socket.io and Firebase.

Some software and hardware used in project were:

- **Microsoft Word**: word processing software used to write and format the report.
- **VS code**: For coding and hence developing front and back end of our website
- **Firebase**: saving our data entered by user and food details
- **Grammarly**: online writing assistant tool used to improve the quality of writing.
- **Google Drive**: cloud storage and collaboration tool used to store and share the report with team members.
- **Canva**: online graphic design tool used to create visual aids for the report.
- **SurveyMonkey**: online survey tool used to gather data for the report.
- **Zoom**: video conferencing software used to communicate with team members during the writing process.
- **Trello**: project management tool used to organize tasks and deadlines.
- **Google Scholar and JSTOR**: online research databases used to gather information for the report.
- **Canon printer and scanner**: hardware used to print and scan documents.
- **Snipping tool**: for taking screenshots of our website
- **Dropbox**: cloud storage tool used to backup important files and documents.
- **LinkedIn Learning**: online learning platform used to research and learn about report writing best practices.

Each of these tools and technologies played an important role in the successful completion of this project. Microsoft Word was used for drafting and formatting the report, while Google Drive enabled seamless collaboration between team members, even when working remotely. Zoom allowed for virtual meetings and discussions even across different time zones, while Trello helped to keep everyone on track and on schedule. Google Scholar and JSTOR were valuable resources for conducting research and finding sources. Grammarly was used to improve the quality of writing, while Canva, an online graphic design tool used to create visual aids for the report.

3.1 HTML

HTML (Hypertext Markup Language) is the commonly accepted language used for designing and building web pages. It consists of a series of elements (tags) that define the structure and content of a web page. HTML tags are used to describe the content that appears on a web page, such as headings, paragraphs, images, links, and more. When a web browser renders an HTML page, it uses the tags to determine how the content should be displayed on the screen. HTML is often used in conjunction with other web development technologies such as CSS (Cascading Style Sheets) and JavaScript to create more dynamic and interactive web pages.

3.2 CSS

CSS stands for Cascading Style Sheets. It is a style sheet language used to describe the presentation of HTML or XML documents on the web, including colors, layout, fonts, and other visual elements. CSS provides web developers with the ability to separate document content from document presentation, allowing for more efficient design and easier maintenance of websites. It is an essential part of web development and is widely used in creating responsive and visually appealing web pages.

3.3 JavaScript and ReactJS

JavaScript is a high-level programming language used to create interactive and dynamic web pages. It is primarily used for front-end web development, but can also be used for back-end development with Node.js.

JavaScript is responsible for adding interactivity to web pages and can be used to create animations, update content on the page without refreshing, and validate forms.

ReactJS is a JavaScript library used for building user interfaces. It was developed by Facebook and is widely used for creating single-page applications and mobile applications. ReactJS uses a component- based architecture, which means that the UI is broken down into small, reusable components that can be easily managed and updated.

3.4 NodeJS

Node.js is an open-source server-side platform built on Chrome's JavaScript engine (V8 engine). It allows developers to build scalable and high- performance web applications using JavaScript on the server-side. Node.js is constructed using a non- blocking I/O model that is event-driven, making it highly efficient and lightweight. This feature makes it a suitable choice for developing real-time applications that can run seamlessly on various distributed devices. With Node.js, developers can build web servers, APIs, and command-line tools, among other things.

3.5 ExpressJS

ExpressJS is a web application framework for Node.js, which provides a set of features for building web and mobile applications. It provides a robust set of HTTP utility methods and middleware that allows developers to create APIs and

web applications easily. With ExpressJS, developers can create routing, define the request and response handling, and add middleware like CORS and cookie parser. ExpressJS also provides a template engine for rendering dynamic HTML pages, which can be easily integrated with front-end libraries like ReactJS.

3.6 Socket.io and Firebase

Socket.IO is a software library that facilitates fast and real-time communication between a server and a client by allowing two-way communication through events as we can see in fig. i) [18].

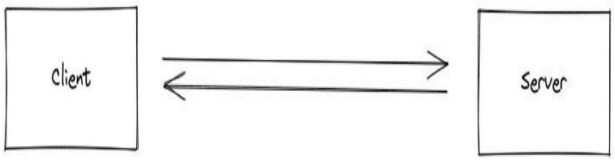

Figure. I)

Socket.IO is a library that is constructed over the WebSocket protocol and provides extra assurances

Such as a fallback to HTTP long-polling or the capability of automatic reconnection. WebSocket is a communication protocol that allows for a full-duplex and low-latency communication channel between the server and the web browser.

4. METHODOLOGY

The waterfall model is a conventional approach employed in the system development life cycle for creating a system in a linear and sequential manner, as depicted in Figure ii) [18]. It gets its name from the fact that the model advances through each phase in a downward, systematic direction, similar to a waterfall. The waterfall method does not provide a way to go back to the previous phase to accommodate changes in requirements. This approach is the oldest method that was used for software development.

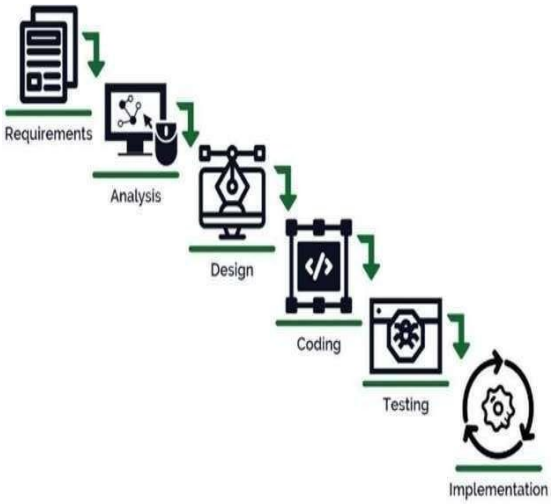

Figure. II) Project Flow Model

4.1 Working of Project

The food waste management web-based application is composed of four distinct modules - Admin, Donor, NGO, and Logistics (delivery system). Each module has registration and login options. The admin verifies the registration of Donors and NGOs to prevent any fraudulent or fake requests. After verification, both the Donors and NGOs can request for donation and supply, respectively. The admin can view the requests and supplies and facilitate communication between them based on the availability, type, and quantity of food. NGOs can view the history of restaurants and send requests to manage their leftover/excess food. In this proposed system proper implementation of website is achieved with various features. In Fig.iii), this platform facilitates easy connection between Donors and NGOs through information provided by the administrator. It includes a dedicated logistics login

For the collection and delivery of food packets from Donors to NGOs. The administrator manages all aspects of the site, including user management, content editing, and settings. The users can access the homepage, about us, innovation, market, and contact us pages. Donors can share details about their leftover food, location, and contact the site administrator as needed.

Figure. III) Proposed System

4.1.1 Four Major Modules

The system comprises of four major modules:

a. Admin

b. Donor

c. NGO (Non-Governmental Organization)

d. Logistics

Admin:

- The application allows users to view requests raised by Donors, NGOs, and Logistics.
- They can either accept or deny the requests after verifying the information provided.
- The system can also map Logistics with NGOs and Donors.
- Additionally, users can view any complaints or suggestions about requests and reply to them.

Donor:

- Register with name, username, password and some personal information.

- Login with registered Username and password.
- Raise the request with details like date, number of packets that can be sent and location.
- Users are able to access and review their submitted requests, and can view the current status of each request to determine if it has been approved or rejected by the administrator.
- Users are able to provide feedback or suggestions regarding the capabilities of the website.
- Track their food whether it is delivered or not

NGO:

- Register with name, username, password and some personal information.
- Login with registered Username and password.
- Raise the request with details like date, number of packets needed and location.
- Users have the ability to view requests they have submitted and check their status to see if they have been accepted or denied by the Admin.

5. THE CONCEPTUAL FRAMEWORK

5.1 Request Making

This interface allows users to request the donation of their leftover food to those in need who do not have access to proper meals due to various reasons. Users can input details such as their location and the amount of leftover food they have. After confirmation, designated managers will be assigned to collect the food and deliver it to those in need.

5.2 Manage the Delivery

The following platform is designed for managers who are responsible for delivering the donated food to the needy. They receive requests on their interface and provide their vehicle and personal details. Once the details are confirmed, they visit the location to pick up the food and then check the urgency level from another interface. Based on the severity, they select the neediest recipient and deliver the food to them.

5.3 Target Area

This system ensures that the severity of the need is considered. If there are multiple places registered in the system that require food, the managers have to determine which place has the highest need and deliver the food there. The level of need can be low, moderate, or high.

5.4 Registration

The users need to register their information in the system to ensure that each user is identified uniquely and the necessary transactions can be carried out smoothly. For example, billing information needs to be issued under the user's name. Additionally, there are other references that may be required in the system.

To access the features of the website, users must register and provide accurate information for verification purposes, including a driver's license if applicable. Unregistered users can only view the landing page and features but cannot use them. Accurate registration details are important to ensure that users are identified correctly and authorized to use the services provided.

5.5 Login

Once a user has registered, they can access the system by logging in with their unique identity and password. The system operator can also log in on behalf of the user. After logging in, the user will have access to other interfaces for performing various actions. In the case of a bride and groom, both will need to log in with their unique identities and passwords to access the main user interface with further options.

5.6 Forgot password

It is common for individuals to forget their login password, which can be a troublesome and cumbersome process to recover manually, particularly when needing to log in during an emergency. To address this issue, there is a password recovery module available named "Forgot Password," which enables users to recover their password within seconds. To use this module, users simply need to enter their registered email ID and click "enter." A confirmation email will then be sent to their email address, with instructions on how to reset their password. Using this module, individuals can easily and quickly solve their password-related issues.

5.7 Admin

The admin account is responsible for controlling the flow of data within the system and has the authority to regulate user access to that data. The primary objective of this account is to ensure the relevance of user data and to provide inputs to other interface modules in order to optimize the system's performance and generate specific timetables. This ensures that all data displayed in the interfaces is clean and well-organized.

RESULTS

Figure. IV) Front Page of Website

In fig. IV), we can see that this is the front page of our website "FOOD DIGGER". Any existing user or any new member who visits our page they got to see this page.

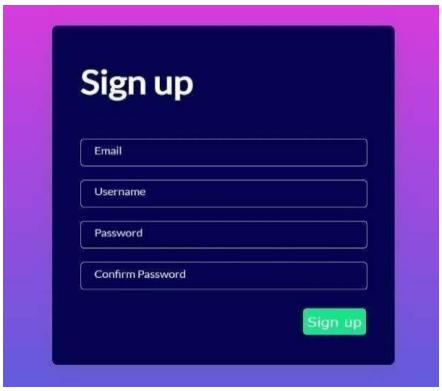

Figure. V) Sign-Up Page

In fig. v), this is the sign-up page where a new user can register in our website and then start donating.

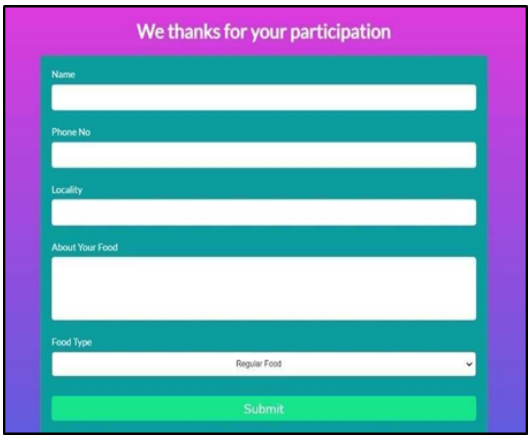

Figure VI) Donation box

In fig. vi), this is the section for donating food, here comes a detail fetching page where a user fills the details about the food they want to donate.

Figure. VII) Live Count and Volunteering

In fig. vii), this bar shows the active users on our site and live status about how much money donated or how much good got donated through our site.

Figure. VIII) Admin Section

In fig. viii), this is the admin section of Food Digger, the admin of this site can see the live status of orders and whether an existing order got cancelled or is there any new order request.

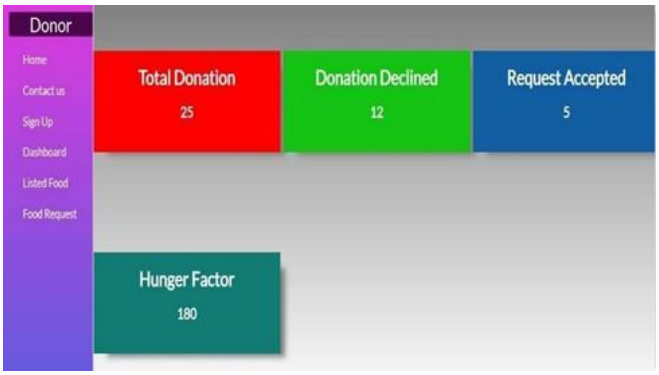

Fig. IX) Donor Section

In fig. ix), here comes the donor section in which a user can see their history of donation or any ongoing donation's details like new requests or cancel order requests etc.

Fig. X) Four Measures

In fig. x), here is a quick access to Get in touch directly with us, Quality check of food which is based on our Food Safety and Standard Guidelines, and a locate option to check most unserved areas around us, and at last a delivery option to track your food and by whom it is delivered

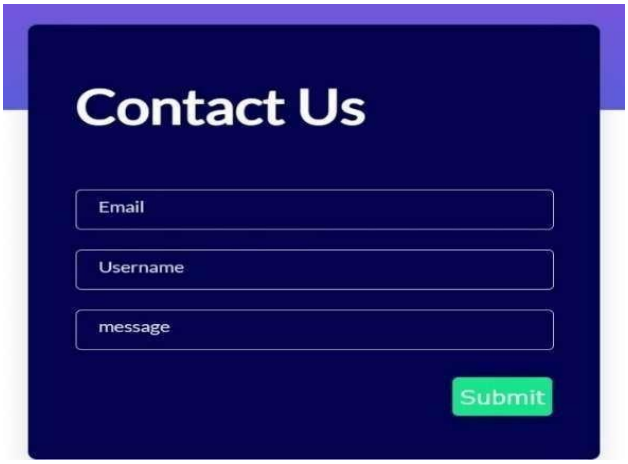

Figure. XI) Contact Us

In fig. xi), this is the contact page as mentioned in the form Where user can contact us and submit any query of them.

Figure. XII) Social Handles

In Fig. xii), these are our social handles, you can reach out us on Facebook, Twitter, Instagram, LinkedIn.

CONCLUSION

In the waste management system, there is a process for reducing food wastage. Firstly, users can request to donate their leftover food from events or functions. The user fills in the details of the food and

REFERENCES

[1] Klonowska, K. and Bindt, P. The COVID-19 pandemic: two waves of technological responses in the European Union, Tech. Report - The Hague Center for Strategic Studies, The Netherlands, and Apr 2020.

[2] F Shahidi (1999) "Food applications of chitin and chitosans", Trends Food Sci Technol

[3] L Bedian (2017) "Bio-based materials with novel characteristics for tissue engineering applications – A review", Int J Biol Macromol

[4] L Yi (2013), "Extraction and characterisation of protein fractions from five insect species", Food Chem

[5] A Caligiani (2018), "Composition of black soldier fly prepupae and systematic approaches for extraction and fractionation of proteins, lipids and chitin", Food Res Int

[6] Ibrahim Olanigan, "Design and Implementation of Food Management System on Android Platform with QR Code Support", pp.7-8, 2013.

[7] S. Jagtap and S. Rahimifard, "The digitisation of food manufacturing to reduce waste - case study of a ready meal factory," Waste Management, vol. 87, pp. 387–397, 2019.

[8] Du, X., Kowalski, M., Varde, A., de Melo, G. and Taylor, R. "Public Opinion Matters: Mining Social Media Text for Environmental Management", ACM SIGWEB journal, Autumn 2019, Article 5, pp. 1-15

[9] K. Jayalakshmi, S. Pavithra, and C. Aarthi, "Waste to wealth—a novel approach for food waste management," in 2017 IEEE International Conference on Electrical, Instrumentation and Communication Engineering (ICEICE), Karur, India, April 2017.

[10] M. Kaur and K. S. Saini, "A framework for recyclable household waste management system in smart home using IoT," in Computing and Network Sustainability, H. Vishwakarma and S. Akashe, Eds., vol. 12 of Lecture Notes in Networks and Systems, pp. 213–223, Springer, Singapore,

[11] T. Nagaraju and B. R. Shubhamangala, "Artificial intelligence powered smart refrigerator to arrest food wastage," in 3rd International Conference on Innovative Computing and Communication (ICICC-2020), Delhi, India, April 2020.

[12] Mathew Paul and J. Baussemaker, "A web-based geographic interface system to support decision making for municipal solid waste management in England", in Journal of Cleaner Production, March 2020

[13] Asian Productivity Organization (2007) "Survey on Solid-Waste Management "2004– 05 Edited by the Environmental Management Centre, Mumbai, India. Published by the Asian Productivity Organization

[14] Troschintez, A. (2005). "Twelve Factors Influencing Sustainable Recycling of Municipal Solid Waste in Developing Countries." Masters of Science in Environmental Engineering Thesis, Michigan Technological University. Houghton, Michigan.

[15] Jennifer L. (2007) "Solid Waste Management" Unpublished Msc thesis, Department of Civil, Michigan Technological University, and Houghton, Michigan.

[16] Haque, A. (1998). "Limits to plastic recycling in the developing and developed Economy". Unpublished PhD thesis, Imperial College, London.

[17] Harashima, Y., (2000). "Environmental Governance in Selected Asian Countries". International Review for Environmental Strategies 1, no 1, 193-207.

[18] Shubahm pawade, "Food Waste Management - the list of project report that we are collecting for an academic project", pp. 2-3