Monitoring Online Operating Fuel Management System

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ABSTRACT

Online fuel station management system makes it easy to manage their work systematically. We used the mern stack to develop this system. In this web application admin can log in to the system and manage functions like employee management, fuel management, order management, inventory management, weekly fuel queue management, supply fuel management, payment management, and vehicle management. Only the admin can log in to the system. Admin can add employee profiles, and employee can see their profile. Also, the user can create a fuel pass and log in to the fuel pass page. Users can see relevant fuel passes and qr codes. They can download and print fuel passes, and users can see how many fuel liters they can get. Users can also order special fuel orders and see order status. In vehicle management, the admin can manage vehicles. Also, the user can see fuel details and new prices. Admin manages inventory and storage of fuel tanks. Also, admin and user are very easy to use in this system.

Keywords-- Fuel Management, MERN Stack, Online System

I. INTRODUCTION

Since the beginning of 2022, Sri Lanka's economy has declined drastically due to a shortage of foreign currency. For this reason, the price of goods imported from abroad has increased dramatically. Also, when the fuel price increases a lot, due to the lack of foreign exchange required for fuel imports, it is impossible to import fuel as per the requirement. For this reason, people had to queue at fuel-filling stations all over the island.

People had to queue for days to get fuel. Also, some cases have been reported of people dying in queues due to illness. Although the fuel price increased continuously, it was only possible to get fuel per the requirements. For this reason, people began to collect and store fuel in large quantities. Also, the stored fuel was sold at higher prices by sellers. In this case, the crisis escalated significantly due to the government's negligence. As a result, getting fuel for essential services such as transport or health services will not be possible.

Due to these conditions, people staying at petrol stations behaved violently and damaged property. The situation was exacerbated by the illegal hoarding and selling of fuel at high prices. It was challenging to control the conflict because the government had not provided a satisfactory solution, and the people were gathering fuel. In this case, the efficiency of gas stations was severely affected. Handling people in queues also made it difficult to carry out the daily process at the filling station. Also, waiting in queues wastes a lot of people's time, and the filling station must wait in queues even if there is no fuel. Moreover, people had to wait in huge queues, wasting time due to a lack of awareness about the current fuel remaining at the filling station.

Considering these facts, we decided to create a new technological solution to manage fuel-filling stations. This technical application contains the day-to-day operations of the gas station, such as employee management, fuel storage management, inventory management, lubricant management, Etc. Through this web application, the customer can: know the prices and information of fuel online, get an idea about the amount of fuel already left at the gas station; decide whether to wait in the queue; register, and use the token system to get fuel. Also available. Furthermore, this makes it easy to manage the day-to-day operations of the petrol station.

This application can use to reserve a token in the queue online, thus reducing the number of people coming to the filling station and thus increasing the efficiency of the filling station. We followed a formal procedure in this token system. When registering for the token, this application only provides fuel to one vehicle once a week. When trying to get the token twice, the application detects and discards the request. Therefore, everyday people can manage their time, and it is also not possible to improperly store and keep fuel.

This application can use to manage other work in petrol stations. For example, connecting the tanks that maintain fuel reserves at the gas station with this application makes it possible to know the number of fuel reserves currently remaining at the time of need. Also, this application lets the customer know if the fuel is available at the fuel station. Also, by connecting to the application via the Internet, the customer can know the fuel in the gas station. For this reason, the customer can decide whether go to the gas station to get fuel or not. Due to this, the customer's time saving, and the fuel stations can do the work efficiently.

Using this application makes it possible to manage the vehicles belonging to the petrol station. This application could do the employee management of the petrol station. This application has also facilitated the fuel station's ability to store and manage new fuel orders. The application can also manage other lubricants sold at the petrol station.

According to expert reports, Sri Lanka's current economic and fuel crises will continue for several years. Therefore, this application is suitable for all gas stations nowadays. Furthermore, this can be used to increase the efficiency of petrol stations. Further information about this is discussed in the following inspection report.

II.   LITERATURE

As a result of today's economic crisis, the price of fuel has risen, and there is much scrambling to get fuel. Recently, the Government of Sri Lanka introduced the QR Code concept [1]. This was an excellent solution to control oil demand. In this online fuel management system, fuel stations can give a QR Code unique to each other. Anyone can easily download and print the QR code using the correct credentials. There are currently Companies in the country that supply fuel to special needs [2]. Anyone can order fuel for special needs in this system by filling out a form. The user can see the order status assigned to the requirement. It is only accepted if it is a requirement that is important. It can control the amount of fuel released in a day. Also, this system manages remaining fuel stocks and new fuel stocks. That way, the admin can get an idea about the amount of fuel remaining and the amount of fuel that needs to be imported. Today we can use the Hela kuru App to learn about fuel details [3]. In this system, the admin can add current fuel details, and the user can see Currently available fuel types, fuel prices, and how many remaining fuel liters. This gives excellent convenience to the user. In Employee management systems, the admin can add new employees [4]. In this online fuel management system, the admin can Add a new Employee profile to the system, and the employee can see the Employee profile using the correct credentials. The employee can see their details,

salary, and designation. This system handles Payment Details. It supports managing very successfully rather than bill writing techniques [5].

III.   METHODOLOGY

A methodology was created using the information in the literature and the expertise of one of the writers actively involved in creating web applications.

This application development is based on the waterfall methodology, the simplest software development methodology.
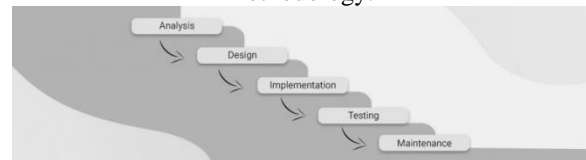

Figure 1: Waterfall Methodology

Under the waterfall methodology, this process structure is under 5 phases.

Phase One – Analysis

The topics of phase one are formulating a web strategy and examining how a website may implement this plan. According to several researchers, the two primary causes of software project failures are a lack of support from top management and an incorrect understanding of the system requirements. By establishing specific strategic goals and objectives and then creating a system to attain them, Phase One tries to lower these risks.

The developed strategy is to be released in a Strategic. The planning Document outlines three core elements that describe the site's goals.

Under analysis phase mainly consider about following criteria:

Technology Analysis - identification of all technological elements and equipment needed to build, house, and maintain the site

Information Analysis - whatever information that the user needs to be identified, whether static (on a web page) or dynamic

Skills analysis - a list of all the different skill sets needed to do the job.

User Analysis - Compared to traditional IS development, this is a significantly more complicated process because of the variety of users and technology.

Risk Analysis - thoroughly examines any significant dangers connected to the site's growth.

After this analysis, a more specific set of goals can be recorded. Any goals that are not currently achievable are listed in a Wish List that is a component of the Objectives Document. This will later be included in the iterative process during the methodology's subsequent cycle.

Phase Two – Design

The development process can proceed to the design phase after the analysis phase is finished, which is guided by the Objectives Document. Websites can quickly become unmanageable as they develop incrementally and frequently need more effective design architecture. The website should be created with the understanding that it will likely undergo additions over its lifespan as needs change and new technologies are developed. The iterative procedure used in the methodology accounts for this.

There are two primary tasks involved in website design:

Information Design: this might be as straightforward as creating a collection of hyperlinked Web sites, or it could entail creating a database script to handle more complicated data structures or procedures.

Graphic Design: The program's "look and feel" is created with the target user in mind. This process involves designing the screen layout, colors, graphics, animations, and other elements.

The design is immediately tested to find any inconsistencies or flaws because testing early in the development process is much more cost-effective than testing the coded program. In order to determine whether the system can satisfactorily create the information requested by the user, this stage entails comparing the Website design to the goals and objectives outlined in the first three processes above.

Design Technologies:

Phase Three – Generation

The methodology's third phase, guided by the design document, focuses on creating the website. This phase has the most critical four facts. Those are:

Resource Selection: During this phase, all the resources required to build the site, including the required staff, communications lines, hardware, and software, will be chosen. There may be a need to integrate a variety of servers and apps, so it is essential to check the technical requirements to ensure compatibility.

Design Review: The design can be implemented from the resources chosen. The Design Document from the Phase is compared with those accessible in the previous stage. The Design Phase and Resource Selection are examined if incompatibilities are discovered. Phase One can be revisited if issues occur because this is an iterative process.

Code Generation & Installation: All the site's associated software is created during the coding phase and installed on the appropriate Web servers. This could upload the website to a Web server or entail more demanding activities like connecting databases.

Testing: Reach the broadest possible audience. The website must be tested in as many of these settings and technology configurations as feasible.

Phase Four – Implementation

The implementation phase is ongoing and lasts the entire duration of the website's existence. Despite being one of the simplest, this phase is undoubtedly one of the most crucial.

A website must be noticeable, and its content must be regarded as valuable to attract repeat visitors.

The website's target audience must be aware of it to be implemented entirely. Therefore, the site should be registered with the major search engines at this time, along with any other advertising strategies like alerting relevant newsgroups.

IV. TECHNOLOGIES

The development process of this application is based on MERN stack technologies' stack means:

M-MongoDB (Database)

E-Express (Framework)

R- React (Frontend)

N-Nodejs (Backend)

Database:

MongoDB is used as the Database for our web application. Using MongoDB can provide many benefits to a software development team. Its flexible schema makes it easy to evolve and store data in a way that is easy for programmers to work with. MongoDB is also built to scale up quickly and supports all the main features of modern databases, such as transactions [6].

Frontend:

Frontend development is done by using ReactJs. ReactJs is a JavaScript language with many important inbuilt libraries. Also, we used MUI (Materiel UI) for further UI design. It made the application further user-friendly.

Backend:

Backend development is done by using ReactJs. Node.js is a platform built on chrome's runtime for easily building fast and scalable network applications. Node.js uses an event-driven model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices [7].

Framework:

We used Express framework for developing the backend using Nodejs. Express is a node js web application framework that provides broad features for building web and mobile applications. For example, it is used to build a single page, multipage, and hybrid web application. Also, Express JS builds API's web applications cross-platform mobile apps quickly and makes Node Js easy [8].

V. PROPOSED SYSTEM

Fuel Pass Management

The new Concept of unique QR codes is a solution to control oil demand. In this system, any user can get his unique QR code after registration. Also, users can find out how much fuel can get there and how much remaining fuel is liters. The user can log into the system with the correct credentials when they need to retrieve the QR Code. Users can print or download QR codes. Admin can scan QR Code and log into fuel pass and view details. Also, the admin can edit and delete fuel pass details. As well as admin can create a fuel pass. Those all details are deleted during the week. There, the number of fuels in the fuel pass is also set to be updated. The system needs to manage users and save time. This online fuel management system will use user-friendly UI designs and easy navigation. So the user can easily understand those things, and the user can be easy to find them.
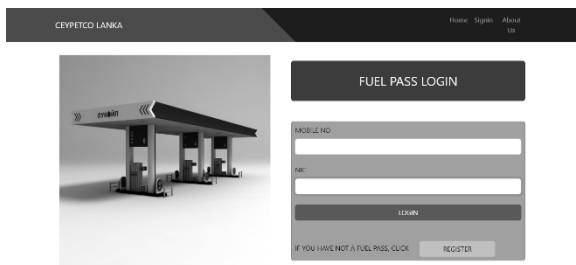

Figure 2: Fuel pass login page

Figure 3: Fuel pass Details Page

Order Management

This is used to systematically distribute and requisition the quantity of fuel when there is a government or private festival or other special occasion. This fuel management system allows users to request fuel by filling out a form. After entering the company's details, filling out the form, and submitting it, the admin can see it. Admin can accept or reject it based on its priority. Also, Users can see the received status of their requests. This online fuel management system will use user-friendly UI designs and easy navigation. So the user can easily understand those things, and the user can be easy to find them. This is a critical function that controls the amount of fuel that is released for free per day.

Vehicle Management

The vehicle management system is designed for managing fuel-transporting vehicles in the fuel station. The application can store data from this function in every fuel-transporting vehicle, including vehicle number, chassis number, Etc. We can use these forms of data to manage fuel transport by adding new vehicles and updating and managing data. This is the best way to keep the data of the vehicles used in the station. To design this function in the application, we used a user-friendly manner for interfaces and color combinations for easy use by the user.
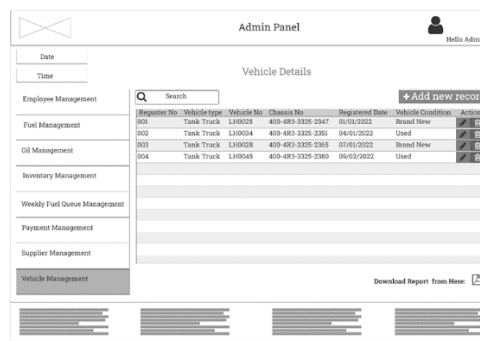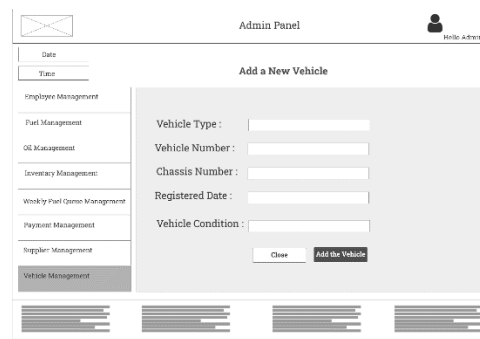

Figure 4: Vehicle Details Page

Figure 5: Add new Vehicle Page

Supplier Management

Supplier management manages and controls the suppliers who supply fuel to the station. This is one of the significant functions of the application. Here, we may manage supplier information and register new vendors. With this feature, we can correctly keep supplier data instead of simply recording it in the books. Additionally, data can be secured and protected in this manner. Additionally, this program makes it easy to obtain all previous data.

Fuel Request Management

This is the primary function of the application. This function is the function that requests the fuel supply for the station. This function asks the system's registered providers to provide fuel. This is an efficient and accurate approach to supplying fuel before fuel limits are entirely

lowered. Additionally, suppliers received an email from the station after completing the request successfully and automatically. The calling and request mechanism that was previously used in the gas station was improved by this method. This is more successful and effective than the first one. This feature is provided to users of our app beneficially.

Employee Management

This system has allowed making all tasks easier for the admin. Employee Management Function, Only the admin can log in to the system using the correct username and password. Admin can Add employee profiles by filling out the form correctly.

Also, the admin can view the employee details page. As well as admin can Edit employee details and the admin can delete Employee details. Furthermore, the admin can search for Employee profile details using some values. Also, the admin can Download the Pdf Employee list.

After Adding to the system, any employee can see their employee profile after submitting the correct NIC and Mobile Number. In addition, the employee can quickly see their designation, salary, and other details. We included easy navigation, Suitable UI names, and a button color theme. In addition, we created a User-friendly UI and followed capital letters for Every first letter.

This is important because employees can easily log in and know their details from employee Management. In addition, because all functions are managed, this function is precious in the system.
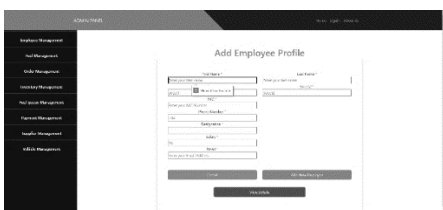

Figure 6: Add Employee Profile Page

Figure 7: Employee Profile page

Figure 8: Employee Profile Login Page

Payment Management

The payment Management Part is significant in any system. Payment Management Function Admin Can Add Payment details by using the filling form. In addition, the admin can see All the payment details and can edit and delete Payment details.

In this function, the admin can manage Payment details very securely. Of course, all the payment details must be kept from the system, but if the admin wants to delete them, the admin can do it. However, all the deleted details get inactive status in the Database.

It is significant for the safety of the system. We included easy navigation, proper UI names, a button color theme, button icons, and setup capital letters for Every first letter.
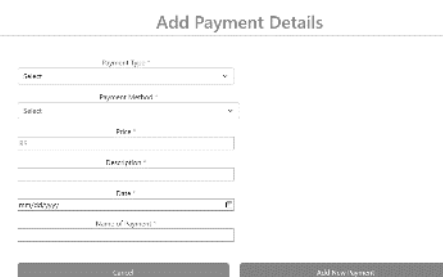

Figure 9: Payment Details Page

Figure 10: Add Payment Details Page

Fuel Details Management

Fuel prices are constantly fluctuating here in Sri Lanka. Therefore, customers can use this system to find fuel prices and information. With this application, the customer can quickly know the date of the last fuel price update and the current price. The admin of this system can quickly enter the information into the system and remove the information from the system when necessary. The

currently entered fuel information can be updated. The information and prices of the available fuel stocks are obtained as a PDF or printed copy. The customer can quickly know the prices of fuel.

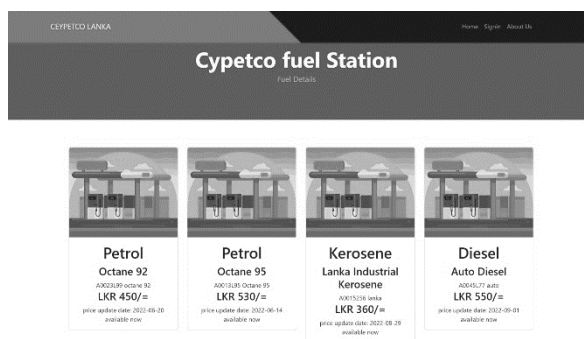**Figure 11:** Fuel details Page

Figure 12: Fuel type details page

Inventory Management

This system allows the day-to-day operations of petrol stations to be easily managed. This application includes an inventory management system. The information about the fuel unloaded at the filling station can be stored in the Database. Admin can use this application and can store the amount of fuel received at the petrol station. Using this application, users can easily update the current information in the Database. The quantity and information of newly unloaded fuel at the gas station can be entered here. This application has provided facilities to search for the existing data in the Database. Also, the data in the Database can be obtained as a printed copy or PDF document. Only admin or authorized workers can access the option of the system.
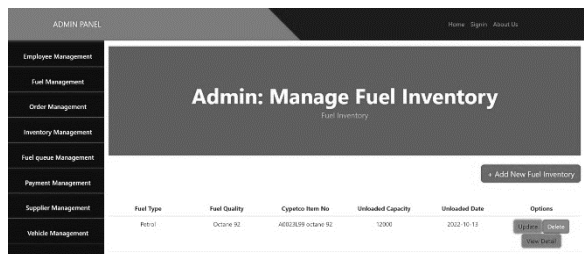

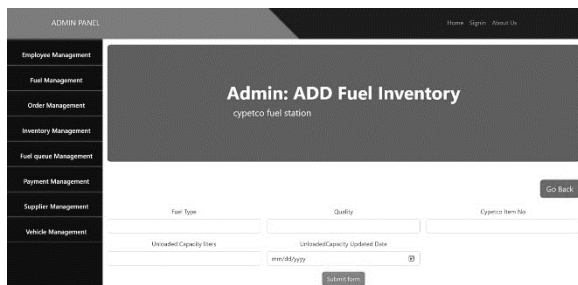**Figure 13:** Fuel inventory details Page

Figure 14: Add Fuel Inventory Page

Storage Management

The application provides an option to manage fuel station storage. Admin or authorized worker can add new storage, update storage details, or remove storage details from the system. Also, this application has the facility to check the available fuel capacity in the storage by connecting the tanks that maintain fuel reserves at the gas station with this application. It is feasible to know the number of fuel reserves currently remaining at the time of need. If there is a need for more technical parts, the application provides a manual way to update the remaining fuel in the tanks. Admin or authorized worker can check the amount of the available fuel capacity level in tanks and insert and update the Database manually. Only admin or authorized workers can access the option of the system. Also, customers can assess only the fuel capacity view page on the front end. At the end of the day, the admin can generate a pdf report about the available fuel capacity in the fuel storage.

The user of this program can also find out if there is fuel at the gas station. Additionally, the consumer can access the program via the Internet to learn how much fuel is currently in the gas station's tanks. Because of this, It is dependent on the client to determine whether purchase fuel at the gas station. As a result, the consumer saves time, and the gas stations can quickly complete the task. Therefore, according to the current situation in the country, this application feature will help customers to save time.

VI. DISCUSSION

We began the survey to find a solution to current issues in fuel stations present days. We collected data and ideas from the fuel station owners and some vehicle owners. According to the survey, we can find out about many more issues than we thought. For example, we only thought about reducing the polls and managing fuel inventory in the station. However, after surveys and research, we can find issues like maintaining the supplier details, employer details, fuel tank details, Etc. Therefore, we planned a complete application that fulfills all the requirements and issues faced by the fuel stations.

Therefore, overall, we can give solutions for fuel stations from an Online Operating Fuel Management System.

Table 1: represent How it used to be and how our fuel management system was made more accessible

Regular process	Process of our Application
Fuel has taken to vehicles according to the place of the polling. Issue: • So much traffics on the roads, some people got ill and died to protect their place in the polling, wasting the time of the people, and some people fighting in the polling	We provide a QR code Advantage: • Reduce poling and traffics, being able to save the time of the customers, reduce struggle between customers and station workers
Writing supplier details in the books Issue: • Maybe lost or damage documented data from fire or other disasters	Enter supplier details database through forms in our application advantage: • Data may be protected and can be backed up when we want)
Inventory checked manually Issue: • Workers need to check alert every fuel machine if fuel inventory decreased	Inventory data can be viewed through an application, and request fuel can be through the application Advantage: • Quickly and successfully maintain the inventory and supply continuous fuel supply.

VII. CONCLUSION

Online Fuel Management System Admin can handle all the management systems. The employee can see the Employee profile using the correct credentials in this system. Users can order special orders, and they can see the order status. Also, users can generate fuel passes and download QR codes. As well Users can see fuel details and fuel prices. We can reduce fuel queues, save time, increase accuracy and efficiency, and reduce illegal fuel dealing. Those are the importance of this system. Users can know about price details daily. Also, Users can get fuel using a QR code. It is a very new technology in Sri Lanka. We used MongoDB, React.js, Express.js, and node.js to develop this web application. We used Azure Boards for planning and managing the project and a version control system like GitHub. We will use SonarQube to check Code Quality and Selenium for testing the system. We plan to deploy this system in a selected area. If it succeeds, we hope to establish the system island-wide.

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