



**TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS**

A Project Proposal

On

The Dorm Den: A MERN Stack Hostel Web Application

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Sincerely,

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ABSTRACT

Every year there is a huge influx of students in Kathmandu valley from all over the country for their higher studies, as such, most of them are seeking a place to accommodate. For students, hostels or dormitory are best choice as they can get place to stay as well as daily foods. So, hostels are one of the basic infrastructures for our students who are the backbone and future of our country Even after all these years, finding a proper and clean hostel is hassle for students so our project “The Dorm Den: A MERN Stack Hostel Web Application “, seeks to be a one stop solution to find a suitable hostel for all the students. The Genuity of information and reviews will be guaranteed in our application since only verified owner can add info and only verified students will be able to leave a review (thus frauds and fake reviews can be avoided). We will be using MERN stack for the development of our web application, which will have an efficient, user friendly and attractive interface to interact with the data. Our project will not only be a way for student to find a good place to stay but also a good portal for hostel owners to showcase their business.

Keywords: Express, Hostel, MongoDB, NodeJS, REACT

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List of Abbreviation

UCD	User-centered Design
BDUF	Big Design Upfront
HCI	Human Computer Interaction
MERN	MongoDB Express React Node
RDMS	Relational database management system
SSPL	Server-Side Public License
ERD	Entity Relation Diagram
UI	User Interface

1 INTRODUCTION

1.1 Background

Altogether there are 1,440 campuses and 460,826 students currently in Nepal as per data collected in year 2077/78 [1] where majority of students prefer to choose to go away from home to study at a larger university as large universities often offer a wider range of academic programs and extracurricular activities than smaller colleges, which can provide students with more opportunities to explore their interests and develop new skills. Attending a large and well-known university can be a prestigious accomplishment, and may open future opportunities such as scholarships, internships, and job offers.

Living in a hostel can be a good option for these students who are looking for a cost-effective, social, and convenient place to live while studying rather than renting a place, room, or dorm.

Our application, a hostel booking app aims to help users to find hostels in their destination and book a bed or a room quickly and easily, without the need to call or visit the hostel in person. This can save students time and effort and make their stay more comfortable and manageable. On top of that, we also are aiming to provide hostels with a convenient way to manage their reservations and occupancy, and potentially attract more guests through our application.

1.2 Motivation

Motivation for our application comes from several factors, one motivation is the need to make it easier for people to find and book accommodations without the need to call or visit the hostel in person.

Hostels are less expensive than renting a place, especially if the student is sharing a room with others. This can make hostels a more affordable option for students who are on a tight budget. Using our application, students can save their time and effort and use their resources more effectively. Hostels are often located in central areas, making them a convenient option for students who want to be close to campus. So, searching suitable places near to central areas becomes more easier for students,

filtering through seas of hostels using our application. Students may prefer additional services and amenities, such as a shared kitchen, laundry facilities, and internet access provided by hostels which can be easily skimmed through by filtering hostels based on features and amenities. Hostels also typically offer a variety of room types, such as dorms, private rooms, which can accommodate different budgets and preferences of students in contrast to renting a place.

1.3 Problem Definition

When booking a hostel offline, it can be difficult to access detailed information about the hostel, such as its location, amenities, and policies. This can make it challenging for students to compare different hostels and make an informed decision about where to stay.

Hostels can fill up quickly, especially during peak seasons. When booking offline, it may be difficult to determine the availability of beds or rooms at the hostel, and students may have to call or visit the hostel in person to check availability and make a reservation.

An online hostel booking application like ours can help alleviate these challenges by providing users with easy access to detailed information about hostels and their availability and allowing them to make reservations quickly and easily.

1.4 Objectives

- Provide a convenient and efficient way for students to find and book hostels.
- Offer detailed information about hostels, including their location, amenities, policies, and availability.
- Offer hostels with a simple and effective way to manage their reservations and occupancy.

1.5 Scope and Applications

Hostel Booking application like ours can be used by students for faster and efficient finding and booking hostels in various locations, and by hostels to manage their reservations and occupancy.

The application provides detailed information about hostels, including their location, amenities, policies, and availability. Users could search for hostels based on their location, budget, and other criteria, and compare different options to find the best hostel for their needs.

Hostels could use the application to manage their reservations and occupancy, and to update information about their hostel, such as the availability of beds or rooms, policies, and amenities. This could help hostels attract more guests and manage their reservations more efficiently.

The scope and application of a hostel booking application would be to provide students and hostels with an easy and convenient way to find and book accommodations.

2 LITERATURE REVIEW

2.1 Agile development and User-Centered Design (UCD)

Agile development, a method of software development that emphasizes on collaboration, flexibility, and continuous improvement, is based on idea that requirements and solutions evolve through satisfaction of customer needs through early and continuous delivery of valuable software features. Agile development focuses on face-face communication for flexibility and adaptability to changing circumstances.

UCD, a design process in which designer works closely with end users to understand their needs, preferences, and limitations. It includes conducting user research, such as interviews, surveys, or usability testing, to gather information about user's goals, motivation, and behavior.

Agile development and UCD can be used together to create software that is not only flexible and adaptable, but also meet the needs of the user using it. Combining the iterative and incremental approach of agile development with the user-centered focus of UCD, teams can create high quality software that is both effective and easy to use.

UCD methods apply the holistic view of user needs and try to gather overall user interface plan before starting the implementation. Agile development focuses on prototype design up front and favors delivering working software functionality as early as possible in development lifecycle. [2] Agile development has warned of typical dangers of big design upfront (BDUF) suggests that the more designs are determined up front the harder it is to mitigate changes onto the development lifecycle as time and experience makes the changes desirable. [3]

Scrum and XP are known to be the best agile approaches used while integrating Agile development and UCD. The various stages during the agile process when the UCD techniques are applied are briefly discussed below:

- **Interaction Design First.** The UCD team applies Human Computer Interaction (HCI) techniques before agile iterations to gather the user view of the system being built. This approach is described as BDUF. [4]
- **Minimal up-front Interaction Design.** A minimal interaction design is discussed before the development team starts with agile iterations.
- **Implicit Interaction Design.** UCD techniques are applied to design the interaction of user stories to be developed in each iteration.
- **Overlapped Track.** UCD teams works at least one iteration ahead of development team such that development team can discuss on development of user stories whose interaction has already been designed.

Patton describes an interaction design first approach in. He uses abstract prototypes of the interaction context. He describes the approach might be cumbersome and time consuming at the start of agile iteration; its application helps identify various interaction components in advance.

Similarly, Ferreira et al. discusses result of one project where UI was designed up front before software development started. [3] In one of the project described in, developers work with user stories as a tool for identifying the priority task and order of development and reaches to completion of interaction design before development starts [5]

2.2 MERN Stack for web development

MERN is a web development stack that helps you to create both web and mobile application. MERN stack is one of the variations of MEAN stack, which comprises of four technologies, i.e., ‘M’ for MongoDB, ‘E’ for Express, ‘R’ for ReactJS, and ‘N’ for Node.js. Brief discussion of technologies used in MERN stack are explained below:

2.2.1 MongoDB

MongoDB is a free and open-source cross-platform document-oriented database program. It is classified as a NoSQL database program, meaning that it does not use the traditional SQL relational database management system (RDMS) model [6]. Instead, MongoDB uses JSON-like documents with optional schema. MongoDB is designed for scalability and performance, with the ability to store and process large volumes of data. It is often used in modern web applications, as it allows developers to easily store and query complex data structures. It is licensed under the Server-Side Public License (SSPL), MongoDB Inc.

2.2.2 REACT.JS

React is a free and open front end JavaScript library to create user interface or UI components. It is maintained by Facebook, Instagram, and a community of individual developers and corporations. React is built around single independent reusable components which create HTML tags, which is created by wrapping HTML tags into the objects to render. These components are handled by working around the delegation of the status of Virtual-DOM and the information content inside the component are managed via state administration.

2.2.3 NODE.JS

Node.js is an open source, cross platform, JavaScript background environment that uses V8 engine and uses JavaScript code offline browser. Node.js has an event-driven project that can create asynchronous I / O. These design decisions aim to improve performance and balance in web applications with many input / download functions, as well as real-time web applications.

2.2.4 Express

Express is a web application framework for Node.js. It provides a set of tools and APIs (Application Programming Interface) for building web applications on top of Node.js. With Express, you can easily create and manage routes. Express is often used in combination with other frameworks, such as React or Angular, to create full-stack web applications.

2.3 Geospatial Information Processing in MongoDB database

The amount of personal location data is forecast to increase by 20% every year, and location-aware information occupies a substantial proportion of the data generated every day: 2.5 quintillion bytes [7]. How to store, manage and query geospatial data has been the focus of research and problems that must be solved.

New geospatial application requires more flexible data schema, a faster query response time, and more elastic scalability than traditional spatial relational database currently have. The most communal problem occurrence has been seen when streaming requests from client to servers suddenly increase, which might cause response delay or even server unavailability. To solve this very scalability problem, a scalable framework was proposed back in MongoDB to implement elastic deployment for geospatial information sharing with the client users growing in number [8]. In this framework, MongoDB is chosen because it is a distributed database and supports a flexible storage schema suitable for massive map tile storage.

Several studies have found that RDBMS have some disadvantage in terms of big data storage and query in some specific areas, such as in streaming request or large data access environment in geospatial applications [9].

MongoDB provides two types of geospatial index types: geohash for 2d sphere and 2d. Within 2d sphere relevant queries are implemented through the calculation of index on Earth-like 2d sphere. Within 2d index, queries are calculated through a calculation of geometries on a two-dimensional plane. Four topological query operations are provided in MongoDB for geospatial data: \$geoIntersects, \$geoWithin, \$near, and \$nearSphere.

In a quantitative comparison of geospatial big data processing between the PostGIS and MongoDB databases, MongoDB had some advantages with its “within” and “intersection” queries and in terms of its response time for loading big geospatial data. [10]

3 METHODOLOGY

3.1 System Block Diagram

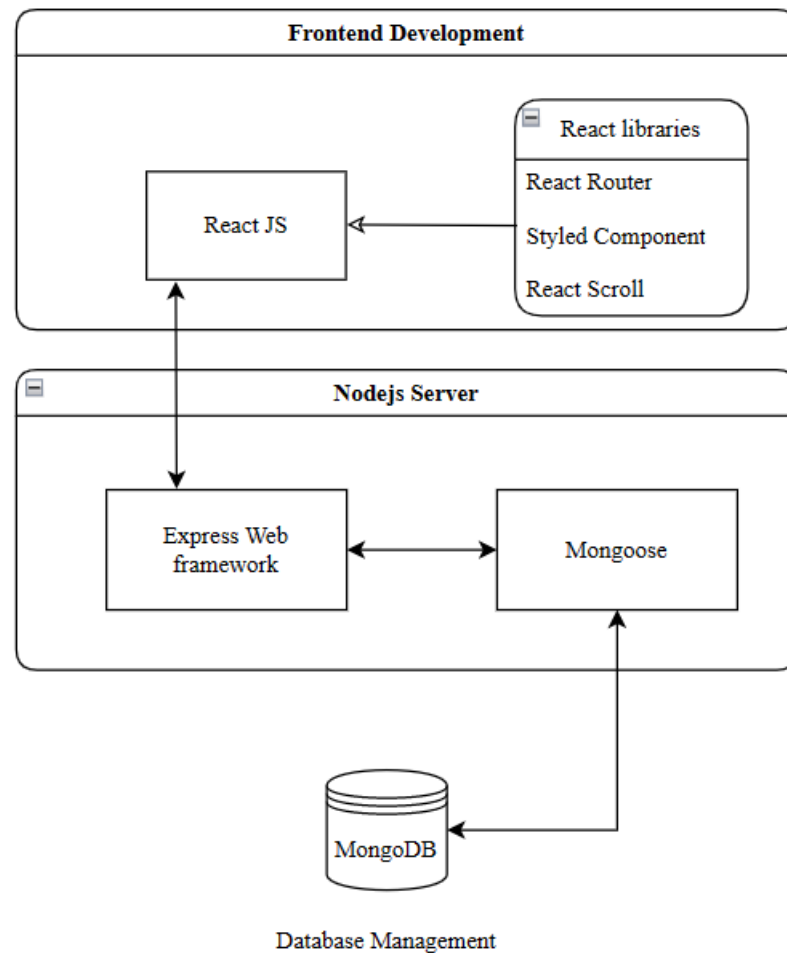


Figure 1 System Block Diagram

We will be using MERN stack for this web application, it stands for MongoDB Express React Nodejs. Our Data would be hosted in mongo, which is a NoSQL database system. These data are presented in an attractive and efficient way through react library, a Frontend-oriented script. Express will work as a bridge between our frontend and backend development, something like a waiter who works between a customer and cooks.

3.1.1 React as Frontend

React.js, more commonly known as React, is a free, open-source JavaScript library. It works best to build user interfaces by combining sections of code (components) into full websites. Originally built by Facebook, Meta and the open-source community now maintain it. We are using React mainly because of its component-based system which is reusable and easy to maintain. Also React uses virtual DOM which is effectively faster than regular DOM. So, there will be improvement in app performance.

3.1.2 MongoDB

MongoDB is an open-source document-oriented database. The term 'NoSQL' means 'non-relational' i.e., it is not based on the table-like relational database structure but provides an altogether different mechanism for storage and retrieval of data. This format of storage is called BSON (like JSON format). We choose Mongo over relational database because of its flexibility and easy-to-handle features, also they are easy to expand since they are Schema-less (Adding new feature does not affect old documents and is extremely easy)

3.1.3 Express

Express is a fast and moderate web framework of Node.js. Express can be seen as a layer built on top of Node.js that helps manage a server and routes. It was created to make APIs and web development with ease and still is very efficient.

The main reason for choosing this framework is because it is very beginner-friendly, time-efficient, fast, and economical.

3.2 Use Case Diagram

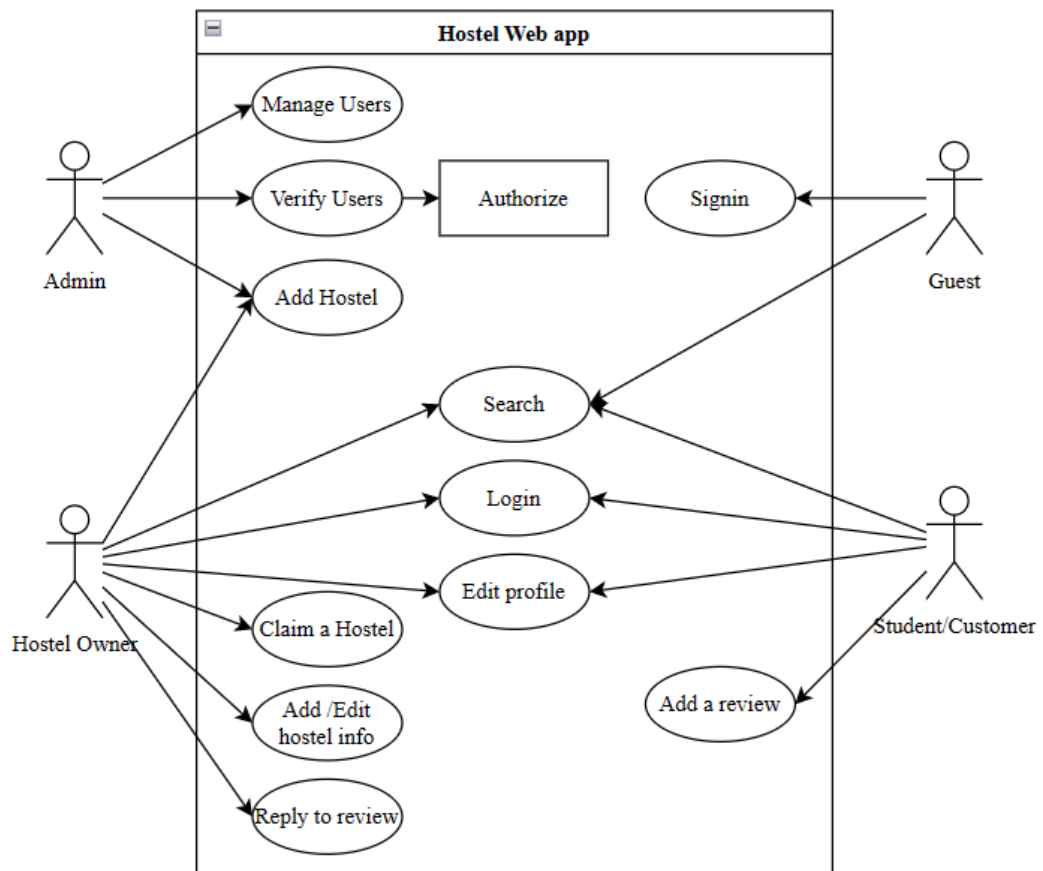


Figure 2 Use Case Diagram

The system's use case diagram, which represents the actors and the system, is depicted in the diagram above. The system's service to the actors is depicted in this diagram. In the system, there are four types of actors: Admins, Guest, Hostel owners and Registered Users. A registered user will be able to search for hostels, write reviews, rate them, and use the recommendation and suggestion services. The user can also make changes to their account. The system administrator will oversee Verifying user documents and moderating any contents as well as add new hostels. Hostel owners can request to add a new hostel or claim one with proper documentation. Guest users are only allowed to search hostels and watch their reviews but cannot give review of their own.

3.3 Entity Relation (ER) Diagram

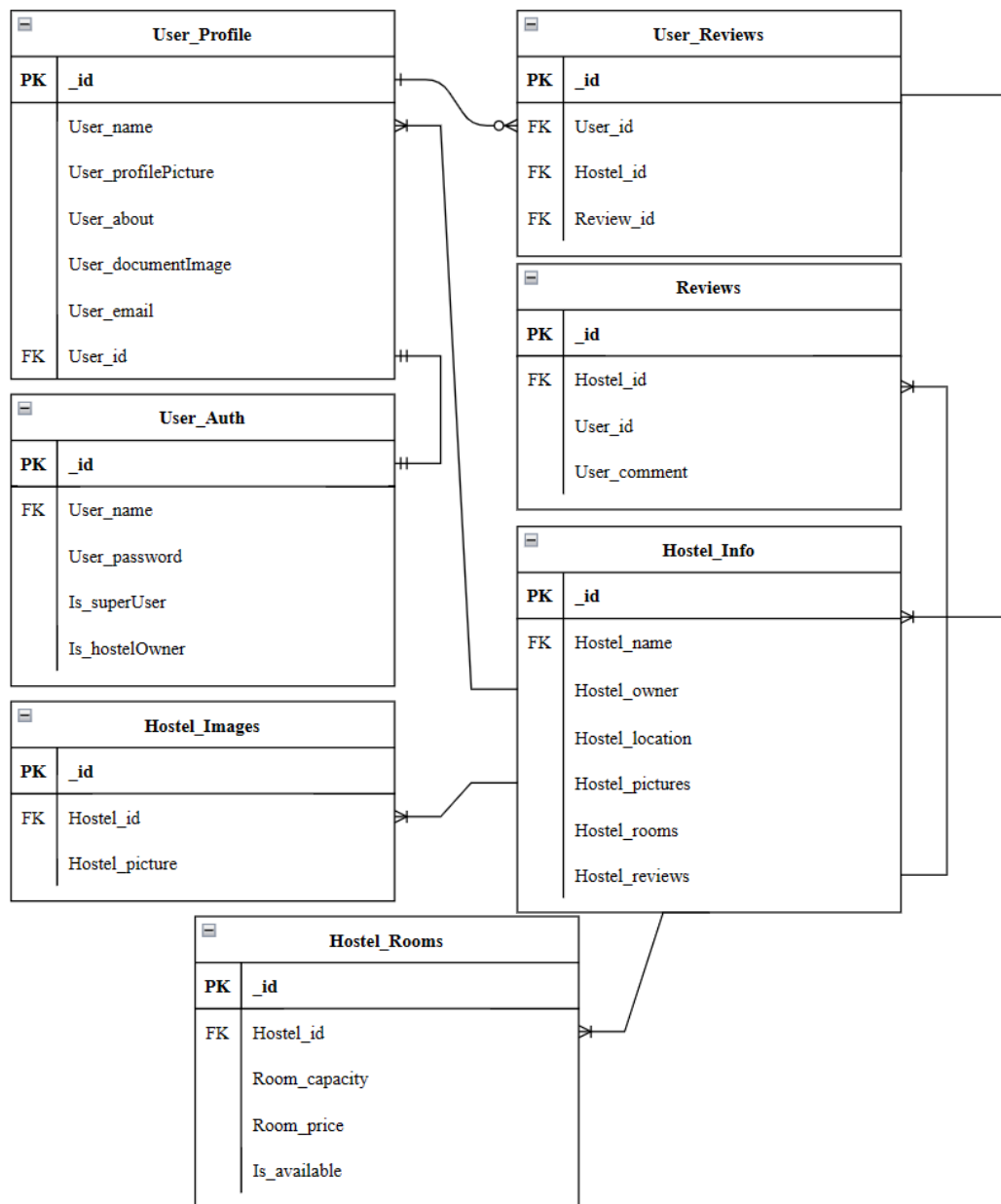


Figure 3 Entity Relation Diagram

ER diagram (entity-relationship diagram) is a diagram which shows entities, attributes of entities and relationship between them. ER diagram of our system is as shown above.

3.4 Description of System Development

3.4.1 Data Collection

For our hostel dataset we will visit different hostel and interview the owner for the required information. This method is effective but quite time consuming and tedious so we would collect data from other sources like google map scrapping as well as data from Nepal hostel association. We want the data to be as relevant as it can be and correct too, this will help enhance user experience in our app and will also fulfill their needs.

3.4.2 UI design

The user interface (UI) is the space where interactions between human computer system occur. UI is an integral aspect of user experience that consist of two major thing visual design (which conveys the look and feel of a product) and interaction design (which is the functional and logical organization of elements). The goal of UI design is to make an interface which is user friendly, attractive, and efficient to interact, for this we will be using Figma.

3.4.3 Host Database

All the user interfaces would be useless if there is no data to serve to the user, so we will host the data collected in a proper format as shown in ER diagram above, for this we will be using mongoose and the data would be stored in cloud (Mongo Atlas). This will be managed and routed with the help of express (that is any http request to the database would be handled by express).

3.4.4 Develop Frontend

We need to properly code the designed UI, we will do this with the help of REACT along with other NPM react packages like React-Router (for routing), React-Spring, React-Scroll etc. (for animation). In React we can create many reusable components which when combined can form web pages.

3.4.5 Test and Deployment

The final step of application development is testing and deployment, before deploying the app for general use, we would first test the app for any bugs and error or any irregular behavior and finally deploy it. For deployment we will be using Azure cloud service and get a custom domain name for our website

4 PROJECT SCHEDULE

ID	Task Name	Start	Finish	Duration												
					Dec 2022				Jan 2023				Feb 2023			
					12/11	12/18	12/25	1/1	1/8	1/15	1/22	1/29	2/5	2/12	2/19	2/26
1	Research	12/12/2022	3/3/2023	12w												
2	Familiarization of tools	12/21/2022	1/6/2023	2.6w												
3	Designing	1/9/2023	1/23/2023	2.2w												
4	Coding	1/24/2023	3/3/2023	5.8w												
5	Testing & Debugging	1/27/2023	3/3/2023	5.2w												
6	Documentation & Reporting	12/12/2022	3/7/2023	12.4w												

Table 1 Gantt Chart

5 PROJECT BUDGET

As the website shall be created by using MERN, the expenditure is minimal for this project.

S.N.	Particulars	Price (Rs)	Quantity	Total Price (Rs)
1.	Server Hosting	2000 per month	1	2000
2.	Acquiring a domain name	1500 per year	1	1500
TOTAL				3500

Table 2 Project Budget

6 FEASIBILITY ANALYSIS

6.1 Technical Feasibility

With the development of different frameworks and technologies, this project is technically feasible. As MERN offers the necessary tools and capabilities to meet the project's requirements, delivers the desired functionality and it is possible to acquire the necessary knowledge and skills to proficiently use MERN within the given timeframe.

6.2 Economic Feasibility

The development cost is low for this project as all the resources to be used are easily available and the expenses are low. Thus, this project is economically feasible.

6.3 Schedule Feasibility

The project can be completed in the estimated time by following the created schedule.

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