Sri Lanka Institute of Information Technology

Solar Power Management System

Project Proposal

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1. <u>Background</u>

B Tech Solar Solutions Pvt Ltd is a newly opened electrical contracting company situated in Kottawa, Sri Lanka. the company is dedicated to providing quality electrical services and knows the importance of doing the job right the first time.

The company currently offer affordable solar installation options for commercial and residential properties, providing you with the latest technology and financial incentives. and also the company offers an amazing LED retrofit program that requires no upfront investment and starts saving money on day one. the company works hard to promote renewable energy and energy efficiency to create a better environment, increase sustainability and improve the local economy for everyone.

currently, the company runs a manual system where all the employees collaborate with physical data transfer techniques and databases. thus it has many operational issues as well as other management issues when performing front desk operations. our client is expecting to get the SRI LANKA SUSTAINABLE ENERGY AUTHORITY'S (SLSEA) approval in the near future. Hence having a computerized system will be beneficial to getting the approval. for the above-mentioned reasons, the client requires a computerized management system to be established in the company. From the proposed system we intend to develop the client's desires to Increase performance and manage all the operations in the company efficiently.

2. Problems and motivations

2.1 Problem Statements [1][2][3]

01) An inconsistent data-entering process

Data inconsistency occurs in the proposed system because there is a problem with entering the same data several times when there is a large amount of data to be inserted.

02) Low security

When manually entered, the data is accessible to everybody. Customers typically provide their personal information when purchasing equipment, therefore if the data is not secure, it can cause a number of problems.

03) Manual Record Keeping and poor record storing facilities.

We've noticed that this company has kept a lot of manual records of their customers over the last few years. As a result, they were unable to conveniently navigate and maintain their previous customers' records.

We discovered something that most companies do not care to investigate: the warehouse management system. There are considerable inconsistencies between the buyer and the provider as a result of poor database administration and storage handling. This is a disgrace to the entire industry. Many organizations frequently neglect this essential component, resulting in low output and bad feedback.

04) Physical Payments

With the development of technology, the use of credit and debit cards is becoming more and more widespread. Even with the proliferation of mobile devices almost everywhere in the world, but here in the company, We observed that the customer must contact the company manually to make necessary payments.

05) Tough to compete with opponents.

Using a manual system makes it extremely difficult to compete with other hotels since, as society and technology advance, people are increasingly yearning for automated methods to do tasks quickly. As a result, they will focus on hotels that employ computerized systems.

06) Harder to obtain SRI LANKA SUSTAINABLE ENERGY Authority clearance (SLSEA)

Although a manual approach has several drawbacks, our customer wants to obtain the SLSEA's approval. Gaining the SLESA's approval would yield better recognition.

07) <u>Fast Tech Growth</u>

As Sri Lanka moves toward being a technologically viable country, both our business and labour workforces must keep up with the times and adopt new technologies. Notwithstanding its low level of technology literacy, Sri Lanka must avoid going further down the rabbit hole.

2.2   Solutions

01) <u>Online Database for Realtime Updating and Backups</u>

In the proposed system the employees should not worry about record keeping and backups due to everything being cloud-based and real-time updating and concurrent backup processes.

All the details regarding payments, Customers, employees, orders, delivery and Transportation, promotions and offers and details of inventory will be stored in different databases so that It's much easier to retrieve data when the company is seeking specific information and also by having separate databases will allow reducing data duplication.

02) <u>Standard Warehouses and Cloud Computing</u>

Warehousing, in technical terms, refers to a place in the system where products are held or stored. Warehousing has become significantly more advanced and complex over time due to its adaptability. To offset this, more attention is being placed on the warehouse's role in attaining product goals such as shorter cycle times, lower costs, lower inventory, and improved customer service. It is currently being redesigned to meet the needs of both buyers and suppliers.

03) <u>Contactless Payment Methods</u>

Online transactions have become more common in the digital age. Ever since the pandemic arrived, it has accelerated the digitization process in literally all fields including business. At a time when people's mobility is becoming more and more limited, online transactions become an option to meet various needs ranging from primary needs such as food, drinks, and other household supplies to tertiary needs. But here our primary goal is not to remove the physical payment methods completely. But we intend to replace it gradually with time.

04) Easy-to-use Application with User Guidelines

Because business environments are continually changing, both the general public and corporate organizations must adapt to the new conditions. As a result of automation, time is saved that could be spent responding to user requests and complaints. Anyone with a basic understanding of computer operations may keep this application running continuously.

2.3   Benefits

01) Secure

We have observed a significant increase in the number of security breaches in company systems in recent years, mostly as a result of a lack of awareness of the sensitive information that users have contributed. Data and privacy protection is significantly more important than anything else, and as a result, it is right in front of those in charge's eyes. Aside from being an important requirement for providing a better user experience, data security can also be a critical financial consideration.

02) Accessible

Making real-time business operations information available is a powerful and useful tool made available through online enterprise platforms. When data is accepted at a rapid pace, management can examine and adjust system procedures much more rapidly and cost-effectively than if they had to wait months for relevant information.

03) Fast and Reliable

A Business System can reduce the amount of time and effort required by employees to carry out their daily tasks and responsibilities, in addition to cutting information technology and training costs. Because of its efficiency, the Enterprise system can eliminate repetitive labour-intensive operations, freeing up team members' time and energy for other important tasks. This system is technically faultless, with no bugs or flaws, and it is extremely reliable.

04) <u>Usability</u>

Using an enterprise solution such as this can be a huge benefit for anyone interested in maximizing their user usability experience. People are wanting a consistent experience as a result of automation, and even ensure that back-end activities are as simplified as possible, according to the report. With only a basic understanding of technology, anyone can effortlessly navigate via this program. The usage restriction is indefinite, and despite a lack of human resources, the system is available 24 hours a day, 7 days a week.

05) <u>Positioning</u>

To keep ahead of the competition, a company's survival depends on the acquisition of numerous positioning techniques. For example, because we explored the idea of standardizing warehouse storage, this is an asset that contributes to the total system quality. Because of the application's high level of service, its daily consumption may gradually increase. An effective positioning strategy like this one may help the company stand out, and people will see our system differently as a result. Because of the product's uniqueness, customers may not be hesitant to submit positive feedback.

06) <u>Expansion</u>

These automated devices were only available in the Colombo metropolitan area for more than three decades. Yet, closer inspection reveals that extending away from Colombo is highly beneficial due to the high level of urgency indicated by the people of the neighbouring areas. The company and the field may benefit in the long run from the product throughout the country and its continuing performance.

3. <u>Aim & Objectives</u> [4]

3.1 Aim

Our ambition is to enhance the efficacy of the solar panel operation and management system by decreasing manual labour done with outdated methods, increasing the productivity of the company's resource usage, and ensuring longevity in this industry as a competing business.

As a result, we plan to develop a web-based tool that will enable solar management to handle functional and administrative activities from anywhere at any time. The system will resolve operational problems with the current manual approach. Each functionality will have its own user interface, and a database system will be developed to hold all the system's data. All system data and information will be protected by identities and passwords. The system we intend to build will allow the client to get approval from the Sri Lanka Sustainable Energy Authority.

3.2 Objectives

01) To manage customer details properly

All relevant details about the customers, such as personal details, e-mail addresses, card information, and so on, will be logged into the system, allowing proper management of the customers' information.

02) To increase the efficiency of employee management

The system will handle employee-related duties such as giving tasks to employees, making employee profiles, and wage payments, among other factors.

03) To increase the productivity of usage of supply inventories

The system will keep a proper log of business stocks and will enable efficient inventory management.

04) To increase the reliability of finance

The system will increase the reliability of the monetary transactions of the system.

05) To manage the project activities

Offers framework and control over the project setting so that the agreed-upon activities create the appropriate goods or services to satisfy the customer's standards.

06) To supply quality repair and service

A repair management system is a technology tool used by service businesses to speed up the process of gathering service requests, documenting information about the job, and enabling simple access for both dispatch teams and technicians so they can work together and track the development of the service tasks in real time.

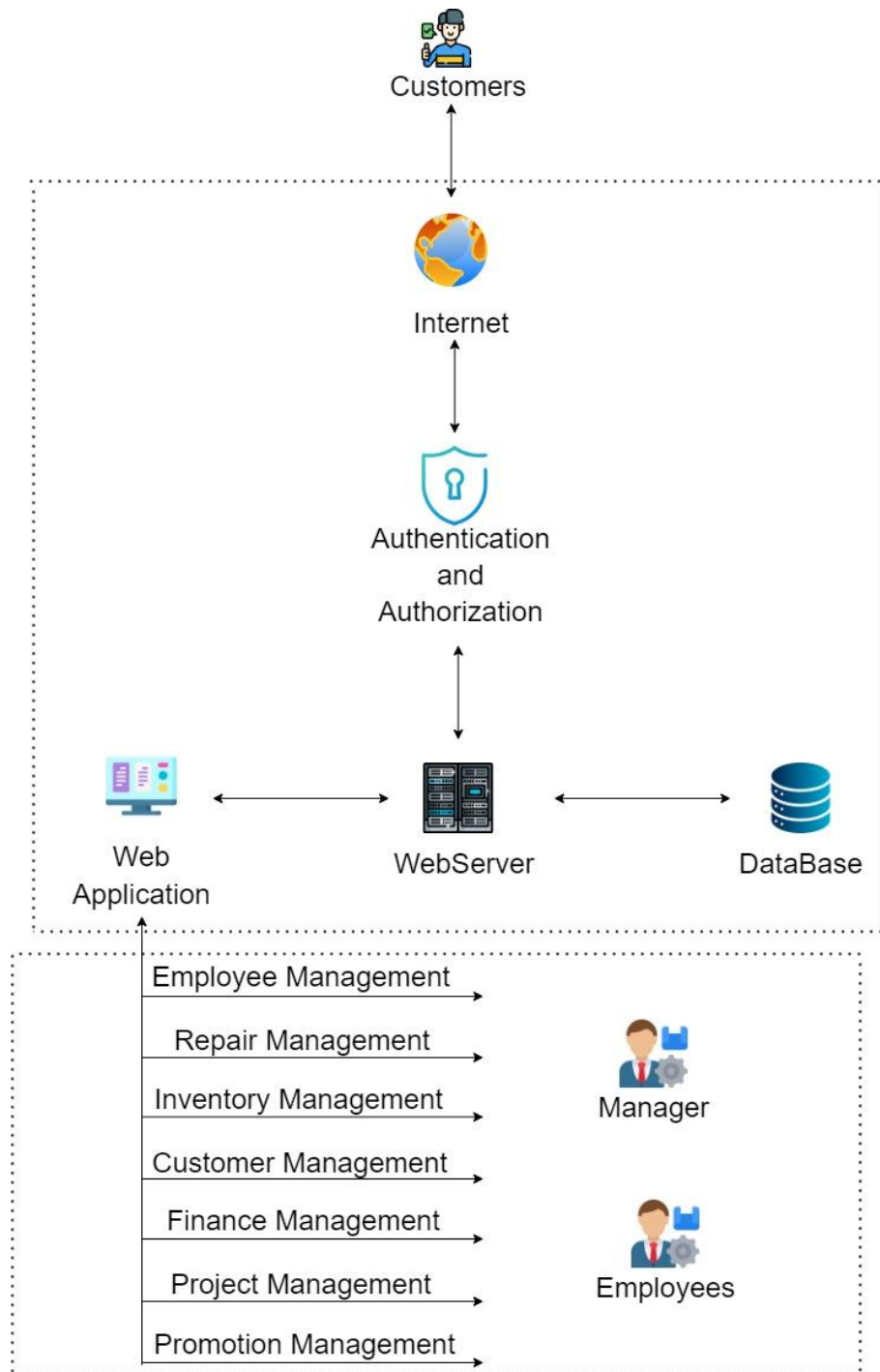### 07) To manage transport and delivery service productivity

The system will be used to handle data pertaining to the shipping and transportation services offered by the company.

08) To ensure that customers are aware of the existence and positioning of products

The system provides better administration of promotions and offers and constantly keeps the business brand in front of customers.

4.   <u>System Overview</u>

Customers

Internet

Authentication
and
Authorization

Web
Application   WebServer   DataBase

Employee Management
Repair Management
Inventory Management   Manager
Customer Management
Finance Management
Project Management   Employees
Promotion Management

4.1   Functional Requirements

1.   Employee Management

Employee management is critical to the success of our company. this capability enables us to

save time. this function, Allows employees to create a personal profile. the admin manually registers the employees to the system. when the admin registers a new employee, the system creates a personal profile for the employee with their personal details. only the admin can add a new employee and create a new profile for each employee. the employee can edit, or delete view their personal details by logging in to the profile with the given username and password.

the admin and the manager can look for the employees' details using the employee id.

update the employee account - the employee can update their personal details on their own

profile. the employee only can make changes in their personal details like name, email,

contact no, and address. details like salary and position can be updated by the employee manager. when the relevant parties. update the relevant information the employees' details are updated on their own profiles.

delete employee account - the admin has access to the delete option as well. if an employee

resigns from the company the admin can delete the relevant employee from the system.

when the admin deletes an employee, the employee account associated with that relevant employee is also erased from the system as well.

Generate reports - The admin and the employee-manager can search for an employee's attendance by giving the employee id. at the end of the month, can generate monthly attendance reports.

within this function, the employee-manager can display all the employee details according to their working categories.

2. Repair & Services Management

Customers' solar systems can run into some troubles. We assist the customer to follow the repair process. We replace our solar panel installations and ones from some other companies. The repairing procedure is monitored by our best engineers.

The customer can contact the company through their hotline and request their repair problems. The repair manager gets all the details about repairing the problem and customer details. The manager logs in with the credentials to repair the dashboard. The manager adds new repair form to the database of company. Occasionally managers are able to view, delete and update forms. Then the manager should assign repair groups to relevant cases. All the above details must send to the customer and assigned employees. After the repair is done employee can submit their workload to the system. Customers may able to send feedback to the system regarding the repair service.

Also filled form display the calculated cost that the customer should pay for the service. This calculated cost is generated after validating the warranty time of the solar panel system.

Additionally, the repair manager can search the repair form using the repair request Id and see the status of the provided service. The monthly system generates a report including expenditure and repair details.

3. Inventory Management

Inventory management is the proper planning of goods or services purchasing, handling, storing, using, and selling. It is very important to the supply chain.
The most important benefit is using resources effectively. Inventory management aims to avoid the accumulation of goods that are not utilized. Accordingly, doing this can prevent the wastage of goods and space.

Web applications help to organize and manage data in real-time. Therefore, it can avoid overstocking and understocking. A few years back, ledgers and spreadsheets were used to enter data. But with the vast improvement of information technology and web applications, it can manage with a simple click.

A web application is accessible from any location, making it simple for users to manage inventories while working remotely or on the go. This can increase efficiency and minimize the time and effort necessary to maintain inventory.

This proposed web application, Manage all solar equipment in the inventory Based on details such as Item number, name, price and Quantity. The stored data can be deleted updated and viewed using MERN Stack. Generate monthly reports on the Balance of Inventory and what items need to be purchased. Company Owners and Managers Can Access this Inventory And they can do the Above Crud Operations.

3. Customer Management

The customer is the primary actor and customer management is an essential part of this project. Customer management typically involves managing interactions between a business and its customers as they are the most valuable aspect of a business. In the process of customer management, it is essential to have customer details stored in a database as it is the easiest way to access large amounts of data in a short amount of time. It is important to have better security for the data gathered through the system that is about to be developed.

In this function, the customer will have a form to enter their personal details and sign up to the system by themselves. The system validates their details and stores them in the system database. After that, customer can use their login credentials to log into the system and do purchases as they desire. The system maintains a profile page for each customer and there, customer details will appear. Customers can edit their profile and delete it when needed. According to customers' purchase details, the system calculates loyalty points for the customers and loyalty tires will be shown in the profile. There will be some benefits to those who have higher loyalty points.

Report generation is an important function in a business system. Therefore, the customer management function includes report generation. The manager has authorized to generate daily as well as weekly customer reports according to their needs. Those reports include the customer name, email and mobile number of all the customers that are registered within the time period given. At the end of the report, the customer count and the total income from those customers will be printed.

4. Finance Management

In this Function, the system will be able to manage all the transactions which are done through the solar management system. Such as buying components, selling items, paying salaries, etc.

Selling Items,
First, the customer must log in to the system then he/she can go to items and add/remove them from the cart. After adding items to the cart customer has to go to the cart page. On the cart page customers can view the quotation and the service charges. Whenever the customer is going to pay for the items, he/she has to click the pay button which is available on the cart page. Then customer will be directed to the payment section. In the payment, section customers will find a personal data form which is editable. After submitting the form, the system will check the validity of the credentials and direct the customer to the bank payment gateway to do the payment. After the transaction is successful system will be able to generate a report of transactions for financial purposes of the finance division of the company.

Paying salaries,
This section is only accessible to the accountants of the company. First, the accountant has to get the details from the employee management system. After that he/she has to enter those details into the salary calculating system. After that salary calculator will calculate and save the salary, employee trust fund, and employee-provided fund of the employee. At end of the

month, the system will generate a salary report. Also, by using this system accountants will be able to watch the salary history of the employees.

5. Promotions & Offers Management

The main target of the Promotions and Offers Management function is getting more orders and boosting sales. The main most responsible character of this function is the Promotion Manager. The Promotion Manager should introduce new promotion plans and choose the best ways to promote the products for the respective seasons. The manager can see all the details about promotions via the system. And also, customers can see promotions details and they can buy products both adding promotions and offers through the system. And the manager can edit details about the promotions and offers of the system, such as updating some details of current offers deleting all irrelevant details and adding the latest promotion plans to the system. The manager must update the promotion details of the system once a week. The manager should plan some special seasonal offers like 'New Year', 'Christmas and, 'Black Friday'. And an e-mail about all the promotions and offers details is sent to all registered customers through the system. So, we hope these methods will increase sales. At the end of the month, the Promotion Manager should make the monthly sales report with the promotions and offers.

6. Project Management

This function is use for manage all project sites details. In the dashboard of system display how many projects are ongoing and how many projects are completed. In here Project manager manage this function and he needs to log in to system with his credentials. After he successfully log in to system, he can search for projects by there names, project id or location.

This function display what are the ongoing projects there progress and what are the complete projects and also display the details of each projects, details like what are used materials ,equipment and used labours like that. when resources is allocating to projects it I will reduce from inventory.

When a new projects is going to start, project manager must add that project to system and update project details also he can view, and delete other projects. Project manager planning and organization of company's resources and labours to do specific projects tasks.

This function generate a report to manager for each projects about project name, id , location and what are the used resources to relevant project , for ongoing projects how many days to complete that project. What are the ongoing and completed projects. And also for customer generate a report that's include basic details of project like progress of project , how many days to complete like that.

7. Transport Management

After the customer places an order customer manager sends details about the order to the transport management function. all ordered products are updated under the inventory manager's supervision and orders are transported to customers by own company vehicles. under this function, the transport manager is the responsible person for this management.

Firstly, the transport manager logs into the system using his own credentials. Transport manager can create roles such as user, admin, and delivery person likewise he can decide which role can access or edit those records. The transport manager has a list of orders that customers placed. the system generates a report that includes the details about all orders. The transport manager can see what are the available orders in the system. The transport manager's responsibility is to assign a delivery person and vehicles for those available orders. The transport manager should arrange schedules for transportation and also transport manager should have an updated record of available and non-available vehicles according to the relevant schedule. if the company gets some issues with previous orders transport manager can search for previous orders and solve problems. The transport manager has a list of all the vehicle details driver details and routes and, he is the responsible person for the above records on behalf of the company. When an order departs from the company transport manager should send a text message to the customer. after fulfilling the order transport manager should send e receipt for the bill to the customer and accountant through email. when a customer cancels the order transport manager removes the order from the system.

delivery person also can logs into the system using his own credentials. he can view what are the deliveries assigned to him. and he can view the details of delivery. after completing the delivery person should send a notification to the transport manager from the system.

customer can also use this function. customer can view the status of the order using this function. when an order departs from the company customer can view the location of the order.

Usually, end of the month the transport manager should generate monthly report of deliveries that have already been made.

4.2   Non – functional Requirements

1.   Performance

determines how quickly a software system or a specific component of it reacts to specific user activities under specific task conditions.

2.   Scalability

assesses the highest workloads under which the system will still satisfy the performance criteria and enables our system to grow as the workloads increase.

3.   Portability

determines how a system or its element can be launched within one environment or another. Hardware, software, and other usage platform specifications are typically included.

4.   Compatibility

defines how this system can coexist with another system in the same environment. For instance, software installed on an operating system must be compatible with its firewall or antivirus.

5.   Reliability

describes the likelihood that a system or its component will operate without failure for a time frame specified under predefined circumstances.

6.   Availability

Availability refers to the likelihood that a user will be able to reach the system at a specific moment. Although it can be stated as a predicted proportion of accepted proposals.

7.   Security

explains how the systems or a part of its data will be secured from malware assaults and illegal access.

4.3 Technical Requirements

Web-based System

Compared to desktop applications, web applications provide a whole range of business advantages. These applications can be accessed from any computer through the internet,

Instead of having to be individually installed on each computer that you wish to access it from. The use of web-based software is commonly called software as a service (SaaS), where apps run

On a virtual, cloud-based environment. [5]

Back – end

Express JS [6]

Node.JS

Express.js is a small framework that works on top of Node.js web server functionality to simplify its APIs and add helpful new features. It makes it easier to organize your application's functionality with middleware and routing. It adds helpful utilities to Node.js HTTP objects and facilitates the rendering of dynamic HTTP objects.

Front – end

React.JS [7]

React is a declarative, efficient, and flexible JavaScript library for building user interfaces. React.JS is an open-source, component-based front-end library responsible only for the view layer of the application. React is used to create modular user interfaces. It promotes the development of reusable UI components that display dynamic data.

Database

Mongo DB [8]

MongoDB is an open-source document-oriented database that is designed to store a large scale of data and also allows you to work with that data very efficiently. It is categorized under the NoSQL (Not only SQL) database because the storage and retrieval of data in the MongoDB are not in the form of tables.

5. <u>Literature review</u>

Renewable energy systems (REN) are distinguished to various natural renewable energy resources (RER)such as sunlight, wind, rain, tides, and geothermal heat, which are naturally replenished. According to Greenpeace International, about 18% of global electricity generation comes from renewables in 2010 [

In a Solar Energy Management System solar inverter converts, the sun's light into usable solar energy. When sunlight is absorbed by the panels, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity as well as heat, light, hot water, and even cooling for homes, businesses, and industries. Solar Systems' products enable remote monitoring systems to check and monitor real-time data from an inverter.

Through the examination and research on other solar management systems, one can weigh out the advantages and disadvantages of the existing systems and implement a better system to suit client requirements.

By studying the following existing web-based solar management systems we could get an idea of developing the required solar management system.

5.1 Rooftop solar power generation project [9]

The "Rooftop Solar PV Power Generation Project" provides electricity consumers with long-term debt financing the for installation of rooftop solar photovoltaic power generation systems in Sri Lanka. As part of the project, technical and commercial frameworks are introduced including technical guidelines and standards for solar rooftop systems that would add value in developing solar rooftop installations.

Here customers can look for project background, eligibility, and loan approval for solar systems and check Rooftop Solar PV Calculator. This calculator provides a guide for any individual interested in investing in a rooftop solar PV system, to assess its viability. Customers can know how the consumer protection system work. Under that how Warranty and Insurance, Customer complaint procedure work. customers can contact the "Rooftop Solar Power Generation Project" by providing a telephone number or email in here.

5.2   My Solar Energy [10]

My Solar is a full-service solar energy provider in Sri Lanka. Here the in-house team will take care of every part of your project. This includes custom system design, permitting, sourcing, product housing, engineering, installation, and existing system master leasing and monitoring.

Here they are offering Energy Solutions for Residential, Commercial, and Industrial problems. here Customers Can look for products they have and Can request a Quote. Customers can look for the details of their completed projects. Under that can see details like capacity, buyer, and location like that. customers can contact "My Solar Energy" by providing a telephone number or email in here.

6. <u>Methodology</u>

6.1 Software process model [11]

<u>Agile software process model</u>

Alternatives:
- Waterfall methodology
- Rapid development methodology
- Lean software development methodology
- Extreme Programming
- Feature-Driven development

Why agile?

- Reduced risks
- Increase flexibility
- Customer satisfaction
- Improved project predictability

6.2 Requirement engineering methods [12]

<u>Interview</u>:- Requirement engineering methods

Alternatives :

- Observation
- Document analysis
- Use case analysis
- Brainstorming
- Surveys and Questionnaires

Why interview?

- Better understanding of stakeholder requirements
- Easier to schedule a meeting
- Less time consuming
- Identify non-functional requirements

6.3   Design methods [13]

Design method – Component-based

Alternatives:

- Object-oriented design
- Model-driven design
- Data-driven design
- Function-oriented design

Why component based?

- Reusability
- Flexibility
- Scalability
- Maintainability

6.4   Development tools

6.4.1   Professional-looking diagrams – Draw.io [14]

Alternatives:

- Microsoft Visio
- Lucidchart
- Gliffy

Why Draw.io?

- Free and Open source
- User-friendly interface
- Works on both desktop and mobile
- Integration with popular tools

6.4.2   Web-based design and collaboration tool(Wire frames) – Mock Flow

Alternatives:

- Figma
- Adobe XD
- UXPin
- InVision

Why Mock Flow?

- User-friendly and easy to use
- Integration with popular tools
- Cloud-based technology
- More tools and templates

6.4.3   <u>Professional looking diagrams – Visual Studio Code</u> [15]

Alternatives:

- Notepad++
- Eclipse
- Replit
- Sublime Text

Why Visual Studio Code?

- Supports more languages
- Cross-Platform support
- Built-in web support
- Terminal support
- Free to use

6.5   Development Technologies

<u>MERN Stack technology:- Development technologies</u> [16]

- M – MongoDB for Database server
- E – Express.js for a server-side framework
- R – React for frontend developing
- N – Node.js - express runnable environment inside

6.5.1   **MongoDB –** Database Server [17]

Alternatives:

- Apache Cassandra
- Apache HBase
- Couchbase
- Apache CouchDB
- Amazon DynamoDB

Why Mongo DB?

- Integration with other tools – It integrates other technologies like Hadoop, Spark, and K afka.
- Flexible data model – Data can be stored in a variety of formats.
- Horizontal scalability – It can easily handle large amounts of data across multiple servers.
- Community support –There is a wealth of knowledge and support available for those using the database.
- Cost-effective – Cloud database no need to maintain servers physically.
- Powerful querying and analytics -MongoDB supports a range of indexing and query capable, which can help to improve performance and efficiency.

6.5.2   Express JS – Server-Side framework [18]

Alternatives:

- Koa
- Haip
- Fastify
- Nest.js
- Adonis.js

Why Express JS?

- Minimalistic and flexible – This allows developers to build a web applications in a simple and elegant way.
- Large ecosystem – This makes it easier to find solutions to common problems.
- Middleware support – This can easily add features like authentication, logging and error handling among others.
- Routing system – It can handle different HTTP methods (GET , POST, PUT, DELETE)

6.5.3   React – Frontend Developing [19]

Alternatives:

- Angular
- Vue.js
- Svelte
- Ember.js
- Preact

Why React JS?

- This is also component-based so, once the component is created it can apply again and again. Furthermore, it converts JSX files to vanilla JavaScript and it can work with multiple CSS files such as SaaS files and Server side rendering can improve performance.
- Declarative programming - Developers can describe the user interface and let React handle the underlying logic, especially for a large and complex application.
- Component-based architecture – Interfaces are built from the small, reusable component.
- Virtual DOM – Lightweight representation of actual DOM.
- Large ecosystem – This makes it easier to find solutions to common problems.

6.5.4   Node JS – Express runnable environment inside [20]

Alternatives:

- Java
- Ruby
- Python
- AngularJS
- ASP.NET

Why Node JS?

- JavaScript – Widely use for web development, save time and increase productivity
- Performance – This handles a high volume of requests.
- Package ecosystem – This can help to reduce the number of bugs and error in your codes.
- Open source
- Cross-platform – This makes it a flexible choice for developers who need to deploy their applications across different environments.

6.6   Testing Methods

Postman: - Testing method[21]

Alternatives:

- cURL
- Swagger
- Insomnia
- SoapUI
- Katalon Studio

Why Postman ?

- User-friendly interface
- Versatile -This supports a wide range of API protocols. Including REST, SOAP, and GraphQL.
- Collaboration
- Documentation – This can help to communicate and understand of API among developers and stakeholders.
- Integration – works with such as GitHub, Jira and Stack

6.7 Integration methods

GitHub:- Integration method[22]

Alternatives:

- GitLab
- Bitbucket
- Source Forge
- Apache Subversion

Why GitHub?

- Large community – This can contribute to repositories like private or public
- Integration with other tools – Such as Jenkins, JIRA, Slack and visual studio code
- User-friendly interface
- Security – This includes two-factor authentications, encrypted and also it can make private repositories.
- Continuous Integration and development – It can help streamline the process of building, testing, and deploying your code.
- Availability of Open Source Project

6.8 Gantt Chart

Task	January		February				March				April			
	Week 3	Week 4	week 1	week 2	week 3	week 4	week 1	week 2	week 3	week 4	week 1	week 2	week 3	week 4
Problem Identification	■													
Build a Solution		■												
Requirement Engineering			■											
Charter Approval				■										
Project Presentation					■	■								
System Desiging						■	■							
Database Designing							■							
Project Implementation								■	■	■	■			
Integrating and testing												■	■	
Final Presentation														■

6.9   Work Breakdown Structure

	Name with Initials	Brief Description of the Function
1.	Rashmitha K.M.	**Employee Management** Manages all the employee details like the name, address, contact number, salary and username and password from which the employee can log in. within this function, we can add, remove, update and modify the details of the employee and can display all the employee details according to their working categories. The employee-manager can search employees by its employee ID. Generate monthly attendance reports of the employees.
2.	De Silva L.K.N.	**Repair & Services Management** The system manages all online repair requests. repair requests are included such as client name, requested date, location, description of the repair, and warranty period. The customer is able to update details. The system directs requests to the repair manager. The manager sends confirm receipt to the customer. And also The repair Manager can search for repair requests by its reference no. Generate monthly reports on repair maintenance.
3.	Malwaththa M.A.G.I	**Inventory Management** Manage all solar equipment in the inventory Based on details such as Item number, name, price and Quantity. The stored data can be deleted updated and viewed. The inventory manager can search items by its item no. Generate monthly reports on the Balance of Inventory and what items need to be purchased.
4.	Jayasinghe K.W.	**Customer Management** Manages all customer details. Add new customers by providing a valid email, full name, username, password, address and phone number. Update and delete customer details whenever necessary. Display all customer details for authorized persons. The customer manager can search for the customer by customer ID. Generate weekly reports on new customers.

5.	Padukka P.D.M.D.	**Finance Management** Manages all the details of financial activities. such as selling items, buying materials, etc. The payments are based on quantity, price, discount, and the date of the payment. This system can add and remove payment methods. such as debit cards, credit cards, and cash payments. The finance manager can search the payment details based on the date of the payment. Also, the system gives administrators access to generate payment and bill reports.
6.	Athukorala P. D.	**Promotions & Offers Management** Manage sales promotions and offers to increase interest or demand for products. There are many reasons why a business may choose to use a sales promotion, but the primary reason is to boost sales. The promotions and offers are managed based on such as item details, promotion amount, Start date and End date. Generate monthly reports about Sales details with promotions. And also the promotions & offers Manager can search the sales promotions and offers by the given item ID. Should be able to assign customers details and update promotion details and periods.
7.	Hapuarachchi T. L	**Project Management** Manages all working site details like Project Id, Project Name, Venue, etc. The project manager can log in with his user credentials, view update and delete projects, and add new projects. The project Manager can search projects by giving the project ID. We can generate reports on ongoing sites and finished projects at the end of the month.
8.	Waduge T.R.	**Transport Management** The system manages all the orders placed by customers. These orders are included such as order date, item details, client name, address, and estimated delivery time. The system assigns a driver. Notify the details of the customer. Customers can update details about delivery and search orders. The Transport manager can search for the relevant transport details by giving the order date. Generate monthly reports on Transports made.

7. <u>Evaluation Method</u>

Evaluation is a crucial component of our Solar Power Management System since it allows us to analyze the final result, the system we are developing for our client, in terms of performance, effectiveness, and general quality.

We are concentrating on the evaluation of each and every scope of the system separately. As a result, we can learn more about how the system reacts to user interactions. We will ensure that the expected result is produced at all times without interfering with the system's operation.[23]

To make this task easier to accomplish, we will break the evaluation procedure into five subcategories.

1. Objective

In this section, we will assess the overall quality and performance of the system. Furthermore, we will thoroughly test the system to ensure that it meets all of the client's requirements.

For example, as needed, generate an accurate report on the current inventory stocks.

2. Method

In terms of method, we will execute many real-time scenarios that will change depending on the needs of the customer. Every scope and function will be tested out here. We'll collect data from the executed test cases and see how the system fared in each one. This task will involve our client, The Manager, and the Employees of the company.

3. Scope

The system will be assessed as a whole web-based system. Each particular functionality will be examined and tested to ensure that it functions properly in combination with others. The various solar Power Management System processes that will be tested are given below.

    I.   Employee Management
   II.   Repair & Services Management
  III.   Inventory Management
  IV.   Customer Management
   V.   Finance Management
  VI.   Promotions & Offers Management
 VII.   Project Management
VIII.   Transport Management

Ex: Each subsystem successfully completes its task and provides the necessary information to the next subsystem.

4. **Timing**

For the evaluation process, the entire system must be completed and run well as a well-integrated system.

As a result, the system will be evaluated as "phase 1" after completion and "phase 2" following handover to the client.

As an example, Delivering the completed system to the client and ensuring that it meets the given requirements

5. **Output**

Based on the results, the system will be tested, evaluated, and judged. The customer and company employees will consider the qualitative assessments and comments. Furthermore, the major criterion will be overall satisfaction.

As an example, conducting a survey for both client and the employees of the company to collect feedback for the system.

Various technologies and tools are to be used in the system evaluation.

1. Automated testing tools – JMeter
2. Data Analytical Tools – Google analytics
3. Virtualization Tools – VirtualBox
4. User Feedback Tools – SurveyMonkey

Reasons to use the above-stated tools.

1. **JMeter -** JMeter's flexibility and scalability are two of its key advantages. JMeter is an open-source tool for testing a wide range of applications, including web applications, REST APIs, databases, and other types of systems.

2. **Google Analytics –** It has the ability to provide powerful insights and it is a free tool provided by Google.

3. **VirtualBox –** Open-source and compatibility to run multiple operating systems.

4. **SurveyMonkey** – It is user-friendly. It has the ability to customize and analyze according to the various needs of the user.

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