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An Integrated Framework to Develop the Smart City by Using Full Stack Development

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Abstract- With the advent of smartphones, technology has helped mankind to solve some of its difficulties. On a similar note, "Social Verse" is a futuristic approach to alleviate obstacles triggered by ever-increasing population and rapid urbanization. This approach will benefit the environment, impoverished communities, and the government. This concise study will give you a better understanding of how full-stack development [1] is used to transform a city into a "Smart City" [2]. Web-based applications ensure accessibility for all users.

Keywords- Smart city, Full Stack Development, Networking Model, Front End development, Back End Development, API, RDBMS.

Abbreviations and Acronyms- Graphical User Interface(GUI), Hypertext Mark-up Language (HTML),Cascading Style Sheets (CSS), Application Program Interface (API), Transmission Control Protocol/Internet Protocol (TCP/IP), Hypertext Transfer Protocol (HTTP), Open System's Interconnection (OSI), Apache Tom-Cat 6.0, Windows, Cross Platform, International Organization for Standardization (ISO), Hypertext Transfer Protocol Secure (HTTPS), Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Operating System (OS), File Transfer Protocol (FTP), Structured Query Language (SQL), Java Script, Extensible Mark-up Language (XML), Domain Naming System (DNS), Internet Protocol (IP), Uniform Resource Locator (URL), User Interface (UI), Development and Operation (DevOps), Relational Database Management System (RDBMS), Servlet, Java.

I. INTRODUCTION

The Social Verse project aims to create a platform where users and organizations can interact. Through full-stack web development, we will create a web-based platform with three different modules that any user can access. The three modules are as follows:

1. Waste Management [3]: Users can upload images of garbage in their surroundings on the webpage, and our application will assign suitable organizations like the municipal department to clean the garbage from that particular area.

2. Leftover Food Management [4]: This platform will connect people who have leftover food after parties or marriages to several organizations that take care of that food and give it to the poor. We will also provide a platform for restaurant owners to register on our website and contact us for providing food to the poor.

3. Donations for the Poor [5]: The website will allow users to donate necessary items for poor children, including old books, clothes, used electronic devices, toys, etc. Our project will contact different orphanages or NGOs for the distribution of the donated items.

The project will comprise two types of development present on the website.

A. Front-end Development

Front-end development [6] refers to the process of implementing website design on the web. Simply put, it involves the part of the website that users can see and interact with, including the graphical user interface (GUI) and command line, such as design, navigation menus, text, images, videos, and more. Some of the front-end languages we use in the project include HTML, CSS, and JavaScript.

B. Back-end Development

Back-end development [7] refers to server-side development. It is the term used for the behind-the-scenes activities that occur when performing any action on a website. In other words, it is the portion of software that does not come into direct contact with users. Users indirectly access the parts developed by back-end designers through a front-end application. In the back-end approach we are using Java.

II. RELATED WORK

The Swachhata-MoHUA [8] is the official app of Ministry of Housing and Urban Affairs(MoHUA), Government of India. The app enables a citizen to post a civic-related issue (eg; a garbage dump) which is then forwarded to the city corporation concerned and thereafter assigned to the sanitary inspector of the particular ward. The app has been built by IChangeMyCity – a division of Janaagraha, a Bengaluru based non-profit working to improve the quality of life in India's cities and towns.

Pom Pom Trash to Cash [9] is a service that pays users for their unwanted recyclable trash. Bhumika Puri, the company's Marketing and Public Relations Executive, said, "We convert recyclables back into a raw form, which can then be used to create new and different products. We aim to provide a one-stop recycling solution for industries and households."

OLIO [10]. OLIO provides a platform for neighbours to share unwanted food and other items, all for free. An OLIO Food Waste Hero (FWH) is an OLIO user who actively picks up unsold food from local businesses to save it from going to waste.

No Food Waste [11]: "No Food Waste" is a not-for-profit surplus food management organization that connects untouched, edible surplus food with needy people to make the world hunger-free and reduce food waste. Leftovers reach the hungry through a mobile app of the same name. The "No Food Waste" mobile app allows the organization to crowdsource data on hunger spots in India and take requests for the donation of excess food. The app has identified 80 such spots in Delhi and the National Capital Region.

"Feeding India" is another social start-up founded by young Indians that uses technology to feed the poor. It feeds 15,000 people in 25 Indian cities, including 2,500 in Delhi. The organization receives around 100 requests for excess food pick-up every day in the capital.

Seva kitchen [12]: Seva Kitchen is an app that connects food givers with receivers who pick up excess food from parties, festivals, and gatherings, and deliver it to those in need. A vast amount of food often goes to waste at such events, but Seva Kitchen aims to reduce this waste by facilitating donations to those who are hungry.

Toy bank India [13]: Toy Bank India is an app that accepts only donated toys. Donors need to provide information such as the quantity of toys, location, name, and mobile number.

Uber blog (NGO - The Vizag Smiles) [14]: Uber blog (NGO - The Vizag Smiles) notes that these apps are excellent platforms for donating old books, toys, games, clothes, bags, phones, laptops,

PCs, and more. They work with NGOs to ensure that donations reach those who need them.

Various researchers have proposed different methods and systems for solving problems [3], [4], [5]. However, none of the above works contain a solution for all problems in one platform. One major issue with waste management apps is poor user reviews. For instance,

Abhijeet Mahajan wrote on July 17, 2021 (14), that complaints filed in the app are not attended to and are just marked as resolved, which is not helpful. He also noted that the app seems to be just for show. Similarly,

Harshit Pandey wrote on October 30, 2021 (47), that while he filed a complaint on the app for the removal of leftover construction materials on his colony road, no one looked into the complaint. He suggested that the app is of no use, takes up phone storage, and seems like even the government has forgotten that they launched it.

Another issue is with the food management app, which does not support a sufficient number of volunteers for the work, resulting in an inlet-outlet problem.

Our paper aims to create a platform that addresses all the problems mentioned earlier by overcoming the challenges faced by related works, all on one website.

III. PROBLEM STATEMENT

There are mainly three different types of modules in our project. The ideas for these modules arise from three different types of problems, which are as follows:

Problem-1

Scattered garbage in our surroundings not only makes them dirty but also pollutes the environment, resulting in unhygienic conditions that cause bad odor and encourage infestation by cockroaches, flies, and other insects. According to waste experts, the threat of waste to the environment, health, and safety is enormous, with significant financial and social implications. Garbage clogging drains can cause flooding, and pollution can seep into groundwater and rivers. The toxic discharge from trash can also poison the atmosphere.

Problem-2

Leftover food in restaurants and after parties.

If just a quarter of the food that is currently lost or wasted globally could be saved, it would be sufficient to feed 870 million hungry people. Taking this into consideration, the actual monetary value of food wastage per year in India is estimated to be a staggering Rs. 92,000 crores [15].

Malnutrition refers to when a person's diet does not provide enough nutrients or the right balance of nutrients for optimal health. Causes of malnutrition include inappropriate dietary choices, a low income, difficulty obtaining food.

If the aforementioned figure of Rs. 92,000 crores were spent on the diet of underprivileged children, it would make a significant difference. We have to think about the following problem:

Every 10 seconds, a child dies due to hunger.

Problem-3

The lack of basic necessities such as books, toys, clothes, and electronic devices for poor children and orphans is a major reason why this segment of society lacks opportunities and awareness to pursue education and career prospects. Our platform offers an efficient solution to these three issues. For the first problem, users can simply upload a picture of garbage in their surroundings. For the second problem, users can report the amount of leftover food after parties and weddings on our website. And for the third problem, users can donate various materials to underprivileged individuals through our platform.

IV. TECHNOLOGY USED

We created our website using HTML and style them using CSS, but we need server-side technology when we want to create a dynamic website.

The web server is a process that handles the client's request and responds. It processes the request made by the client by using the related protocols. The main function of the webserver is to store the request and respond to them with web pages. It is a medium between client and server. For example, Apache is a leading webserver.

The HTML stands for Hypertext Mark-up Language; it is a common language for Web Server and Web Client communication. Since both the web server and web client are two different software components of the web, we need a language that communicates between them.

The HTTP stands for Hypertext Transfer Protocol; it is a communication protocol between the client and the server. It runs on top of the TCP/IP protocol.

Servlet

A Servlet [17] is a Java program that runs within a web server; it receives the requests and responds to them using related protocols (Usually HTTP). The Servlets are capable enough to respond to any type of request; they are commonly used to make the application functional.

React.js

React [18] is a JavaScript-based UI development library. Facebook and an open-source developer community run it. Although React is a library rather than a language, it is widely used in web development. The library first appeared in May 2013 and is now one of the most commonly used frontend libraries for web development. React offers various extensions for entire application architectural support, such as Flux and React Native, beyond mere UI.

Easy creation of dynamic applications: React makes it easier to create dynamic web applications because it requires less coding and offers more functionality, as opposed to JavaScript, where coding often gets complex very quickly.

Improved performance: React uses Virtual DOM, thereby creating web applications faster. Virtual DOM compares the components' previous states and updates only the items in the Real DOM that were changed, instead of updating all of the components again, as conventional web applications do.

Reusable components: Components are the building blocks of any React application, and a single app usually consists of multiple components. These components have their logic and controls, and they can be reused throughout the application, which in turn dramatically reduces the application's development time.

Unidirectional data flow: React follows a unidirectional data flow. This means that when designing a React app, developers often nest child components within parent components. Since the data flows in a single direction, it becomes easier to debug errors and know where a problem occurs in an application at the moment in question.

Node.js

Node.js [19] is an open-source and cross-platform JavaScript runtime environment. It is a popular tool for almost any kind of project! Node.js runs the V8 JavaScript engine, the core of Google Chrome, outside of the browser. This allows Node.js to be very performant. A Node.js app runs in a single process, without creating a new thread for every request. Node.js provides a set of asynchronous I/O primitives in its standard library that prevent JavaScript code from blocking and generally, libraries in Node.js are written using non-blocking paradigms, making blocking behavior the exception rather than the norm. When Node.js performs an I/O operation, like reading from the network, accessing a database or the filesystem,

instead of blocking the thread and wasting CPU cycles waiting, Node.js will resume the operations when the response comes back. This allows Node.js to handle thousands of concurrent connections with a single server without introducing the burden of managing thread concurrency, which could be a significant source of bugs. Node.js has a unique advantage because millions of frontend developers that write JavaScript for the browser are now able to write the server-side code in addition to the client-side code without the need to learn a completely different language. In Node.js the new ECMAScript standards can be used without problems, as you don't have to wait for all your users to update their browsers - you are in charge of deciding which ECMAScript version to use by changing the Node.js version, and you can also enable specific experimental features by running Node.js with flags.

Springboot

Spring Boot, [20] the conversation has to start with Java—one of the most popular and widely used development languages and computing platforms for app development. Developers all over the world start their coding journey learning Java. Flexible and user-friendly, Java is a developer favorite for a variety of apps—everything from social media, web, and gaming apps to networking and enterprise applications.

MongoDB

MongoDB [21] is a popular open-source NoSQL database that allows for the storage and retrieval of data in a flexible, scalable, and efficient manner. Unlike traditional relational databases, MongoDB uses a document-based data model, which allows for more dynamic and complex data structures to be stored. One of the key advantages of MongoDB is its ability to handle unstructured data, which can be difficult to manage with a traditional relational database. This makes it particularly well-suited for applications that deal with large amounts of data, such as social networks, e-commerce platforms, and content management systems. MongoDB also offers a range of advanced features, such as support for distributed data processing and automatic data sharding, which allow for horizontal scaling and improved performance. Additionally, it provides a flexible query language and a rich set of APIs, making it easy for developers to interact with and manipulate data. Overall, MongoDB is a powerful and flexible database solution that offers significant advantages over traditional relational databases, particularly for applications dealing with large amounts of unstructured data. Its popularity has made it a top choice for many developers and organizations, and it is widely used across a variety of industries and applications.

H2 Database H2 database [22] is a high-performance relational database management system that is written in Java. It is an open-source software that is designed to be fast, reliable, and easy to use. The database is ACID-compliant and supports standard SQL syntax. H2 database can be used as an embedded database, in-memory database, or standalone database server.

To create a web application, we need the following tools:

- IDE- IntelliJ IDEA, Visual Studio Code
- Database- H2 Database, MongoDB
- Server- Apache Tomcat 6.0

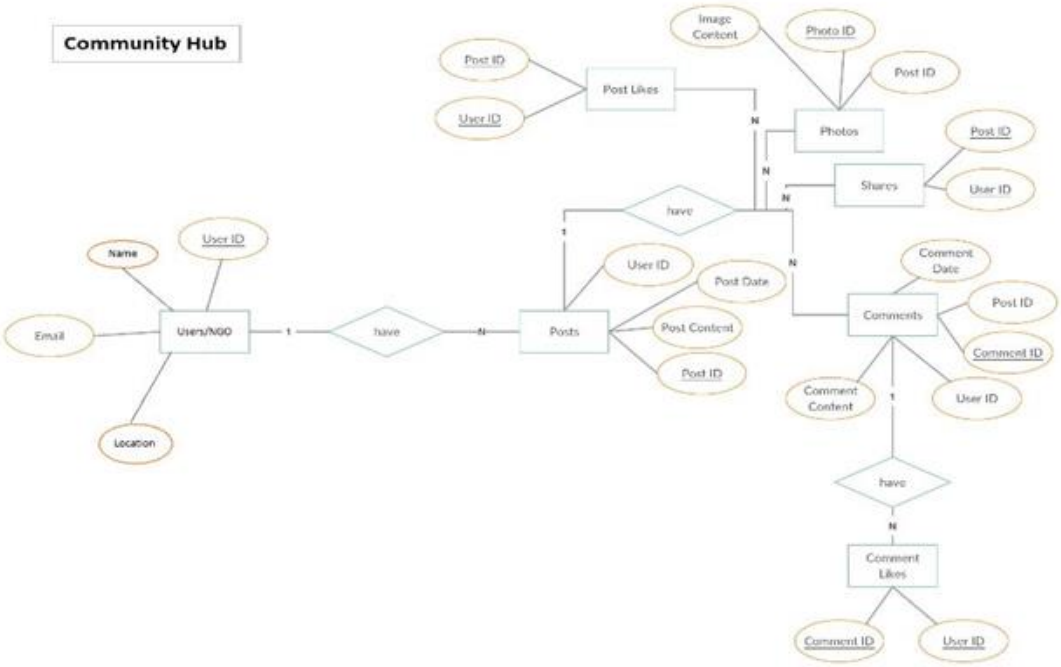

Fig.1. Community Hub Page

One of the main advantages of H2 database is its fast speed and low memory footprint. It is optimized for performance and can handle large amounts of data with ease. The database also supports many advanced features such as transactions, indexes, and stored procedures. In addition, it provides support for various data types including text, binary, and spatial data. H2 database is also easy to set up and use.

It has a simple installation process and comes with a user-friendly web-based console that allows users to manage and interact with the database. Furthermore, it supports many programming languages including Java, C++, Python, and Ruby, making it a versatile choice for developers. Overall, H2 database is a powerful and efficient relational database management system that is ideal for developers who need a fast and reliable database for their applications.

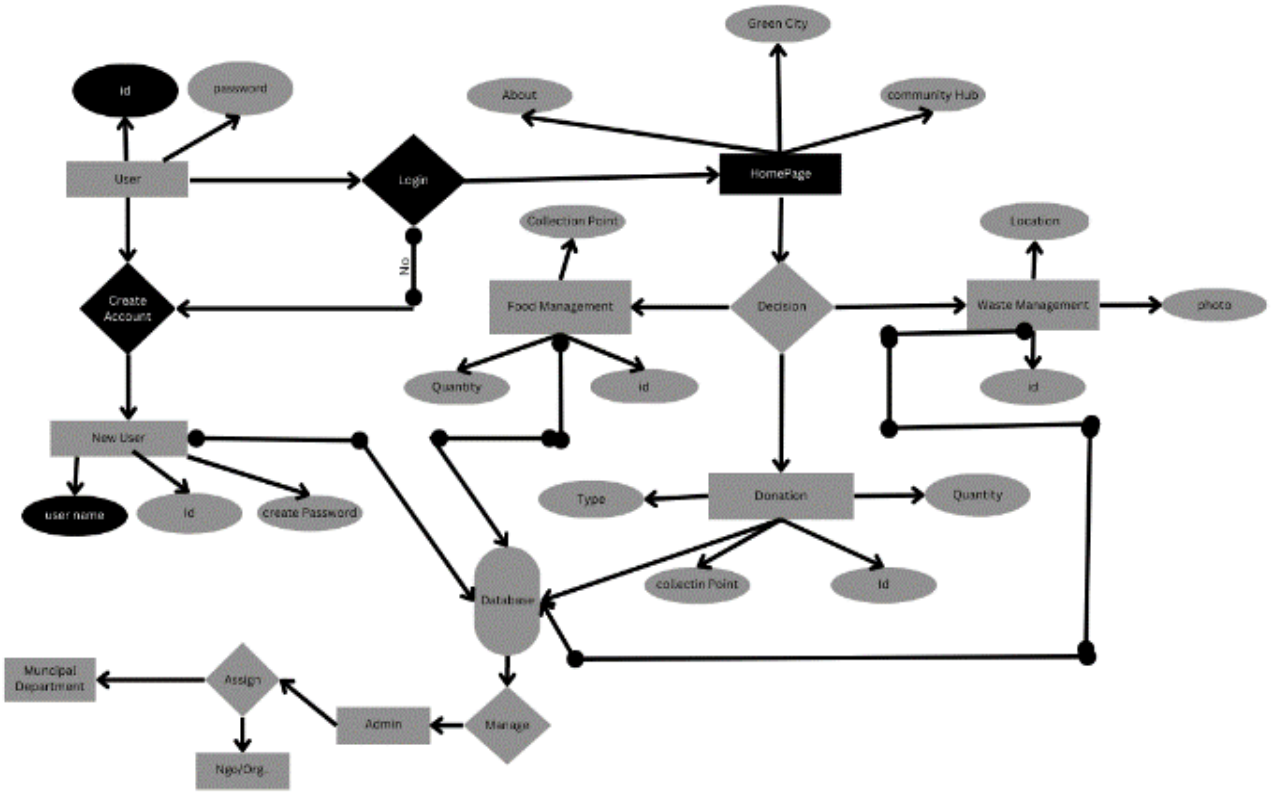

Fig.2. Website Working Blueprint

V. PROPOSED METHODOLOGY

We have utilized various methods and technologies mentioned in [V]. The functioning of our website has been divided into three distinct phases.

Phase 1: The user will interact with our website through the graphical user interface we have provided on the front end in a systematic way. Firstly, the user will register on our website, and their information such as ID, password, and email address will be securely saved in our database. Whenever the user logs in to our website, they can request for an action such as receiving leftover food, donating items, or reporting waste on roads or public places. Our website will ask the user to allow access to their current location because it is necessary for performing the requested action. After this, the user's work will be finished.

Phase 2: The admin receives the user request and collects their data such as username, email id, location, and type of problem from the database. Based on the type of work, the admin assigns it to the relevant NGO or authority. The admin then shares the location of the place where the action needs to be performed along with the type of work. The user's email id is verified and stored in the database to prevent fake requests. Any necessary

action against users who submit fake requests will be taken. The website itself acts as the admin, utilizing automation to enhance productivity and efficiency of the work.

Phase 3: The task assigned by the user will be projected on a page accessible only to authorized NGOs or government authorities on the website. Once the organization completes the task, they can close the request. To enable this feature, we will collaborate with certain NGOs currently engaged in such social work. NGOs like Robin Hood Army, Seva Kitchen, Toy Bank, Smile Foundation, and PepsiCo India are working towards contributing to the Swachh Bharat Abhiyaan through their 'Waste No More' initiative.

VI. CONCLUSION

In this paper, we conclude that our platform is a good approach for any user to make our city clean, fit for the poor society, and preserve the environment. Our application raises awareness about how we all can make our city smart by contributing just a few minutes on our platform. This application can also emphasize the Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission, a country-wide campaign initiated by the Government of India in 2014 to eliminate open defecation and improve solid waste management.

According to the viewpoint that "One-third of the food produced around the world is never consumed," we have included leftover food management on our website. This approach not only helps the poor people but also helps the government save money on the wastage of food, which is approximately 92,000 crore per year in India. With proper management, such food waste can be minimized. Therefore, our website will definitely help the society to make a better place.

VII. REFERENCES

[1] "DevOps," March 2020, page Version ID: 947885950. [Online]. Available: https://en.wikipedia.org/w/index.php?title=DevOps&oldid=947885950

[2] United Nations. World Urbanization Prospects. United Nations, Department of Economic and Social Affairs, Population Division: the 2011 Revision: Highlights. 2012.

[3] Environmental impacts of food waste: Learnings and challenges from a case study on UK Davide Tonini, Paola Federica Albizzati, Thomas Fruergaard Astrup June – 2018.

[4] Young et al., 2017

W. Young, S.V. Russell, C.A. Robinson, R.Barkemeyer Can social media be a tool for reducing consumers' food waste? A behaviour change experiment by a UK retailer Res. Conserv. Recycl., 117 (2017), pp. 195-203

[5] Who Clicks on Online Donation? Understanding the Characteristics of SNS Users during Participation in Online Campaigns, 23 May 2019; Accepted: 2 July 2019; Published: 4 July 2019.

[6] https://frontendmasters.com/guides/front-end-handbook/2018/what-is-a-FD.html

[7] https://www.geeksforgeeks.org/

[8] Swachhata-MoHUA developed by Janaagraha Productivity and existed on google play store.

[9]https://pompomtrashtocash.wordpress.com/author/pompomtrashtocash/

[10] Food Waste App OLIO Has Become A Lifeline For Those Who Can't Afford To Feed Themselves. Huffington Post (UK).

[11] https://nofoodwaste.org

[12] https://sevakitchen.org

[13] https://toybank.in/

[14] https://www.uber.com/en-IN/blog/chennai/

[15] https://krishijagran.com/agriculture-world/how-much-food-is-wasted-in-india/

[16] Li C, Qin Z, Novak E, et al. Securing SDN infrastructure of IoT–fog networks from MitM attacks. IEEE Internet of Things Journal. 2017;4(5):1156–1164

[17] https://www.javatpoint.com/servlet-tutorial

[18] https://www.simplilearn.com/tutorials/reactjs-tutorial/what-is-reactjs

[19] https://nodejs.dev/en/learn/

[20] https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-java-spring-boot/

[21] https://en.wikipedia.org/wiki/MongoDB

[22] https://www.h2database.com/html/main.html