Smart City Web Application for Business, Healthcare & Education

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Abstract

Through actively encouraging area development and utilizing technology, the Smart Cities project seeks to promote economic growth and enhance people's quality of life. The proposed system addresses the problem of 'Limited knowledge' for the newcomers in the city, by creating an integrated platform. The prototype provides immigrants, businesses, and health enthusiast's information like healthcare services, shopping landmarks, emergency helplines, news, and blogs in the city. In this paper, a single website platform is proposed with three integrated models of Healthcare, Business, and Education. This paper introduces a single website platform with three integrated models—Healthcare, Business, and Education. The healthcare model focuses on electronic health portals and administrative support services, while the business model enables exploration of opportunities and real-time news for informed decision-making. The education model offers comprehensive information on schools, colleges, online platforms, Olympiads, exams, and institutional details. A prototype website is built using React as a frontend with Nodejs used to make backend connections with databases. The prototype website, built using React for frontend and Nodejs for backend connections, ensures user-friendly interfaces with the latest information obtained through APIs. All the models are separately made and connected through React router dom. The proposed system provides a holistic approach, creating a centralized platform for essential city information and to create a go-to platform for acquiring it. The prototype's robust architecture ensures scalability, allows for adapting to the evolving needs of the city and its diverse population.

Keywords

Supply Chain, Streamlit, Thinkspeak, Dynamic data acquisition and analysis

1. Introduction

A developing nation can become developed once its people modernize and advance. Smart Cities have a great impact in this respect, which serve as markers for advanced economies [1]. Smart City Projects are being implemented around the world as a result of the introduction of new generation technologies and information-driven "intelligent" solutions. The concept of a smart city is not new, but recent advances in technology have made it possible to implement smart city initiatives on a larger scale. Cities and urban areas showed a large wave of individuals for seeking jobs, education and better lifestyle. At beginning they are not aware regarding the facilities, attractions, and services which are available inside the city. Innovation and technology can spur urban growth and create a better environment for residents to live in. By allowing the

development, sharing, and retrieval of lay information, various important fields like Business, Education, Tourism and Information centers can fully transform and be more user-friendly which can ease the citizens' livelihood. Smart cities can use a combination of sensors, Internet of Things (IoT) devices, and data analysis to collect and process large amounts of data. This data can then be used to optimize city operations, reduce costs, and improve citizens' quality of life. The use cases extend towards the healthcare part, where it presents new options to reach towards patients and other health care consumers [2]. Various information can be accessed easily using smart technology including traffic, pharmacies, parking, events providing a complete guide to the citizens and other users [3]. The idea can be extended forward with the progressive innovations, leading to the proposal of having a versatile platform for different residents of the city [4]. Keeping the aspect of reaching to people in mind, the mobile technology is among the most accessible by all types of users. It could provide a way to communicate between citizens and city authorities so as to facilitate collaborative process and digital participation in smart city [5]. Witnessing the rise of technologies, with the goal of making information access easier and spreading proper awareness among the users, the need to create a platform for the citizens arises. This will help in social security through fake news detection [6], CCTV surveillance in public places [7], automated fair evaluation of learners in education sectors [8], precision agriculture [9] activities etc. It can further assist people from various sectors and their needs such as medical, business dealers, jobseekers, and students with all those who wish to gain sufficient information of the city, increasing their awareness and boosting the economy of the city.

2. Literature Review

The various requirements of a city being developed into a smart city are a lot. Smart education systems are upgraded versions of contemporary educational information technology kept up by technologies like cloud computing, and the Internet of Things. The aim and challenge of a smart education system is big data applications. The paper conducts a study on the use of big data in intelligent educational systems, supporting the conversion of university information portals into service portals [10]. The idea of "smart education" refers to education in the digital age, which paves the way for the creation of smart cities. The aim of the paper is about smart cities and the steps that need to take to achieve them using cutting-edge technology like the IoT [11]. With the use of innovations like cloud technology, the Internet of things, and mobile Internet, smart educational standards provide ubiquitous network environments, cloud computing data centers, and multifunctional sensor technology. Several information services have indeed been launched using the Internet of Things and other application systems [12]. Zhu et al. provided a conceptual framework to assist students to get the knowledge, an idea of smart pedagogic and features of smarter learning are presented [13]. This paper provides a theoretical basis for the introduction of the Individual's Career Assistance System, the first revolutionary strategy in education (SCAS). It performs a systematic review of the literature to collect the information needed to establish the initial understanding of the solution design. An evaluation criterion was established to determine the most essential studies already published in the education sector, with a total of 40 sample articles qualified using this criterion

[14]. The other component of Smart City is Business, which is key to its development and economic advancement. The paper introduces an innovative idea about business. A technical solution is to develop a "business operating system" that will manage corporate operations across diverse organizational frameworks. Business processes would become portable. It offers a stimulating and fresh perspective and outlines the next research problems [15]. Langley et al. proposed an application that was designed and customized based on the various client groups. The person can locate every distributor who is prepared to sell the goods for which they have registered. Based on the customer's need, these marketing techniques differ from location to location, from moment to moment, and from product to product [16]. The goal of this paper is to establish a picture of the Internet of Everything can change enterprises' modules and methods through which organizations produce worth. It demonstrates the need for a better understanding of how the IoE will affect how to do business at levels [17]. Gaining a shared understanding of the definition of the smart city is the primary goal of the current study. Second, a summary of the study's findings is provided, including both opportunities and problems. Thirdly, the author discusses the primary business models that can be used for services, as well as prerequisites to beginning the shift toward services [18]. A website offers all the necessary information on a certain city, including tourist attractions, route maps, corporate settings, job boards, information about institutions that provide transport, lodging, and the city's overall history. These websites are designed to be easily accessed by all types of users, including students, jobseekers, businesspeople, tourists, etc. These advancements in technology make it easier for people to react rapidly and avoid accidents. The services offered in the city also have an increased in their market reach and get a bigger platform of people [19]. Another key component in Smart City is Healthcare. To introduce the idea of smart healthcare, the first major technologies need to be identified. An outline is provided for the current issues with smart healthcare and finally to offer solutions. Lalband et al. [20] evaluate current models in terms of providing the best SDLC model for Smart applications regarding healthcare that prioritize improvement. The paper also highlights the difficulties in performing research in software design for smart apps [21]. Recent research on each component of the model is presented, along with an assessment of its advantages, disadvantages, and applicability to a wearable IoT healthcare system are only a few of the difficulties that the IoT in healthcare must overcome. Recommended- options are also offered for future research paths [22]. Solana et al. propose some of the most important trends and areas of study that will have an impact on the field of smart healthcare in the coming years. To achieve this, it takes into account an approach that groups the research trends by how they manifest themselves throughout the data life cycle [23]. There is an urgent need for effective and practical health service app platforms that serve the elderly and young people to improve and promote smart health services [24]. The proposed system provides the importance of Smart city development. Healthcare, Business, and Education are the three epitome models needed in Smart Cities. This, being an important phenomenon for an organization's success, immense im- importance is given to them [25]. This paper realizes the importance of Business, Healthcare, and Education in the Smart City by proposing a website with 3 platforms to connect to all the people in need of these facilities while coming to a new city. The following section explains the methodology of our proposed system. This study-aims at the numerous components of a smart city. A framework has been given to get deeper insights into the concept of smart cities to minimize the literature gap between the

concept and its execution. The paper discusses how different elements can contribute to the success of the smart city initiative [26].

3. Methodology

The methodology employed in developing the Smart City website involves a strategic integration of technologies to cater to the diverse informational needs of city newcomers and residents. The website, designed to offer insights into the city for first-time visitors and those keen on gaining a deeper understanding, amalgamates three pivotal aspects—Business, Healthcare, and Education into a cohesive platform. The methodology is divided for developing a JavaScript application using React and connecting it with databases. The model works like a full-stack interface for Business, Education, and Healthcare as seen in (Fig.1). The database and information are all provided on the cloud, which helps the user to easily access them. This methodology guarantees a seamless and user-friendly experience, epitomizing the innovation embedded in the Smart City website's development. The algorithm is discussed in (Fig. 2).
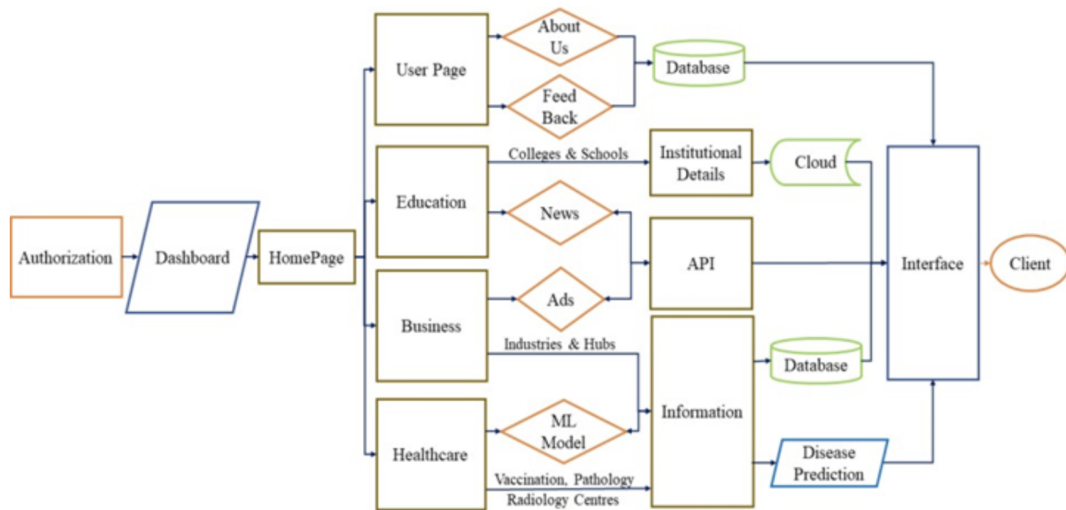
3.1. Block Diagram

Figure 1: Schematic of the model representing systematic flow of the proposed Smart City Website

3.2. System Setup & Requirements

PERN stack is employed to construct the proposed system. PostgreSQL, React Express, and Nodejs together make this PERN stack. It is stated to be a full-stack application and uses JavaScript/Typescript as the language and Mongo dB as the database. The application's front end is developed in React. The package manager for installing and changing NodeJS packages is called NPM (Node Package Manager).
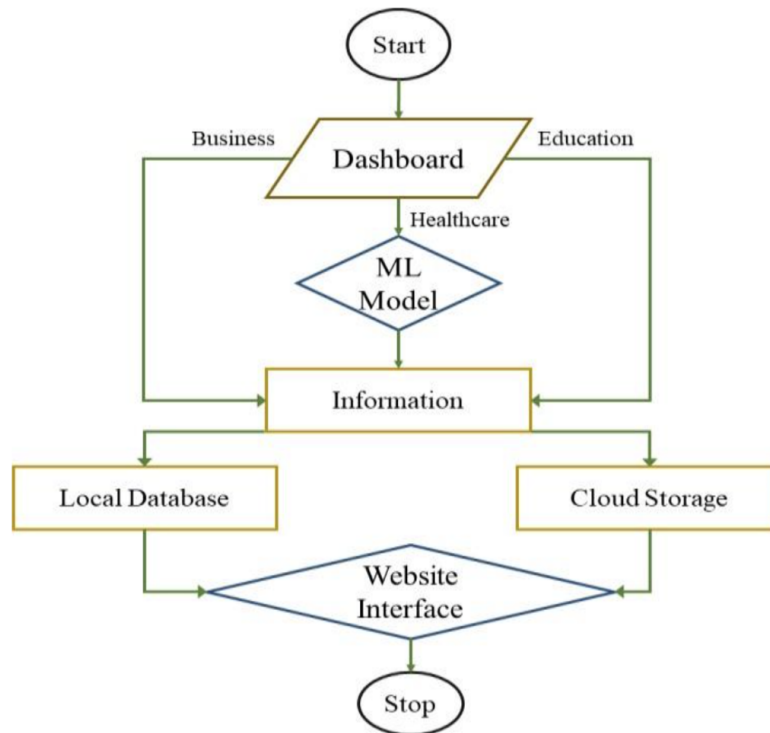
Figure 2: Website Flowchart

When a user first visits the website, he/she will be directed to the dashboard, which is further split into three modules (Fig. 3). User could access all three components of the smart city according to requirement. Each module gets directed to its information, where a user finds detailed information about the same. The information displayed is acquired from local storage or a cloud server. The education sector is connected with PostgreSQL local storage, where a user can access all the academic details and curriculum. The healthcare module additionally contains an ML model where a user will obtain the predictive analysis regarding a particular illness given the user's health. PostgreSQL is used to create a one-to-one connection between the user database and the frontend. After initialization, all the significant dependencies, including express, nodemon, mongo dB, etc, were installed. Using the command "npm-init," which launches a NodeJS project, the backend development process officially began. was initially set up in both microservices (frontend and backend; link in results and discussion). The procedure involved setting up a cluster and creating an account on the mongo dB website. A component library called MUI (Material UI) is used to build react components for the front end. To develop these components, a reference is made to the MUI documentation. Redux is the choice that is selected to do the job of managing the application's overall state. A global store, reducer, and controllers are components of the global state management solution Redux. The creation of an authentication system was the following feature or task. We are utilizing Firebase as the authentication system provider to simplify the codebase. We can integrate the application using

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Firebase's many capabilities and functionalities. From a UX standpoint, Google authentication is a crucial feature. Additionally, connected with Firebase is Google authentication. Another feature offered by Google Firebase is cloud storage.

3.3. Module Descriptions

Business module is made which contains business related information. For storing all the business-related information, we have used mongo dB as the storage. The website provides users with Ads regard to business and industries according to the users' demands. The platform allows customers to add their details for selling their products and real-estate properties. Brief information is provided for Industries and hubs with their location over the website. Axios which is the promised based http client for JavaScript is the library used for getting all the information related to the api from the News-Api website and storing them in them as objects in the articles. For showing the various information got from the api in a user presentable way, we use React. Firebase connection is done to connect the two models and a successful login page is built. There is an urgent need for effective and practical health service app platforms that serve the citizens to improve and promote smart health services. The healthcare module facilitates this by providing a platform where a user can enter his health symptoms and receive a disease prediction related to it. An ML model which is cross-platform and uses a collaborative filtering as a tool for recommending respective Healthcare authority. Additionally, the module includes user information and all the data that is required for hospital visits. We created a MONGODB schema for it and utilized the primary and foreign key-based mapping to map the user.
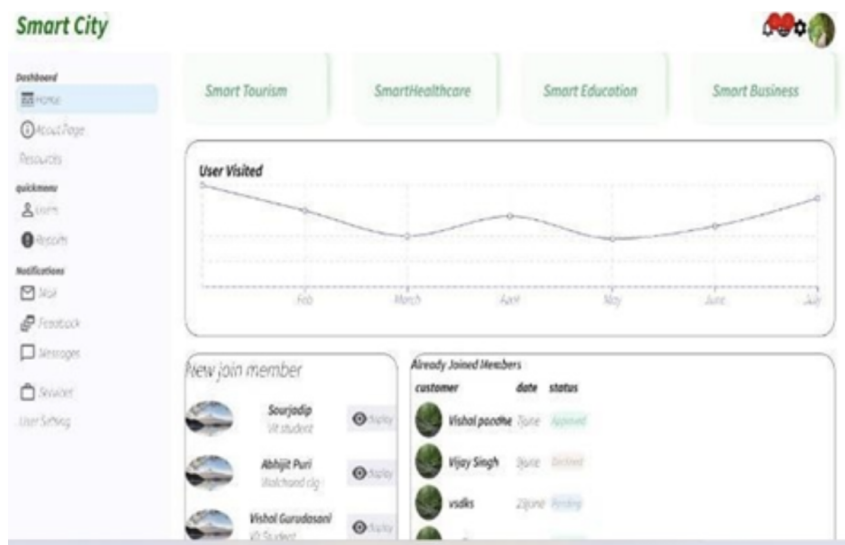

Figure 3: Website Dashboard

The education website does have several different pages, making it a multipage website. PHP is employed in the login page's implementation. While the user tries logging in, PHP connects to a database that saves the user details and verifies if whether the user is present or not. An

error message appears if the user credentials are incorrect.

Once the user successfully logs in, a new session is started, and it lasts until the user logs off. The HTML and CSS used to design the website's front end are called Bootstrap and Sass. To improve the user experience, the interface has been kept straightforward and uncluttered. It is divided into categories like about, experience, contact, services offered, header, and footer. Thus, accessing the website's many sections is simple for the user. The website's news page is made up of asynchronous communication between the website and the News API, which provides a variety of news. For retrieving the technological news, a unique API key is created. Form and form action is available on the register-contact page. The client-side calls into and validates the PHP form. The PHP connects to a database with exam details after the form is submitted. This is displayed in a table's new route. The session is over when you click.

The website has been built as an interactive dashboard where users can enter increase their awareness and gain adequate knowledge for the interested domain. The user can easily reach out to authorized persons through the contact details or the feedback and review section provided on the website.

4. Results and Discussions

The administrator provides user access to the Login and registers on the page as seen in (Fig. 4). The main page includes information about local news, medical facilities, and business-related topics. The data will be managed and stored on the web page, being updated daily by the administrator. At first, the user needs to sign up on the page providing user information such as his or her user's name, phone, address, email address, and secure password.
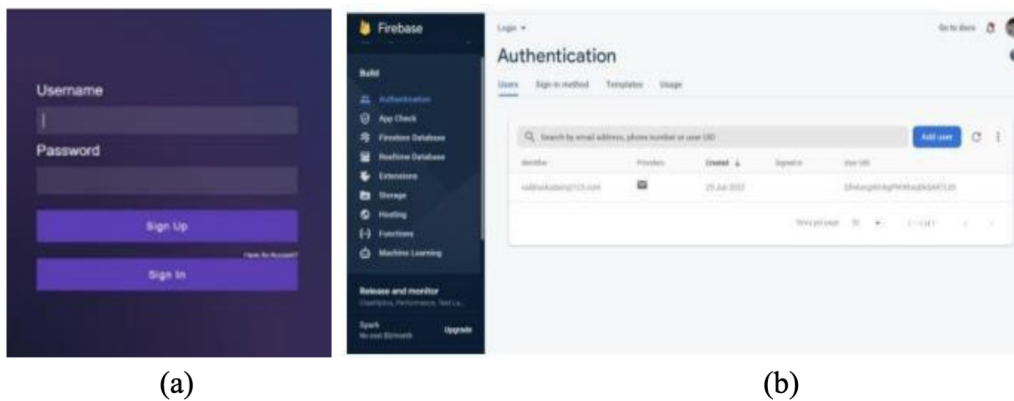

(a)   (b)

Figure 4: (a) Firebase login model (b) Firebase User Authentication system

The frontend implementation of the business model and its main portions are directed in (Fig 5). The user can discover business possibilities and live business-related news from a variety of sources, before coming to the city. The platform aids companies and marketing agencies to display their products through Ads to increase their reach. The outcomes are evidence of

proper news retrieval from the API, as shown in (Fig 6).

The user can then make decisions based on the knowledge they have gained about the various hubs, trade, and industry. With this, a user will get an understanding of how the business sector is thriving in the city.
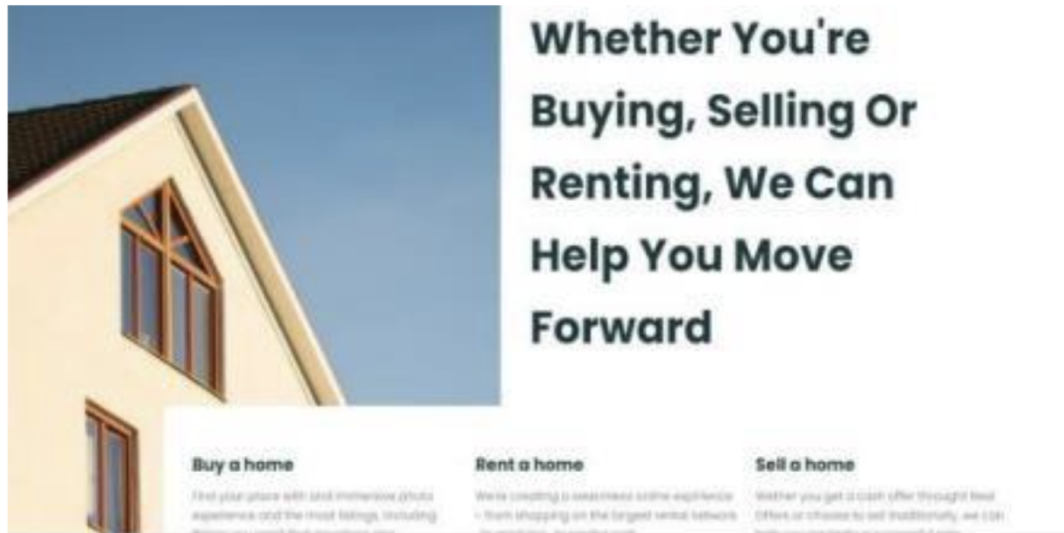

Figure 5: Frontend Page for the Business Website

Figure 6: Business News Page

Based on the services offered to users, the E-healthcare systems are primarily divided into three types:

- People's access to e-health services and tools includes the ability to supply information

through electronic health portals.

- In order to give users with health services rather than just electronic data like e-Prescriptions, Administration, and e-Results, administrative of E-Health support services and tools are administered for many individuals.
- ML model, which recognizes a particular illness based on symptoms. All inter-faces of the proposed website are shown within Fig (7 and 8).

Figure 7: Front-page for E-healthcare

Figure 8: About us page for E-healthcare.

The educational website is divided into various subcomponents. The students can access the education website for School & College details in the city as shown in (Fig. 9). The students also have access to various free online platforms for books, lectures, and blogs. A list of Olympiads, and other important exams, is provided. Additional news and institutional

information can be acquired, helping the students to get a preliminary understanding of the educational environment of the city. The front page for the website can be seen in (Fig. 9).
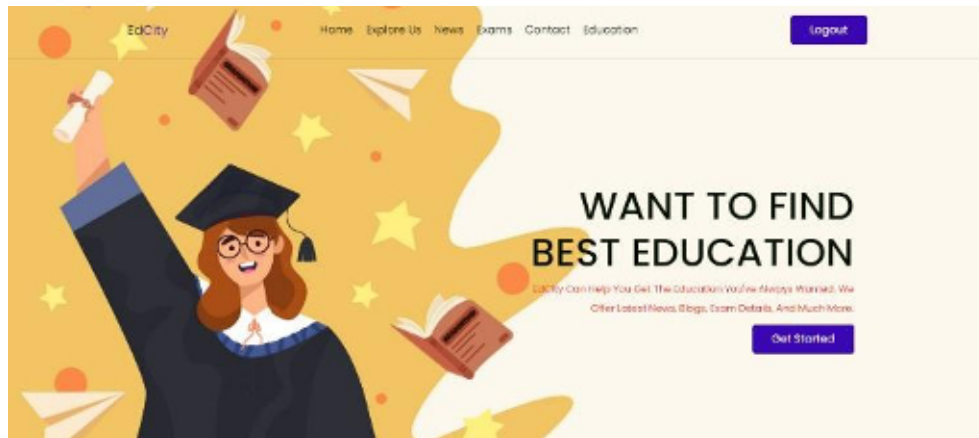

Figure 9: Dashboard for Educational Website

Login page for E-education is depicted in (Fig. 10) with query selection on Post-greSQL database.
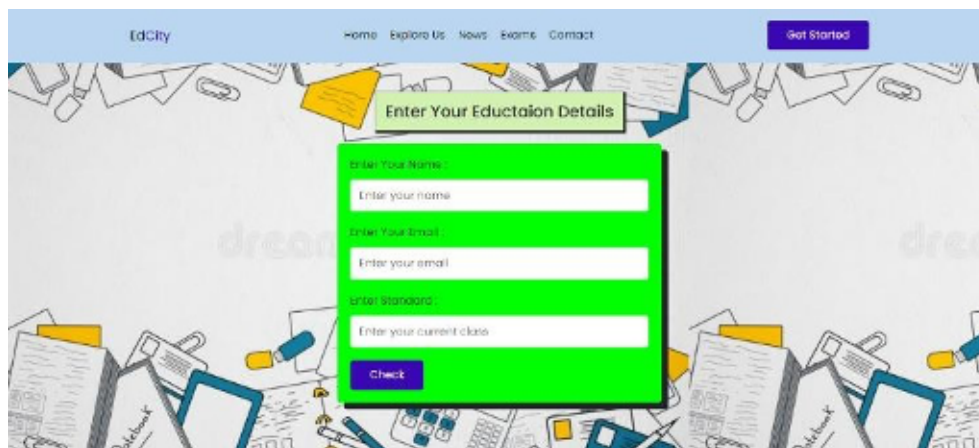

Figure 10: Education Website Query Checking and Registration form

The system provides a comprehensive and user-centric approach to city exploration and acclimatization. Unlike conventional platforms, the Smart City website addresses the diverse needs of newcomers and residents alike by seamlessly combining three crucial dimensions of urban life—Business, Healthcare, and Education. The healthcare model stands out with its incorporation of electronic health portals and administrative support services. The business model introduces an innovative paradigm by enabling users to not only explore business opportunities but also stay abreast of real-time news, facilitating informed decision-making and amplifying the visibility of local businesses through Ads. Additionally, the educational
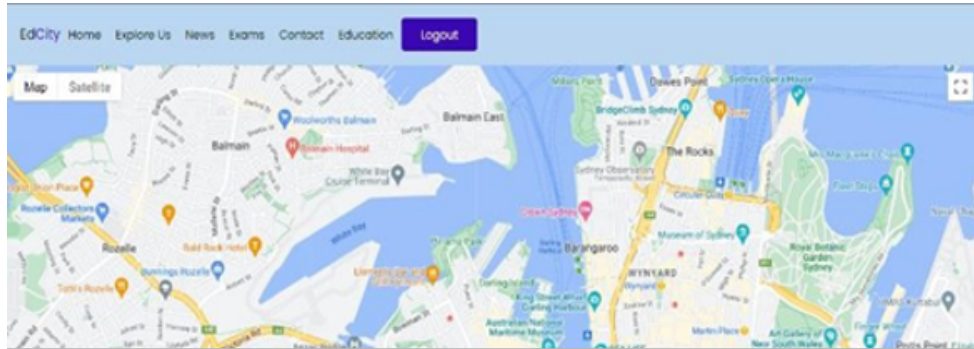
Figure 11: Education sectors within a given location

model provides students with an extensive repository of information on schools, colleges, online platforms, Olympiads, exams, and institutional details, fostering a holistic understanding of the city's educational landscape. This amalgamation of vital city components in a single, accessible platform establishes the system's novelty, offering an unparalleled resource for individuals seeking a dynamic and informed city experience.

5. Limitations

It is crucial to recognize the limitations and strive towards resolving them. The shortcomings of the system include the requirement for network connection. The system doesn't cover all the required modules in smart city like Tourism. The ML model used can predict few diseases, which is lacks in providing proper justification for the patients' diseases. In the authentication system, there is a lack of common identity verification for the citizens.

6. Conclusion

The key component of a smart city is to concentrate on numerous issues involving governments, companies, organizations for research, institutions, and hospitals in the technical features of smart cities. Here, we advocate for the admin a better understanding, question residents about the situation and comprehension with citizens. After discussing smart city topic commonly with citizenries, researchers can find a more direct method to find pertinent. We have covered a lot of ground in this post on immigrants to a specific city, including information on the business, healthcare, and educational sectors. It will be a useful tool to acquire a comprehensive view of a given city. These smart city online applications are simple to use to obtain and comprehend information. Once the user register and provide their username, mobile number, and provide a good password to safeguard the data from others, they are all set. The user can log in using their username and password, to visit the page wherever and anywhere they like. Such smart cities Applications improve and modernize folks' lives. The people can use this website to access any information about the city, including local news, organizations, and hotels. So accessing it is simple and sensible. Previously, whenever we travelled to unfamiliar locations, we would

hire a guide, but today we don't need a guide to travel anywhere in the world. It is especially beneficial for students pursuing higher education given the locations of their universities, and they are new in the locality. More functionalities can be added to smart city web application like tourism, other locality description, and food centers. Also, web scrapping and machine learning concepts like sentiment analysis and user recommendation based on user activities could be provided. Finally, implementation through mobile apps could be done to better increase the connectivity with the users. The prototype of the idea has been created and is a boon for people living in different cities.

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