Comparison of MERN Tech Stack with Tech Stack that Uses AWS Amplify Project

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Comparison of MERN Tech Stack with Tech Stack that Uses AWS Amplify Project

# **Introduction**

## **Overview of MERN Stack**

MERN is an acronym used in describing the set of JavaScript-based technologies applied in the JavaScript web application development process. Ideally, this technology is made with the idea of making the development process to be smooth. MERN comprises the following open-source components: Mongo DB, Express JS, and Node JS. They are web development technologies stacks that are used today by most web developers globally. Each of them plays a paramount role in web application development whereby MongoDB acts as a database system, Node JS as backend run-time atmosphere, Express JS as a back-end web framework, and React JS as a front-end framework (MongoDB, n.d). Choosing the right stack in a project is paramount. The MERN stack architecture involves a 3-tier architecture that is a frontend, backend, and database that use JavaScript and JSON. The top tier is React JS that is a declarative JavaScript framework for creating dynamic client-side applications in HTML. In this tier, complex interfaces are built through simple components that connect them to data on the backend server and send them back as HTML. The middle tier is Express JS server-side framework that runs inside the Node JS server. It has powerful models for Universal Resource Locator (URL) routing and handling HTTP requests and responses. Express JS functions use MongoDB's, Node JS drivers, or callbacks for promises, access, and update data in the MongoDB database.

It is worth noting that there are several stacks to choose from and most software developers tend to go for the easiest and the newest options available (Smith, 2021). Notably, React JS UI components within the application i.e., front-end, resides in the browser. Additionally, the front-end is served by the application backend that resides in the server, but through Express JS. With MERN, any interaction that leads to a data change request is directed to NodeJS. MERN is a framework that makes it simple to create universal apps with Mongo, Express, React, and NodeJS. It cuts down on setup time and gets you up to speed quickly with tried-and-true technology (Aryal, 2020). When comparing the two stacks, the most noticeable difference is that React.js has replaced the former Angular.js. React is a JavaScript library for creating user interfaces (also known as React.js or ReactJS). Facebook, Instagram, and a network of individual developers and corporations’ organizations keep it up to date. React allows you to construction of huge apps that allow for the loading of new data without requiring a page refresh Increasing the app's speed and giving users a better browsing experience. It is primarily up to the application developer to choose between the Tech stack and MERN stacks. If and only if a developer is familiar with ReactJS, the MERN stack makes sense. Performance metrics of two stacks, on the other hand, may not have a significant impact on small to medium projects. The rationale behind this is because the speed and quality of development are determined by the experience and comfort of the software developer.

When deciding who performs what within the software development team. Ideally, the significant to overlap between the application features between the two stacks is critical in deciding who does what in the application development process (Aggarwal & Verma, 2018). Nevertheless, React.js has always been considered as a component of MERN Framework due to various reasons, such as its robustness in data security, low latency, application code being connected to the user directly, thus making it extremely safe. Additionally, with the usage of robust servers, its performance has improved tremendously. Your choice of technology stack and how you are planning on how to apply it for the growth and development of both the product and your company is a crucial influence in the successful implementation of your application when designing it. Your tech stack has a big impact on scalability and making the wrong decision can drive up expenses and slow down development.

Working with the MERN stack yields powerful results in a short amount of time. Because building and deploying solid MERN programs is expected to become more crucial in the future, knowing your way around the stack is essential. Backend apps are run on Node.js. It's a runtime environment for Javascript scripts. The Google V8 JS Javascript engine underpins Node.js totally. Node.js has important functionalities, such as networking protocols like HTTP, that aid in the development of online applications (Mai, 2020). Through the node package manager npm, Node.js supports the use and installation of third-party applications. The following are advantages of Node.js, which forms part of MERN Tech Stack.

1. When compared to other runtime environments, Node.js has the advantage of being incredibly quick and responsive.
2. It's an open-source environment, which means the community is quite active and there are a lot of users that are always contributing input.
3. Node.js is growing in popularity, and more developers are adapting it, ensuring that the technology will be around for a long time.

Node.js is a programming language that allows you to create web applications.

Node.js was developed on top of Chrome's JavaScript runtime to make it easier to create scalable network applications. The platform is designed to work with

## **Overview of Tech Stack in Relation to AWS.**

Tech stack is a term used to describe tools, software, hardware, services, coding, languages, and programs adopted by an organization in building an application. In the modern technology world, the tech stack is also referred to as techniques used by marketing and sales teams in monitoring how users interact with an application. In the implementation of tech stack in the cloud, many software developers opt to deploy parts of their tech stack in the cloud, with the aim of reducing the administrative complexity linked with application development (Tonjona, 2020). With the cloud service providers such as AWS, they deliver software development platforms via the cloud with the platform as a service cloud delivery model. Ideally, deployment of the components of the tech stack into the cloud is helpful in reducing costs and streamlining development but is also important in creating more potential attack vectors for malevolent cyber-attacks. AWS cloud-native platform addresses issues relating to cloud security with ideal and robust security analytics, which include threat intelligence, threat detection, and incident response capabilities that are critical in helping to identify malicious cyber-attacks. Additionally, the AWS cloud platform simplifies the process of provisioning instances as well as deploying application code and providing appropriate access to them. Currently, this service is available for web applications that are developed with Java/ Tomcat tech stack. Moreover, software developers can conveniently do packaging of their web applications into a WAR file and use AWS elastic beanstalk to perform automation of its deployment on the AWS cloud.

A technological stack is a fundamental and basic instrument that a developer should consider when working on a mobile or web app project. It consists of the requisite software, programming language, and all other components necessary for the project's correct functioning. This includes the framework, back-end, databases, and front-end programming language. It permits the design of a system made up of many application functions that all run on their own infrastructure. Client and server sides, or merely client sides, make up the majority of the Tech stack. The project will determine which side will be chosen (Tran, 2021). The visual component of the application, often known as the front-end or client-side, is described as the application's easier visual property. For the client's comfort, the project must be created on a user-friendly and inviting interface. The back end, also known as the server-side, is in charge of data processing and is largely invisible to users. This section of the software is mostly concerned with server-to-database communication. In both scenarios, the technology stack may require a simple programming language, framework, CMS, or a combination of all three.

 Based on the components of Tech Stack in application development, mostly they are two main components, which include front-end stacks and back-end stacks. The two components of stacks are performing the backbone role of the developers’ building the project. HTML (Hypertext Markup Language) is a markup language that is used to create and display electronic documents, most notably web pages.HTML is the building block for organizing and putting material on web page.CSS, or Cascading Style Sheets, is a programming language used to control the look and feel of a web page, including colors, layout, style, and size, among other things. AngularJs is a Google open-source MVC framework that is mostly used to build single-page applications. AngularJs is a technology that transforms static HTML pages into dynamic ones using an animating framework. MVC Architecture, Pojo Model, Dynamic Binding, and Dependency Injection are just a few of the fantastic features of Angular Js that help you avoid common pitfalls. ReactJS is another JavaScript library from Facebook. ReactJS is a declarative JavaScript library with a focus on performance and flexibility. It is an open-source frontend that works on the app's design. ReactJS has a ton of cool capabilities, and the code is declarative, which makes debugging easier and more predictable.

The second component of Tech Stack is known as back-end Tech Stack which is also referred to as server-side development. Stack. It's characterized by the app's or website's internal workings, which are hidden from users. They are not visible, yet they are essential tools for keeping the app's mechanics in top shape. They are crucial to the app's or website's continued operation. Some of the main elements that needs to be included at the back end with MERN Stack and Tech Stack include Database - to store and administer the data base, the optimum stack must be picked. Here are several significant stacks for MySQL, MongoDB, or PostgreSQL database management. Moreover, it is finally time to connect the database to AWS server using MongoDB Atlas. It is worth noting that MongoDB provide a free tier cluster that do not expire at all and can allow user to access various features. The following steps must be followed when creating a new database cluster.

1. Login to your MongoDB Atlas account.
2. Select the region that is close to you and select create cluster option.
3. Navigate to network access on the left had section and configure your IP address to the whitelisting.
4. On the Database access section, create the database user and then create the password that you would want to use.
5. Click connect from the Clusters.
6. Select connect your application as your connection method.
7. You will need to copy the connection string at this point which will be used to connect to MongoDB.

With the connection string, you need to navigate to the server folder to create *config.env* file, where it is a requirement to paste ATLAS URL variable. With the database configuration, you are required to do replacement of username and password with your actual database and password as captured in the code below.

ATLAS\_URL=mongodb+srv://<username>:<password>@sandbox.testing.mongodb.net/mydatabase?retryWrites=true&w=majority

PORT=3000

 If database is not available, one can register to have a MongoDB account Based on the issue of data flow in Angular, it is bidirectional in nature. If UI is altered this leads to translation of the model state automatically. For the case of React, the data flow is on unidirectional state; hence, if you use React it is possible to alter the UI after transformation of the model state.

Notably, React unidirectional data binding provides a good data overview, which is critical in handling large data projects. This makes MERN Stack to be more favorable than any other framework especially when handling large projects. For a small project, MEAN is the most recommended, since the bidirectional data binding offered by Angular is considered to be a more efficient approach. With the implementation and integration with AWS, MERN Stack provides a third-party support, where one can work by installing other useful libraries, which is one of the main factors when considering the application of MERN. For MERN to work in AWS, it requires additional configurations for performing some operations. Such additional configurations may include installation of the libraries or plugins within AWS.

# **Problem Statement**

Understandably, choosing a tech stack has been a key issue; however, this depends on the types of requirements and how they are will suffice using the application that is under development. With the advancement of technology, developers are looking for means to develop an application with great ease and linking graphical user interface with the database, and finally creating the back-end application and running it under higher performance platforms that help in delivering scalability. Additionally, one of the notable problems in software development is based on the choice of tech stack (Smith, 2021). The ecosystem of JavaScript is hastily changing, and new frameworks or libraries are introduced claiming to have better features than its predecessor. The issue that arises is based on the decision-making process in choosing one framework over the other, which is very challenging for the developers.

 In ensuring that there is rapid development, the application of MERN Stack and Tech Stack has been deployed instantly since they are considered to be efficient as a hosting web service due to them being non-blocking implying that they can serve a large number of clients simultaneously. The MERN Stack is a collection of technologies applicable to create high-end web applications. Frameworks, libraries, databases, and other technologies are commonly used in the development of web applications. Additionally, the two technologies are known not to require switching language when working on different parts of the applications. Moreover, it offers solutions to many problems experienced in the development process such as sharing of the code logic throughout the application.

# **Aim and Objectives of the Project**

1. The aim of this research is to investigate the comparison between MERN Tech Stack and Tech Stack that Uses AWS Amplify Project at its Core.
2. The main objective of this research is to understand the requirements of implementing MERN Tech Stack and Tech stack, by performing a comparative study of the two technologies.

# **Research Questions**

1. What are the differences between MERN Tech Stack and Tech Stack in their application in AWS Amplify Project?
2. What are the implementation requirements in the application of MERN Tech Stack and Tech Stack?

# **Significance of the Project Study**

Completion of this project will be of great significance because it will help the research to perform and understand comparative study on MER Tech Stack and Teck Stack together with their application in software development. Additionally, this study will help the researcher to understand the deployment of applications developed using the two frameworks in AWS cloud service.

# **Methodology for Project Implementation**

With the preponderance of web applications, the development of web applications has been discussed vividly especially when it comes to choosing the right methodology and the right stack in custom software application development. Ideally, the implementation methodology of the main types of stacks means a lot in any project and they have relative benefits, With the stack methodology, both MERN Tech Stack and Teck Stack methodology comprises f combination of the technologies and programming languages that comprise technology stacks as well as application stacks. Furthermore, with the technology stacks methodology, it comprises of a multidisciplinary approach in the software development process.

The implementation of MERN Tech Stacks and Tech Stack deeply relies on Agile development methods. Ideally, it has become increasingly paramount to select the ideal method and technological infrastructure to help in maximizing identified business goals. In full-stack development, since modern applications are created using a stack of various technological solutions, it is important to identify the right framework and methodology that is efficient in developing the applications. The use of agile software development must be mapped with the MERN Stack and Tech Stack when the need arises by ensuring that both the client-side and server-side of the application have been implemented based on the requirements. Additionally, the right stack must be chosen between MERN Tech Stack and Tech Stack (Solanki, 2021). In the methodology chosen, the criteria for choosing the best type of stack in software development include type and size of the project, scalability, maintainability, time to market, cost of the overall development, and type and size of the market.

# **Project Development Time and Cost**

 The web application domain in project development is mostly saturated with myriad technologies and frameworks that have different costs in terms of developer salaries and maintenance.Developer salaries in this case depend on the technology they work on and the level of expertise. If the stack is sophisticated the higher the cost will be and selecting open-source technologies can reduce the cost of the project. Technology stack as a programming language ensures that there is an integrated and uninterrupted development procedure, perfect balance, and flexibility of the project. The critical aspect of the technology stack that uses Java Script it reduces the project cost and development time throughout project development. Ideally, stack developers help to keep every part of the web application running smoothly. Team members can solve any issue within the project management to reduce infrastructure, personnel, and management cost as they possess to know how numerous technologies or frameworks can be fixed and delivered rapidly. The project manager can use the cost to determine the activity duration of the task and project schedule. The effectiveness of project management brings out the project completed on time and schedule. Estimating project duration is a key function of scheduling. The accuracy of the overall schedule depends on the accuracy of the project estimation. Additionally, a project manager can use a work breakdown technique to reduce the activity of tasks to perform accuracy for the project completion.

# **Comparison of Core Functions between MERN Tech Stacks and Tech Stack**

Core functions define services, products, and activities that are designed to achieve common results and missions to provide valuable information such as comparability between agencies. In today's digital world, tech advancements and new markets demand are changing on daily basis and having an application or website may not bring full impact on business growth without having the right tech stack for the project. Tech stack is a cloud-compatible and open-source that helps in sending cloud functions within the application by reducing the circle space cost. It also makes isomorphic coding possible and easy to move code to another framework that is written in a particular framework to allow reusability, maintenance, testability, and high speed based on JavaScript open-source framework. Developers can easily switch between server-side and client-side development depending on project requirements which becomes beneficial to them in developing JavaScript to handle the whole project. Additionally, Tech stack is referred to as the fastest-growing open-source stack development framework that supports developers with necessary tools or plugins to reduce system administration time to allow fast deployment of websites, web applications, and APIs on complex project development processes.

On other hand, In MERN Tech Stack, developers can use codes written on React on both browsers and servers. This JS stack gives the flexibility of making pages on the server when required. Accessing the work of Aryal (2020), MERN tech stack allows the developer to create and develop a CRUD (Create, Read, Update, and Delete) app easily from the begging to end. React library gives the developer access to high-end tools for building apps. Ideally, it comes with pre-built extensive suite for testing tools. Additionally, the MERN tech stack covers both development cycles from front-end to back-end with Java Script.

# **Comparison of Implicit Software Architectures**

Software architecture involves the description of elements from which systems are created, interactions among those elements, patterns that guide their composition, and constraints on these patterns. In general, this type of system is defined as a collection of components with interactions between them. Clients and servers, databases, filters, and levels in a hierarchical structure are examples of the components. Interactions such as client-server protocols, web streams, and database accessing protocols are determined in instances of styles. In the real sense, software programs always have a robust infrastructure to sustain in a volatile atmosphere. In this case, developers have a responsibility to have clarity on features of the stacks, cost-effectiveness, and other related benefits to help them to choose the correct stack for maximum scalability, performance, and flexibility when deploying the project (Raju et al, 2021). A combination of technologies in the MERN stack such as frameworks, libraries, and databases are used to develop web applications. It contains different open-source components such as MongoDB, React, and Node JS that provides the end–to–end framework for developers to work on web development.Node.js as JavaScript open-source runtime environment it runs code outside the browser where developers can handle multiple connections via a single server. Notably. MongoDB document database stores data in JSON format that allows multi-cloud data distribution.

MERN is known to be a full stack that follows the traditional 3-tier architectural pattern including the traditional front-end display tier, which in this case is React.js, application tier. i.e., Node.js, and finally database tier in this case it is MongoDB. The rationale behind having MERN Stack in the application development is based on various reasons. To start with, MongoDB was designed to work with Node.js, which makes storage, manipulation, and representation of JSON data in every tire to be easier and everything from command line interface to its query language. MERN is considered to be a stack and architecture of choice for today’s software development. On the other hand, the implicit software architecture of Tech Stack comprises of a combination of compatible technologies, programming languages, technologies, and frameworks. Additionally, Tech Stack provides an integrated and uninterrupted development approach, adding an excellent balance and flexibility to a given project. In web development, MERN stack and Tech Stack development has become the norm since the framework offers the ideal solutions for frontend, backend, and testing of the application.

# **Application of CRUD APIs in the Implementation**

Ideally, the application of CRUD APIs can be applied in various aspects of the application development using MERN Tech Stack framework. A comprehensive guide on building CRUD (Create, Read, Update, and Delete) using MERN and its underlying technologies provides an overview of various aspects, such as installation of the CRUD API’s. In the MERN Stack, the installation and creation of React App requires opening a terminal or Node.js command then navigating to the MERN projects folder. At this point, once can proceed with installing React app creator (create-react-app) for easier creation of React. The following command needs to be typed on the command line do the installation.

sudo npm install -g create-react-app

The next thing is to create a React app using the command below.

create-react-app mern-crud

The above command creates a new React application using the name “mern-crud” and this process can take sometimes since all dependencies and modules are installed automatically. The next step in the creation of CRUD API is to navigate to the newly created folder via the command below.

cd ./mern-crud

The next step is to run the React application for the first time through the command below.

npm start

By learning the above command, it will automatically open a default browser via <http://localhost:300>

The next thing to be done in this process is to get connected to MongoDB from Node.js application; This require using of Mongoose.js to act as Mongo.js object modelling. This technology offers provides an ideal, and schema-based solution in modelling your application data. Additionally, this comprises of built typecasting, validation, and query building, building of business logic, among others. Before the installation of Mongoose is to stop running of Express server then process with the installation as shown below.

npm install --save mongoose bluebird

In the application and configuration of CRUD API’s, one must edit app.js file and then adding the lines below after another variable line that declare connection to MongoDB via Mongoose as captured below.

var mongoose = require('mongoose');

mon

oose.Promise = require('bluebird');

mongoose.connect('mongodb://localhost/mern-crud', { useMongoClient: true, promiseLibrary: require('bluebird') })

  .then(() =>  console.log('connection succesful'))

  .catch((err) => console.error(err));

The connection to MongoDB must be well tested by running the node application and viewing the message over the terminal as shown below.

Connection succesful

# **Functional Requirements- Analytics, Authentication**

Functional requirements in any system provides an overview of what the system can do. Implementation of various systems functionality via MERN Stack can be implemented using different perspectives. Implementation of authentication functionality using MERN Stack require creation of a web service through the MERN stack. The Tech Stack primary comprise of MongoDB to offer the data storage layer with JSON Token Ring for API authentication. With the Tech Stack and MERN Stack, various routes are meant for authenticating the users of the service. The authentication process is achieved through registered username-password combination which enables user from gaining a JsonWebToken which allow API access.

Understandably, MERN Tech Stack can be integrated with Google Analytics functionality through an inclusion of a block of JavaScript on pages within the application. When users to the application view a page, this JavaScript code file references a JavaScript file which later do execution the tracking operations for the analytics. Additionally, the tracking operations retrieve data relating to page request through various means and then sending this information the analytics serve, through a list of parameters linked to a single pixel image request.

# **Non-Functional Requirements for Project Implementation (Scalability, and Maintainability)**

Non-functional requirements are meant to define system attributes which include security, performance, reliability, usability, scalability, maintainability, among other non-functional requirements. Non-functional requirements serve as constraints in the design of the system along with many backlogs. Additionally, such requirements are key in enhancing the usability as well as effectiveness for the entire system. The idea behind non-functional requirements is to provide and present the criteria necessary for judging the operation of the system rather than the specific behaviors of such a system or application. At moment, MERN stack software programs require to have a robust infrastructure to sustain in a volatile atmosphere and developers to choose the right stack for maximum scalability, performance, maintenance, and flexibility because it is crucial to comprehend what a stack is and how it can bring a world of opportunities when developing a project. For those case of MERN stack technology and Tech stack, below will be the non-functional requirement.

1. The application should provide a higher level of security and privacy of information. Additionally, application authentication should be stored within the local device and should require users’ permissions to have access to it.
2. The app should guarantee 100% reliability to perform the required operations, such as downloading the training materials or any other form of operation.
3. The mobile app should provide a high level of usability, which should make it easier for users to understand without any guidelines.
4. The application should be highly scalable, especially when increased usage is concerned.
5. The application should provide high maintenance abstraction in the code to secure and manage project files and system.
6. The app should be ready for scalability to be an overnight sensation like other apps such as PayTM and Myntra.

# **Data Storage Mechanism**

Data storage involves recording of information in a storage medium either in handwriting, magnetic tape and optical devices form in a storage system for future use. Storage systems rely on electromagnetic and other media to preserve and restore data if needed that makes the work easier to backup files and documents for quick recovery in case of computing crash or cyberattack. It is handled by various forms of storage mechanisms that provides method to read and write data for any form with the given mechanism. Data storage it occurs on physical hard drives, disk driver, USB drives or virtual in the cloud. Based on MERN technology stack, MongoDB documents are stored in databases that is, it stores data as a document inside a collection with many collections inside the database. The document data is then stored as BSON which is JSON in a binary format for performance. The data is schema-less whereby each document cab have as many keys and values as needed with no restriction on the data types. Tech stack in relation to AWS, google cloud contains relational and non-relational databases and data warehouses that permits the developer to store all real-time and historical data. This component is a key for storing data about what happens inside the application and how users behave when using it. Notably, Tech stack represents set of robust components and modular technologies that allows developers to develop powerful and enterprise-grade applications. Data analytics stack encompasses diverse technologies that allow users and developers to build a robust analytics engine to integrate, model, and transform data from numerous data sources. Additionally, it consists of various reliant layers that make up an effective and full functioning analytical system with each layer offering unique level of processing.

 Based on the data storage mechanism supported by AWS, first it is important to understand that this platform is Linux-based; hence, it requires configurations to be done before deployment of any application that is made using MERN Tech Stack and Tech Stack. The for the file storages, MERN Tech Stack allow storage of data in files directory, that is all files being uploaded via the application. Additionally, AWS service allows installation of MongoDB which provide Cloud DBaaS. The MERN stack consists of MongoDB, Express, React, and Node, which are used in combination to construct online apps. In this configuration, Node and Express link the web backend together, MongoDB serves as the NoSQL database, and React serves as the user's interface. When choosing a NoSQL database for any application, MongoDB is a strong contender. It's a document-oriented database that stores information as JSON-style documents. As a result, fields might differ from one document to the next, and data models can change over time as application requirements change.

MongoDB's availability and scalability help applications that place a high importance on them. All four of these technologies are open-source, cross-platform, JavaScript-based, and have a large community behind them. The distributed architectural features of MongoDB are beneficial to applications that prioritize availability and scalability. High availability, horizontal scaling via sharding, and multi-data center scalability across geographic distributions are all built-in features. MongoDB offers a strong query language that allows for ad hoc queries, indexing for quick lookups, and real-time aggregation, all while retaining performance even as data expands dramatically (Nguyen, 2021). With an application data platform that supports your transactional, search, mobile, and real-time analytics workloads on any cloud, you can drastically MongoDB simplify your data infrastructure. MongoDB Atlas provides a cloud-based service on AWS which can scale a MongoDB database configured via a few clicks. Access to your database via AWS cloud may be easily controlled with MongoDB Atlas. To maintain network isolation, your database instances are deployed in a separate Virtual Private Cloud (VPC). IP whitelisting or VPC peering, always-on authentication, encryption at rest and in transit, sophisticated role-based access control, and more are among the other security features.

# **Project Plan (Schedule and Project Costs**

In the implementation of MERN Tech Stack application, it requires project planning for all the project activities to be involved from coding to hosting. Additionally, it requires to do project costing to ensure successful implementation of the project. Before doing project plan in such a project, it is important to consider may factors relating to your project (Keinänen, 2018) Such factors include type of the size of the project, expertise of the project team and knowledge base, time to market, scalability, maintainability of the application, and overall development cost. The table below capture project plan on the implementation and duration to be taken for each project activity.

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity ID** | **Project Activity** | **Duration** | **Assigned to** |
| 1 | Project Planning and Requirements Gathering | 12 weeks | Project Manager and Systems Analyst |
| 2 | Requirements Analysis | 4 weeks | System Analyst |
| 3 | Design | 4 weeks | System Analyst and System Design |
| 4 | Coding/ Development | 24 weeks | Software Developer |
| 5 | Integration and Application Testing | 4 weeks | System Tester |
| 6 | Implementation/ Deployment to Cloud | 1 week | Software Developer and Systems Admin |
| 6 | Operations and Maintenance | Continuous Process | Software Developer |

Table 1: Project Plan.

 Regarding the project cost, this can be divided into two categories, which include:

1. **Implementation/ Deployment Cost**
2. **Maintenance Cost**

The table below provides an overview of project costing from the development perspective using MERN Tech Stack and Tech Stack Perspective. This cost considers a standard project implemented using MERN Tech Stack/ Tech Stack framework

|  |  |
| --- | --- |
| **Cost Item** | **Cost Amount ($) (Annual Cost)** |
| Development Cost | $2,000 |
| Domain | $25 |
| SSL | $50 |
| AWS Hosting Plan | $1,750 |
| Miscellaneous Expenses | $175 |
| **Total Cost** | **$4,000** |

Table 2: Project Cost

 The costing of implementing a project is dependent on many things, which include the size of the project, complexity of the project, and storage requirements. Additionally, the cost may be dependent on the hosting plan that is chosen by the customer.

# **Summary**

In summary, MERN technology is made with the idea of making the development process to be smooth. MERN comprises the following open-source components: Mongo DB, Express JS, and Node JS. They are web development technologies stacks that are used today by most web developers globally. Each of them plays a paramount role in web application development whereby MongoDB acts as a database system, Node JS as backend run-time atmosphere, Express JS as a back-end web framework, and React JS as a front-end framework. Choosing the right stack in a project is paramount. The MERN stack architecture involves a 3-tier architecture that is a frontend, backend, and database that use JavaScript and JSON. The top tier is React JS that is a declarative JavaScript framework for creating dynamic client-side applications in HTML. In this tier, complex interfaces are built through simple components that connect them to data on the backend server and send them back as HTML. The middle tier is Express JS server-side framework that runs inside the Node JS server. It has powerful models for Universal Resource Locator (URL) routing and handling HTTP requests and responses. Express JS functions use MongoDB's, Node JS drivers, or callbacks for promises, access, and update data in the MongoDB database.

Based on the implementation of functional requirements, with the of authentication functionality using MERN Stack require creation of a web service through the MERN stack. The Tech Stack primary comprise of MongoDB to offer the data storage layer with JSON Token Ring for API authentication. With the Tech Stack and MERN Stack, various routes are meant for authenticating the users of the service (Mehra et al., 2021). Non-functional requirements are meant to define system attributes which include security, performance, reliability, usability, scalability, maintainability, among other non-functional requirements. Non-functional requirements serve as constraints in the design of the system along with many backlogs.

Additionally, such requirements are key in enhancing the usability as well as effectiveness for the entire system. The idea behind non-functional requirements is to provide and present the criteria necessary for judging the operation of the system rather than the specific behaviors of such a system or application. At moment, MERN stack software programs require to have a robust infrastructure to sustain in a volatile atmosphere and developers to choose the right stack for maximum scalability, performance, maintenance, and flexibility because it is crucial to comprehend what a stack is and how it can bring a world of opportunities when developing a project.

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