BATTERY MANAGEMENT SYSTEM USING IOT

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A MINI PROJECT REPORT

Submitted to the

FACULTY OF ELECTRICAL AND ELECTRONICS ENGINEERING

In partial fulfilment for award of the degree

of

BACHELOR OF ENGINEERING

SNS COLLEGE OF TECHNOLOGY, COIMBATORE – 35

(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NOV-2024

BONAFIDE CERTIFICATE

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ACKNOWLEDGEMENT

First of all we extend our heartfelt gratitude to the Management of SNS College of Technology for providing us with all sorts of support in completion of the Project. We record our indebtedness to our Director **Dr. V. P. Arunachalam** and our Principal **Dr. S. Chenthur Pandian** for their constant support and sustained encouragement for the successful completion of project.

Our sincere thanks to **Dr. C. Ramakrishnan**, Professor and Head Of the Department Department of Electrical and Electronics Engineering, who has encouraged and given us valuable advice for the completion of this project in all possible ways.

We whole heartedly place on record our deep sense of gratitude for the valuable motivation and support provide to us by project coordinator **Dr. R. Senthilkumar**, Associate Professor,Department of Electrical and Electronics Engineering, for making us think innovatively and complete this project.

We extend our thanks to the faculty members of our department and also the Technical staff for their help during the project. We also thank our parents and all our friends who have directly or indirectly helped us in this work.

BATTERY MANAGEMENT SYSTEM BY USING IOT

CONTENTS

SYNOPSIS:

The rapid evolution of Electric Vehicles (EVs) has presented new challenges and opportunities in the realm of battery management. This paper explores the integration of Internet of Things (IoT) technologies in enhancing the efficiency and reliability of EV batteries, focusing on two critical aspects - voltage monitoring and battery backup surveillance. By employing IoT-driven solutions, we aim to revolutionize the monitoring and management of EV batteries, ensuring optimal performance, safety, and prolonged lifespan.

CHAPTER-1

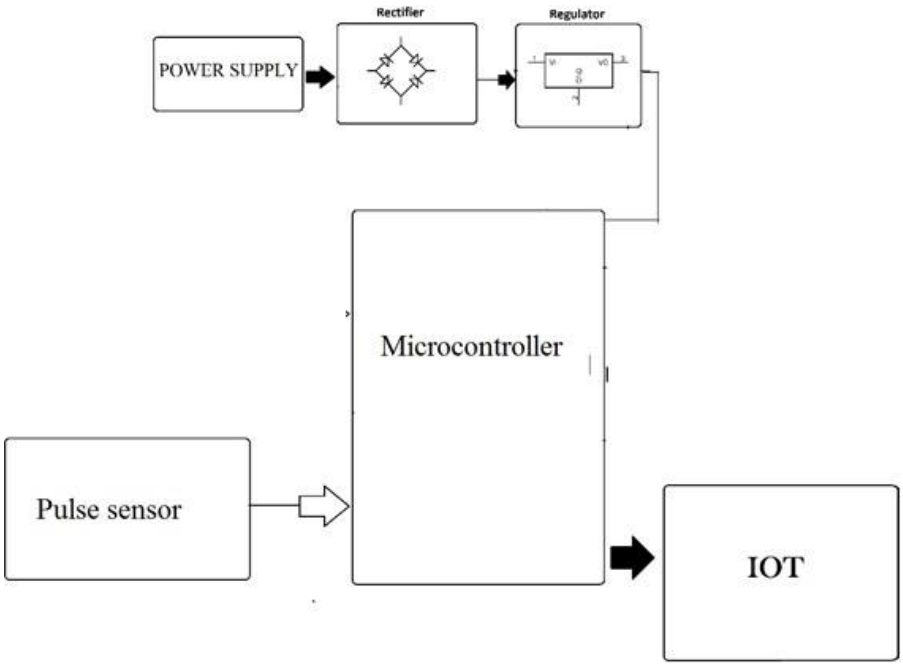
INTRODUCTION

1.1 About the project

The surge in electric vehicle adoption underscores the urgency to develop sophisticated battery management systems that go beyond traditional approaches. In this context, the amalgamation of Electric Vehicles with the Internet of Things (IoT) provides a groundbreaking avenue for real-time monitoring and control of crucial battery parameters. Voltage Monitoring: Voltage is a fundamental indicator of the health and performance of an EV battery. Continuous monitoring of voltage levels can unveil important insights into the state of charge, potential imbalances between battery cells, and early signs of degradation. IoT-enabled sensors embedded within the battery system collect and transmit voltage data to a centralized platform, allowing for immediate analysis and timely interventions. This paper will delve into the technical aspects of voltage monitoring through IoT, emphasizing its role in preemptive maintenance, optimizing charging strategies, and overall battery health management. Battery Backup Surveillance: Reliable battery backup systems are essential for the seamless operation of Electric Vehicles, especially in emergency scenarios or during unexpected power fluctuations. IoT plays a pivotal role in ensuring the readiness of backup systems by monitoring key parameters such as capacity, charging status, and anticipated usage patterns. The integration of IoT allows for predictive maintenance, ensuring that the backup power is consistently available when needed. This paper will explore the implementation of IoT in battery backup surveillance, discussing the advantages in terms of reliability, safety, and the overall resilience of EVs in various operational contexts.

Challenges and Future Directions: While the fusion of IoT with EV battery management offers immense potential, challenges such as data security, interoperability, and standardization must be addressed. The paper will also discuss the evolving landscape of EV battery management, highlighting potential future directions for research and development in the pursuit of more efficient and sustainable electric transportation. In conclusion, the utilization of IoT technologies for voltage monitoring and battery backup surveillance in Electric Vehicles marks a transformative leap in battery management systems. This integration not only enhances the performance and longevity of EV batteries but also contributes to the broader goal of creating a reliable and sustainable electric transportation ecosystem.

1.2 BLOCK DIAGRAM



1.3 MODULES DESCRIPTION

A module is a Hardware and software component or part of a program that contain one or more routines. One or more independently developed modules make up a program. The project “EV BATTERY MANAGMENT MONITORING SYSTEM BY USING IOT” consists of two main modules they are,

- ✓ Hardware
- ✓ Software

1.3.1 HARDWARE:

1. SENSORS

a sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes depends upon tranducer in its environment and send the information to other electronics, frequently a microcontroller. A sensor is always used with other electronics**.**

2. ESP8266 WIFI

The ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability, and the amazing thing is that this little board has a MCU (Micro Controller Unit) integrated which gives the possibility to control I/O digital pins via simple and almost pseudo-code like programming language. This device is produced by Shanghai-based Chinese manufacturer, Espress if Systems.

1.3.2 SOFTWARE SIDE

I. COLLECT

SEND SENSOR DATA PRIVATELY TO THE CLOUD.

There are sensors all around—in our homes, smart phones, automobiles, city infrastructure, and industrial equipment. Sensors detect and measure information on all sorts of things. And they communicate that data in some form, such as a numerical value or electrical signal.

II WHY WOULD YOU WANT TO COLLECT DATA IN BLYNK?

Sensors, or things, sense data and typically act locally. Blynk enables sensors, instruments, and websites to send data to the cloud where it is stored in either a private or a public channel. Blynk stores data in private channels by default, but public channels can be used to share data with others. Once data is in a Blynk channel, you can analyze and visualize it, calculate new data, or interact with social media, web services, and other devices.

III ANALYZE AND VISUALIZE YOUR DATA WITH MATLAB

Storing data in the cloud provides easy access to your data. Using online analytical tools, you can explore and visualize data. You can discover relationships, patterns, and trends in data. You can calculate new data. And you can visualize it in plots, charts, and gauges. Storing data in the cloud provides easy access to your data. Using online analytical tools, you can explore and visualize data. You can discover relationships, patterns, and trends in data. You can calculate new data. And you can visualize it in plots, charts, and gauges

IV WHY WOULD YOU WANT TO ANALYZE AND VISUALIZE DATA IN BLYNK?

Blynk Provides Access to MATLAB to Help You Make Sense of Data. You can:

- Convert, combine, and calculate new data
- Schedule calculations to run at certain times
- Visually understand relationships in data using built-in plotting functions
- Combine data from multiple channels to build a more sophisticated analysis

II. ACT

II.1 TRIGGER A REACTION.

Acting on data could be something as simple receiving a sensor (specified in Block) from Arduino and data send to web server via Wi-fi module.

WHY WOULD YOU WANT TO USE BLYNK TO ACT ON DATA?

Blynk Provides Tools That Enable Device Communication for All of These Actions and More. You Can:

- React to data—both raw data and new data that you calculate—as it comes into a channel
- Queue up commands for a device to execute

CHAPTER-2

SYSTEM SPECIFICATION

2.1 HARDWARE SPECIFICATION

- ✓ Microcontroller
- ✓ Temperature Sensor
- ✓ Heart Beat Sensor
- ✓ Panic Button
- ✓ Transformer
- ✓ Resistors
- ✓ Capacitors
- ✓ Diodes

2.2 SOFTWARE SPECIFICATION

- ➢ Arduino Compiler
- ➢ MC Programming Language: C
- ➢ IOT Gecko

2.3 ABOUT THE SOFTWARE

FRONT END

PHP

PHP stands for Hypertext Preprocessor. PHP scripts run inside Apache server or Microsoft IIS. PHP and Apache server are free. PHP code is very easy. PHP is the most used server side scripting language. PHP files contain PHP scripts and HTML. PHP files have the extension “php”, “php3”, “php4”, or “phtml”. Generate dynamic web pages. PHP can display different content to different user or display different content at different times of the day Process the contents of HTML forms. We can use an PHP to retrieve and respond to the data entered into an HTML form. Can create database-driven web pages. An PHP can insert new data or retrieve existing data from a database such a MySQL. PHP is a standard HTML file that is extended with additional features. Like a standard HTML file, PHP contains HTML tag that can be interpreted and displayed by a web browser. Anything we could normally place in an HTML file Java applets, Blinking text, server side scripts. We can place in PHP. However, PHP has three important features that make it unique. PHP contains server side scripts. PHP provides several built-in objects.

HYPER TEXT MARKUP LANGUAGE (HTML)

HTML is an application of the Standard Generalized Markup Language (SGML), which was approved as an international standard in the year 1986. SGML provides a way to encode hyper documents so they can be interchanged SGML is also a Meta language for formally describing document markup system. Infact HTML uses SGML to define a language that describes a WWW hyper document's structure and inter connectivity. Following the rigors of SGML, TBL bore HTML to the world in 1990. Since then, many of us have it to be easy to use but sometimes quite limiting. These limiting factors are being addressed but the World Wide Web Consortium (aka W3c) at MIT. But HTML had to start somewhere, and its success argues that it didn't start out too badly.

PHP Syntax

A PHP scripting block always starts with <?php and ends with ?>. A PHP scripting block can be placed anywhere in the document.

On servers with shorthand support enabled you can start a scripting block with <? And end with ?>.

For maximum compatibility, we recommend that you use the standard form (<?php) rather than the shorthand form.

A PHP file normally contains HTML tags, just like an HTML file, and some PHP scripting code. each code line in PHP must end with a semicolon.

The semicolon is a separator and is used to distinguish one set of instructions from another.

BENEFIT OF PHP :

• Cross Platform

All the PHP based applications can run on various types of platforms. PHP is supported by majority of Operating Systems, some of which includes Solaris, UNIX, Windows and Linux. The mentioned platforms can be used to write codes in PHP and also view web pages or run the PHP based applications.

• Easy database connection

A programming language like PHP is widely used on the internet and needs to connect to the database very often. Therefore, having a feature that could help PHP to connect to database easily is mandatory. Several websites such as the ecommerce websites, require good database management system.

• Easy to use

PHP is widely used because it is easy to use. In contrast with other programming languages that are complex, PHP is simple, fluent, clean and organized, hence it is a boon for the new users. PHP has a well-organized syntax which is logical at the same time. The high speed of PHP gives it an advantage over other scripting languages and gives it an application in important administrations such as the server administration and mail functionalities.

• Open source

One of the important advantages of PHP is that it is Open Source. Therefore, PHP is readily available and is entirely free. In contrast to other scripting languages used for web development which requires the user to pay for the support files, PHP is open to everyone, anytime and anywhere. PHP is maintained and developed by a large group of PHP developers which helps in creating support community of PHP

that helps people in PHP implementation and manipulation.

BACK END

MYSQL SERVER

Database

A database is simply a collection of used data just like phone book. MySQL database include such objects as tables, queries, forms, and more.

Tables

In MySQL tables are collection of similar data. With all tables can be organized differently, and contain mostly different information- but they should all be in the same database file. For instance we may have a database file called video store. Containing tables named members, tapes, reservations and so on. These tables are stored in the same database file because they are often used together to create reports to help to fill out on screen forms.

Relational database

MySQL is a relational database. Relational databases tools like access can help us manage information in three important ways.

- Reduce redundancy
- Facilitate the sharing of information
- Keep data accurate

Fields

Fields are places in a table where we store individual chunks of information.

Primary key and other indexed fields

MySQL use key fields and indexing to help speed many database operations. We can tell MySQL, which should be key fields, or MySQL can assign them automatically.

Controls and objects

Queries are access objects us display, print and use our data. They can be things like field labels that we drag around when designing reports. Or they can be pictures, or titles for reports, or boxes containing the results of calculations.

Queries and dynasts

Queries are request to information. When access responds with its list of data, that response constitutes a dynast. A dynamic set of data meeting our query criteria. Because of the way access is designed, dynasts are updated even after we have made our query.

Forms

Forms are on screen arrangement that make it easy to enter and read data. we can also print the forms if we want to. We can design form our self, or let the access auto form feature.

Reports

Reports are paper copies of dyna sets. We can also print reports to disk, if we like. Access helps us to create the reports. There are even wizards for complex printouts.

Properties:

Properties are the specification we assigned to parts of our database design. We can define properties for fields, forms, controls and most other access objects.

FEATURES OF MYSQL

• MYSQL is a relational database system. If you can believe many diehard MYSQL fans, MYSQL is faster, more reliable, and cheaper -- or, simply put, better -- than any other database system (including commercial systems such as Oracle and DB2).

• Many MYSQL opponents continue to challenge this viewpoint, going even so far as to assert that MYSQL is not even a relational database system. We can safely say that there is a large bandwidth of opinion.

• The fact is that there is an ever increasing number of MYSQL users, and the overwhelming majority of them are quite satisfied with MYSQL. Thus for these users we may say that MYSQL is good enough.

• It is also the fact, however, that MYSQL still lacks a number of features that are taken for granted with other database systems.

• If you require such features, then MYSQL is (at least for the present) not the database system for you. MYSQL is not a panacea.

• The following list shows the most important properties of MYSQL. This section is directed to the reader who already has some knowledge of relational databases. We will use some terminology from the relational database world without defining our terms exactly. On the other hand, the explanations should make it possible for database novices to understand to some extent what we are talking about.

• Relational Database System: Like almost all other database systems on the market, MYSQL is a relational database system.

• Client/Server Architecture: MYSQL is a client/server system. There is a database server (MYSQL) and arbitrarily many clients (application programs), which communicate with the server; that is, they query data, save changes, etc. The clients can run on the same computer as the server or on another computer (communication via a local network or the Internet).

• The familiar large database systems (Oracle, Microsoft SQL Server, etc.) are client/server systems. These are in contrast to the file-server systems, which include Microsoft Access, dBase and FoxPro. The decisive drawback to file-server systems is that when run over a network, they become extremely inefficient as the number of users grows.

CHAPTER-3

SYSTEM STUDY

3.1 EXISTING SYSTEM

GSM based EV Battery managment Health Monitoring Project mainly works for allowing doctors or relatives of EV Battery managment to check the status of EV Battery managment health remotely. The system calculates the heartbeats and body temperature of EV Battery managment and if it goes above certain limit then immediate informative alert message will be sent to the registered number

In this fast pace of life, it is difficult for people to be constantly available for their near ones who might need them while they are suffering from a disease or physical disorder. So also constant monitoring of the EV Battery managment's body parameters such as tempe rature, pulse rate, sugar level etc. becomes difficult. Hence to remove human error and to lessen the burden of monitoring EV Battery managment's health from doctor's head, this method presents the methodology for monitoring EV Battery managments remotely using GSM network and Very Large Using this technology an alarm is generated whenever the EV Battery managment is at risk but it could not provide the detail information about the EV Battery managment health status. And it is not possible to view all the recorded data at the same platform.

3.2 PROPOSED SYSTEM

Internet of Things (IoT) is the emerging paradigm, which contains huge amount of smart object and smart devices connected to the internet for communicating with each other. IoT devices are used in many fields which make the users' day to day life more comfortable. These smart devices are used to collect temperature, blood pressure, sugar level etc., which are used to evaluate the health condition of the EV Battery managment. Communicating the collected information to the doctor, making accurate decision on the data collected and notifying the EV Battery managment is the challenging task in the IoT. PHMS also notifies the EV Battery managment with possible precautionary measures to be practiced by them. This system suggests the EV Battery managment with medical care and next step to be followed in case of critical situation. we introduce a new way of implementing PHMS with Arduino Uno named as an IoT based EV Battery managment Health Monitoring System using Arduino. Data generated by the sensors are processed by arduino microcontroller ATMEGA 328P. ESP8266 provides unsurpassed ability to embed Wi-Fi capabilities within other systems. It offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. The data generated from arduino is available in the IoT website thinkspeak.com with the use of Wi-Fi module. The PHMS also notifies the EV Battery managment with possible precautionary measures to be practiced by them. This system suggests the EV Battery managment with medical care and next step to be followed in case of critical situation.

CHAPTER-4

SYSTEM DESIGN

4.1 DATA FLOW DIAGRAM

System design is the process of planning a new system or to replace the existing system. Simply, system design is like the blueprint for building, it specifies all the features that are to be in the finished product. System design phase follows system analysis phase. Design is concerned with identifying functions, data streams among those functions, maintaining a record of the design decisions and providing a blueprint the implementation phase.

Design is the bridge between system analysis and system implementation. Some of the essential fundamental concepts involved in the design of application software are:

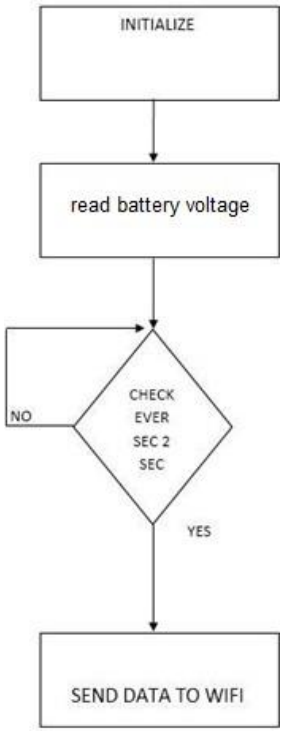
• Abstraction

• Modularity

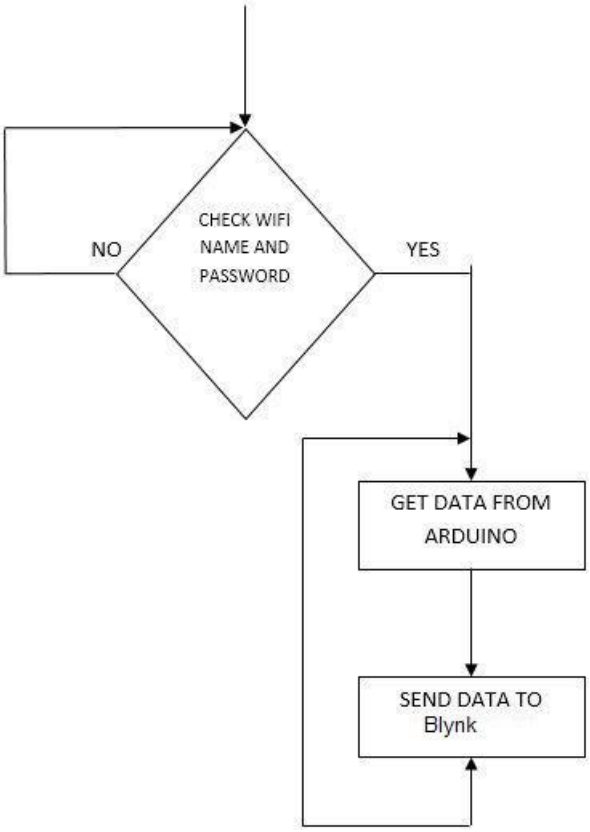
• Verification

A data flow diagram is graphical tool used to describe and analyze movement of data through a system. These are the central tool and the basis from which the other components are developed. The transformation of data from input to output, through processed, may be described logically and independently of physical components associated with the system. These are known as the logical data flow diagrams. The physical data flow diagrams show the actual implements and movement of data between people, departments and workstations. A full description of a system actually consists of a set of data flow diagrams. The development of DFD'S is done in several levels.

TRANSMITTER SIDE:



RECIVER SIDE:



Field Name	Attribute	Type	Size	Description
Id	Primary key	Int	10	It uniquely store id in the table
Temperature	Null	Int	12	It store Temperature of the EV Battery managment Monitoring
Heart beat	Null	Int	12	It store Heart beat of the EV Battery managment Monitoring

4.2 TABLE DESIGN

Table Name: EV Battery managment Monitoring system by using IOT

Table Description: This table stored EV Battery managment Monitoring information

4.3 INPUT DESIGN

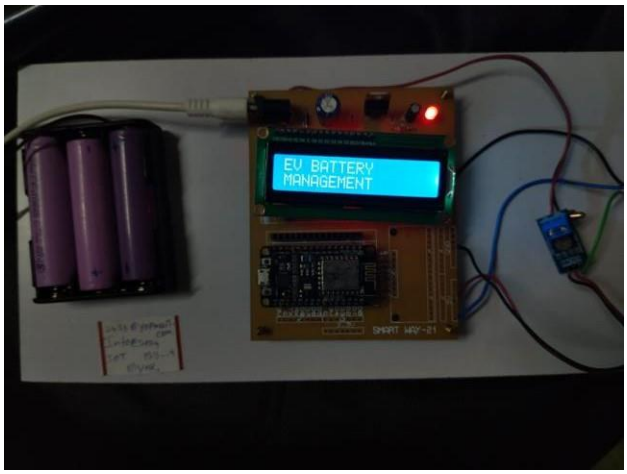
Input design is one of the most expensive phases of the operation of computerized system and is often the major problem of a system. A large number of problems with the system can usually be traced back to fault input design and method. Needless to say, therefore that the input data is the life block of a system and has to be analyzed and designed with the most consideration.

The decisions made during the input design are:

- To provide cost effective method of input.
- To achieve the highest possible level of accuracy.
- To ensure that input is understood by the user.

System analysts decide the following input design details like, what data item to input, what medium to use, how the data should be arranged or coded data items and transaction needing validations to detect errors and at last the dialogue to guide users in providing input. Input data of a system may not be necessarily a raw data captured in the system form scratch. These can also be the output of another system or sub-system. The design of input covers all phases of input from the certain of initial data to actual entering the data to the system for processing.

HARDWARE SCREENSHOT



4.4 OUTPUT DESIGN

Output design generally refers to the results and information that are generated by the system. For many end-users, output is the main reason for developing the system and the basis on which they evaluate the usefulness of the application.

The objective of a system finds its shape in terms of output. The analysis of the objective of a system leads to determination of outputs. Outputs of a system can take various forms. The most common are reports, screens displays printed form, graphical drawing etc. the outputs vary in terms of their contents, frequency, timing and format. The users of the output, its purpose and sequence of details to be printed are all considered. When designing output, the system analyst must accomplish things like, to determine what information to be present, to decide whether to display or print the information and select the output medium to distribute the output to intended recipients.

Internal outputs are those, whose destination is within the organization. It is to be carefully designed, as they are the user's main interface with the system. Interactive outputs are those, which the user uses in communication directly with the computer.

CHAPTER-5
SYSTEM TESTING AND IMPLEMENTATION

5.1 TESTING AND METHODOLOGIES

System testing is the stage before system implementation where the system is made error free and all the needed modifications are made. The system was tested with test data and necessary corrections to the system were carried out. All the reports were checked by the user and approved. The system was very user friendly with online help to assist the user wherever necessary.

TEST PLAN

A test plan is a general document for the entire project, which defines the scope, approach to be taken, and schedule of testing, as well as identifying the test item for the entire testing process, and the personal responsible for the different activities of testing. This document describes the plan for testing, the knowledge management tool.

Major testing activities are:

- Test units
- Features to be tested
- Approach for testing
- Test deliverables
- Schedule
- Personal allocation

TEST UNITS

Test Case specification is major activity in the testing process. In this project, I have performed two levels of testing**.**

- Unit testing
- System testing

The basic units in Unit testing are

- Validating the user request
- Validating the input given by the user
- Exception handling

The basic units in System testing are

- Integration of all programs is correct or not
- Checking whether the entire system after integrating is working as expected.
- The system is tested as whole after the unit testing.

TEST DELIVERABLES

The following documents are required besides the test plan

✓ Unit test report for each unit

✓ Test case specification for system testing

✓ The report for system testing

✓ Error report

The test case specification for system testing has to be submitted for review before the system testing commences.

TEST CASE AND TEST REPORTS

UNIT TESTING

The system is tested as whole after the unit testing.

Test Case No	Test Case	Test Case Description	Expected Result	Observed Result	Result Pass/Fail
1	Enter the username and password	Check the valid username and password	The username and password has to be accepted	The username and password has entered correctly	Pass

VALIDATION TESTING

The objectives of this testing is to tell user about the validity and the reliability of the system

Test Case No	Test Case	Test Case Description	Expected Result	Observed Result	Result Pass/Fail
1	Testing all the modules in the system	It tests all the modules based on the input from the system and getting an valid output from the system	Valid input from the user to the system and getting a valid output from the system	Getting a valid and reliable output from all the modules in the system	Pass

SYSTEM TESTING

Entire system is tested as per the requirements. Black-box type testing that is based on the overall requirements, covers all combined parts of a system.

Test Case No	Test Case	Test Case Description	Expected Result	Observed Result	Result Pass/Fail
1	Testing all the modules in the system	It tests all the modules in the system whether it is executing in the system or not	By testing all the modules it is accepted by the system and should execute the result	It tests all the modules and the system accept all the modules and it produces an expected result	Pass

INTEGRATION TESTING

This type of testing is especially relevant to client/server and distributed systems.

Test Case No	Test Case	Test Case Description	Expected Result	Observed Result	Result Pass/Fail
1	Testing all the modules to verify combined functionality after integration	It tests all the modules in the system based on the inputs from the user to the system and getting an valid output from the system	Valid input from the user to the system and getting a valid output from the system	Getting a valid reliable output from all the modules in the system	Pass

5.2 SYSTEM IMPLEMENTATION

System Implementation is the stage of the project when the theoretical design is tuned into working system. If the implementation system stage is not carefully controlled and planned, it can cause chaos. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the users a confidence that the system will work and be effective.

The implementation stage in a project involves,

✓ Careful Planning investigation of the current system, checking constraints and the implementation.

✓ Training the staffs in the newly developed system.

A software application in general is implemented after navigating the complete life cycle method of a project. Various life cycle processes such as requirement analysis, design phase, verification, testing and finally followed by the implementation phase results in a successful project management. The software application which is basically a Windows based application has been successfully implemented after passing various life cycle processes mentioned above.

As the software is to be implemented in a high standard industrial sector, various factors such as application environment, user management, security, reliability and finally performance are taken as key factors throughout the design phase. These factors are analyzed step by step and the positive as well as negative outcomes are noted down before the final implementation.

Security and authentication is maintained in both user level as well as the management level. The data is stored in MySQL, which is highly reliable and simpler to use, the user level security is managed with the help of password options and sessions, which finally ensures that all the transactions are made securely.

The application’s validations are made, taken into account of the entry levels available in various modules. Possible restrictions like number formatting, date formatting and confirmations for both save and update options ensures the correct data to be fed into the database. Thus all the aspects are charted out and the complete project study is practically implemented successfully for the end users.

CHAPTER -6

CONCLUSION

While the benefits of IoT integration in EV battery management are evident, it is imperative to address challenges such as data security, interoperability, and standardization. Overcoming these challenges will be pivotal in unlocking the full potential of IoT technologies for the electric transportation sector. Additionally, future research and development efforts should focus on refining and expanding the capabilities of IoT-driven solutions, ensuring their adaptability to evolving battery technologies and the dynamic landscape of electric mobility.In conclusion, the synergy between IoT and EV battery management, particularly in voltage monitoring and battery backup surveillance, marks a transformative era in the quest for efficient, reliable, and sustainable electric transportation. As technology continues to evolve, the insights gained from this integration will not only enhance the current generation of EVs but also pave the way for innovations that contribute to a cleaner, greener future in the realm of transportation.

CHAPTER-7

FUTURE ENHANCEMENT

In the future, improvements in IoT-based electric vehicle battery management are expected to bring about more accurate predictive analytics, ensuring proactive maintenance and longer battery life. Edge computing within EVs will enable quicker decision-making in critical situations, while blockchain technology ensures secure data management and builds trust among stakeholders. Wireless charging optimization, enhanced human-machine interaction, and integration with smart grids are key areas for development, promoting efficiency and sustainability. Additionally, tracking the entire lifecycle of EV batteries and establishing interoperability standards will contribute to a more seamless and eco-friendly electric mobility ecosystem.

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APPENDIX

A. Screen Shots

B. SAMPLE SOURCE CODE