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A

DBMS Mini Project Report

On

" CAR RENTAL "

SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF DEGREE OF

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

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CERTIFICATE

Certified that the DBMS Mini Project entitled "**CAR RENTAL**" carried out by **Prince Kumar [1JB20CS085]** and **Sadhana Kumari [1JB20CS100]** are bonafide students of **SJB Institute of Technology** in partial fulfilment for the award of **BACHELOR OF ENGINEERING** in **COMPUTER SCIENCE AND ENGINEERING** of the **Visvesvaraya Technological University**, **Belagavi** during the academic year **2022-23.** It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the Departmental library. The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said Degree.

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Regards
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ABSTRACT

Our Aim is to design and create a data management System for a car rental company. This enables admin can rent a vehicle that can be used by a customer This system increases customer retention and simplify vehicle and staff Management in an efficient way. This software car Rental System has a very user friendly interface. Thus the users will feel very easy to work on it. By using this system admin can manage customer confirm and cancel booking request, customer Testimonials, customer issues. The car information can be added to the system. Or existed car information can be edited or deleted too by Administrator .There is no delay in the availability of any car information, whenever needed, car information can be Captured very quickly and easily. Demonstarting the car rental.

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CHAPTER 1

INTRODUCTION

1.1 Project Overview:

The Car Rental Management System is a simple PHP/MySQL project that helps to manage a certain car rental business to manage their car rental records. The admin side of the car rental management system is the side where the company's management manages the rental records and other related data needed such as the list of the company's cars for rent. The client-side or borrower side will be served as the booking website of the company for their clients. Each booked rentals will be verified by the car rental management to confirm the client's reliability and booking details. The car for rent is organized by their categories, transmission type, and engine type so that the borrowers can choose their desired car to rent by these data if the available car for his/her given pickup and drop-off date and time. This system stores the car's registration no and plate for the company's references for identifying if which car is used by the client and also identifies if the client already picked-up/Dropped-off his/her rented car.

1.2 Introduction to Web Database Architecture:

- Browser issues an HTTP request for a particular web page.
- Web server receives the request ,retrieves the file and passes it to the PHP engine for Processing.
- PHP engine connects to the MySQL server and sends the query.
- MySQL server receives the query , processes it ,and sends it to the web server .
- PHP engine receives the results ,prepares the HTML page and send it to the web server.
- Web server sends the HTML page to the browser and browser displays the page to the user.

MySQL+PHP Programming Model :

- Web site made from php files on web server .
- ".php" files contains HTML with embedded PHP code.
- PHP code is enclosed in <?php..?>
- Basic steps followed in any PHP script used to access database:
  - Check and filter data coming from the user
  - Set up a connection to My SQL server
  - Selecting the appropriate database

- Query the database
- Retrieve the results
- Present the results back to the user
- Close the database connection

1.3 Introduction to XAMPP:

XAMPP is an abbreviation where X stands for Cross-Platform, A stands for Apache, M stands for MYSQL, and the Ps stand for PHP and Perl, respectively. It is an open-source package of web solutions that includes Apache distribution for many servers and command-line executables along with modules such as Apache server, MariaDB, PHP, and Perl.
XAMPP helps a local host or server to test its website and clients via computers and laptops before releasing it to the main server. It is a platform that furnishes a suitable environment to test and verify the working of projects based on Apache, Perl, MySQL database, and PHP through the system of the host itself. Among these technologies, Perl is a programming language used for web development, PHP is a backend scripting language, and MariaDB is the most vividly used database developed by MySQL

Software Components:

It provides a base for testing of projects based on different technologies through a personal server. XAMPP is an abbreviated form of each alphabet representing each of its major components. This collection of software contains a web server named Apache**,** a database management system named MariaDB and scripting programming languages such as PHP and Perl**.** X denotes Cross-platform, which means that it can work on different platforms such as Windows, Linux, and macOS.

Apache: Apache is an open source web server ,the most popular in use.

MySQL: MySQL is an open-source relational database management system (RDBMS). It is the most popular database system used with PHP. MySQL is developed, distributed, and supported by Oracle Corporation.

- The data in a MySQL database are stored in tables which consists of columns and rows.
- MySQL is a database system that runs on a server.
- MySQL is ideal for both small and large applications.
- MySQL is very fast, reliable, and easy to use database system. It uses standard SQL
- MySQL compiles on a number of platforms.

PHP: PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side. PHP is well suited for web development. Therefore, it is used to develop web applications (an application that executes on the server and generates the dynamic page.).

1.3 Overview of the Components: Front End

a) Hypertext Markup Language (HTML):

It is used to design web pages using a markup language. HTML is the combination of Hypertext and Markup language. Hypertext defines the link between web pages. A markup language is used to define the text document within the tag which defines the structure of web pages. This language is used to annotate (make notes for the computer) text so that a machine can understand it and manipulate text accordingly. Most markup languages (e.g. HTML) are human-readable. The language uses tags to define what manipulation has to be done on the text.

b) Cascading Style Sheets (CSS):

Cascading Style Sheets, fondly referred to as CSS, is a simply designed language intended to simplify the process of making web pages presentable. CSS allows you to apply styles to web pages. More importantly, CSS enables you to do this independent of the HTML that makes up each web page. It describes how a webpage should look: it prescribes Colors , fonts, spacing, and much more. In short, you can make your website look however you want. CSS lets developers and designers define how it behaves, including how elements are positioned in the browser.
While html uses tags, Css uses rulesets. CSS is easy to learn and understand, but it provides powerful control over the presentation of an HTML document.

1.4 Glance at the Apache Web Server:

Apache, an open-source Web server created by American software developer Robert McCool. Apache was released in 1995. In the early 2020s, Apache servers deployed about 30 percent of the Internet's content, second only to Nginx. As a Web server, Apache is responsible for accepting directory (HTTP) requests from Internet users and sending them their desired information in the form of files and Web pages.

1.5 Overview of the Components : Back End

a) MySQL:

MySQL (Pronounced as "My Sequel") in the world's most used open source relational database management system(RDBMS) as of 2008 that runs as a server providing multi user access to a number of database**.**MySQL is the world's most popular open source database. According to DB-Engines, MySQL ranks as the second-most-popular database, behind Oracle Database. MySQL powers many of the most accessed applications, including Facebook, Twitter, Netflix, Uber, Airbnb, Shopify, and Booking.com. Since MySQL is open source, it includes numerous features developed in close cooperation with users over more than 25 years. So it's very likely that your favorite application or programming language is supported by MySQL Database

b) Hypertext Preprocessor :

PHP is a programming language and stands for Hypertext Preprocessor. It's through the PHP language, and other languages such as HTML, that we can build stuff on the worldwide web. Moreover, PHP is open-source, which means that everyone is free to use it. In fact, PHP has attained its popularity by leading open source web technology. PHP runs on a server; thus, when you type in a web address you want to visit, PHP is working in the background. To be able to communicate with a computer, you must use a language that the computer understands. The text, the software, is called 'source code'.

Function

PHP has hundreds of base functions and thousands more via extensions. These functions are well documented on the PHP site, however ,the built in library has a wide variety of naming conventions and inconsistencies.

Advantages

- Simple and very easy to learn.
- Open source.
- PHP can be used on all major OS.
- It can plug-in with most of the databases.
- Powerful built-in functions.
- Extremely useful for text processing features.

Disadvantages

- Security flaws due to unknown vulnerabilities.
- Not good to create Desktop Application.

CHAPTER 2

DATABASE MANAGEMENT SYSTEM

DBMS is a collection of programs that enables users to create and maintain a database **.** Database is a collection of interrelated data which helps in the efficient retrieval, insertion, and deletion of data from the database and organizes the data in the form of tables, views, schemas, reports, etc. For Example, a university database organizes the data about students, faculty, admin staff, etc. which helps in the efficient retrieval, insertion, and deletion of data from it.

Characteristics of Database Management System:

- Self -describing nature.
- Keeps a tight control on data redundancy.
- Enforces user defined rules to ensure that the integrity of table data.
- Provides insulation between Programs and data ,Data abstraction.
- Supports multiple views of the data.
- Helps sharing of data and Multi-user Transaction processing**.**

Advantages of using the DBMS approach:

- Controlling the redundancy.
- Restricting unauthorized access.
- Providing persistent storage for program objects.
- Providing storage structures for efficient query processing.
- Providing backup and recovery.
- Providing multiple users interfaces.
- Representing complex relationships among data
- Enforcing integrity constraints.

2.1 Structured Query Language (SQL):

SQL is used to create, remove, alter the database and database objects in a database management system and to store, retrieve, update the data in a database. SQL is a standard language for creating, accessing, manipulating database management system. SQL works for all modern relational database management systems, like SQL Server, Oracle, MySQL, etc.

CREATE: Specifies a new base relation by giving it a name, and specifying each of its attributes and their data types and to specify its domain values.

CREATE TABLETNAME([< Constarints>], [< Constarints>], ……. [< Constarints>], [,]);

ALTER: Used to add an attribute to/from one of the base relations drop constraint -- The new attribute will have NULLs in all the tuples of the relation right after the command is executed; hence, the NOT NULL constraint is not allowed for such an attribute.
Example: ALTER TABLE EMPLOYEE ADD JOB VARCHAR2 (12);

DROP: If a whole schema is not needed any more, the Drop Schema command can be used. There are two drop behavior options: CASCADE and RESTRICT.

CASCADE: This option is used to remove the database schema and all its tables, domains and other elements**.**

UPDATE: The UPDATE statement is used to modify the existing records in a table.
SYNTAX: UPDATE table_name
SET column1 = value1, column2 = value2, ...
WHERE condition*;*

STATEMENTS IN SQL:

a. SELECT: This is the same as the projection operation of relational algebra. It is used to select the attribute based on the condition described by WHERE clause

b. INSERT: The INSERT statement is a SQL query. It is used to insert data into the row of a table.

c. UPDATE: This command is used to update or modify the value of a column in the table.

d. DELETE: It is used to remove one or more row from a table.

Aggregate Functions in SQL:

Following aggregate functions are provided by the SQL.

- COUNT -Returns number of tuples.
- SUM - Returns sum of entries in a column.
- MAX -Returns Maximum value from an entire column.
- MIN - Returns Minimum value from an entire column.
- AVG - Returns Average of all the entries in a column.

Constraints in SQL:

Following constraints are provided by the SQL.

- NOT NULL - Ensures that a column cannot have a NULL value.

PRIMARY KEY - A combination of a NOT NULL and UNIQUE. Uniquely identifies each row in a table.

- UNIQUE - Ensures that all values in a column are different

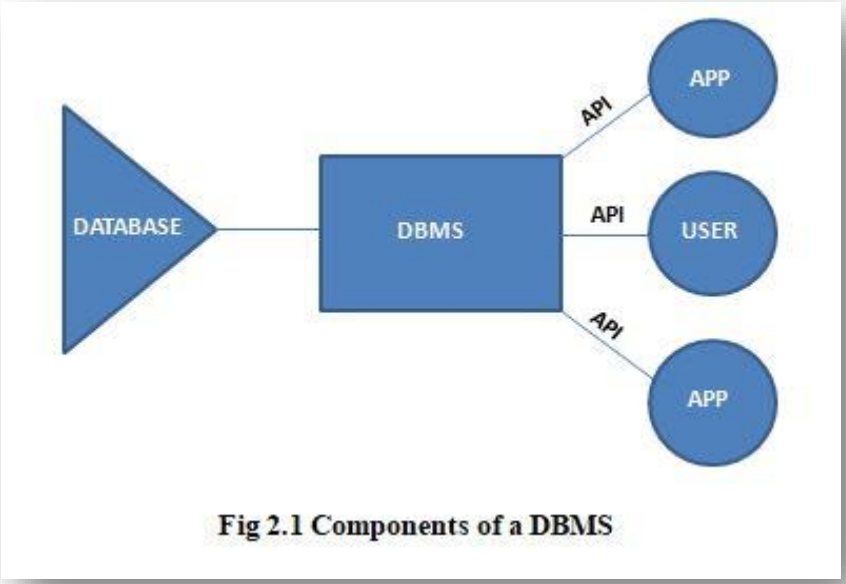


Fig 2.1 Components of a DBMS

CHAPTER 3

GRAPHICAL USER INTERFACE AND FEATURES

3.1 Graphical user interface

The application is very user friendly and uses a GUI interface implemented in PHP and HTML to communicate with the user. Various features are self-explanatory. Data are easy to fill in and components can be added ,removed and updated very easily through a Single dialog box.
The application includes tool-tip hints to give a brief description of the particular input field. Side bars boxes are used to display all the components at once so that the admin can see all the components of a particular attribute at once. The admin can just select the component and modify and remove the component(based on his priority and wish).

3.2 Features

- Clean separation of various components to facilitate easy modification and revision.
- All the data is maintained in a sperate file to facilate easy modification.
- All the data required for different operations is kept in a separate file.
- Quick and easy saving of loading of database file

Chapter 4

REQUIREMENT SPECIFICATION

Software Requirement:

- Database :MySQL
- Server-side Technology :PHP,XAMP sever ,phpMYAdmin
- Language :PHP
- Client-Side Technology :HTML,CSS
- Webserver :XAMP server/Apache server
- Web browser :Google Chrome, Mozilla Firefox
- Operating :Windows11

Hardware Requirements:

- Processor : Intel core i5
- Ram : 2GB or more
- Hard disk : 100GB or more
- Monitor : 11''COLOR or higher

Chapter 5

FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

5.1 Functional Requirement:

a. Admin Login: The system should allow the admin to Log In with correct credential online and Access to the data information of the service.

b. Online reservation of cars: Customers should be able to use the system to make booking and online reservation.

c. Automatic update to database once reservation is made or new user registered. Whenever there's new reservation or new registration, the system should be able update the database without any additional efforts from the admin.

d. Feedbacks to customers: It should provide means for customers to leave feedback.

5.2 Non-Functional Requirements:

It describes aspects of the system that are concerned with how the system provides the functional requirements. They are:

a. Security: The subsystem provide a high level of security and integrity of the data held by the system only authorized personnel of the company can gain access to the company's secured page on the system. The password in the system is also encrypted for make the system data more secured with sha1 when store in database .

b. Performance and Response time: The system have high performance rate when executing user's input and is able to provide feedback or response within a short time span usually 3 seconds for highly complicated task and 1 to 2 seconds for less complicated task.

c. Error handling: Error is considerably minimized and an appropriate error message that guides the user to recover from an error should be provided. Validation of user's input is highly essential. Also the standard time taken to recover from an error should be 15 to 20 seconds.

d. Availability: This system is always be available for access at 24 hours, 7 days a week. Also in the occurrence of any major system malfunctioning, the system should be available in 1 to 2 working days, so that the business process is not severely affected.

5.3 Software System Attribute

1**. Usability**: The links are provided for each form. The user is facilitated to view and make entries in the forms. Validations are provided in each field to avoid inconsistent or invalid entry in the databases. Some forms consists Hyper Links ,which provides further details

2. **Security:** Application will allow only valid users to access the system Access to any application resource will depend upon user's designation. Security is based upon the individual username and password.

3. **Maintainability**: The products details will be easily available for the user.

4**. Availability:** System will be available around the clock except for the time required for the Back up of data.

5. **Portability**: The application is developed in ASP.NET .It would be portable to other operating system provided..NET framework is available for the OS**.**

Acceptance Criteria

- A user -friendly interface with proper menus.
- Data transfer should be accurate and with in a reasonable amount of time keeping in mind the network traffic.
- The system should not allow entry of duplicate key values.
- System should have the ability to generate transactional Logs to avoid any accidental loss of data. Aims and Objective:-The main purpose behind the proposed system is to provide a comprehensive computerized system, which can capture ,collate and analyze the data and evaluate the impact of the program.

Characteristics of the proposed system:

The web application has following features

- In comparison to the present system the proposed system as it is automated.
- The proposed system is very secure as no chances of loss of data as it is dependent on the administrator only.

4.4 Other Requirements

We are going to perform the project on windows platform so we need the OS as windows. Any version of windows as windows xp , windows 8 or windows 10 . The system should have minimum ram of 256 MB as well as minimum storage capacity of 15 GB.

Used language :PHP
Uses database: bootstrap ,css ,HTML
Browser :chrome
Software: XAMPP

CHAPTER 6

SYSTEM DESIGN

6.1 ENTITY RELATIONSHIP

ER diagrams are used to sketch out the design of a database. By defining the entities, their attributes, and showing the relationships between them, an ER diagram illustrates the logical structure of databases.ER diagrams are created based on three basic concepts: entities, attributes, and relationships.

ENTITY: Any object that physically exists and is logically constructed in the real world is called as an entity. It is a real-world object that can be easily identifiable. An entity is represented as a rectangle in an ER diagram.

ATTRIBUTE: An attribute is a property or characteristic of an entity. An entity may contain any number of attributes. The attributes that can uniquely define an entity are considered as the primary key. In an Entity-Relation model, attributes are represented in an elliptical shape. It also may refer to a database field. Attributes describe the instances in the database.

There are five such types of attributes:

- Simple attribute
- Composite attribute
- Single-valued attribute
- Multi-valued attribute
- Derived attribute.

Simple attribute–Attributes that are not further divisible into sub-attributes (atomic) are known as Simple attributes.

Composite attribute– Composite attributes can be divided into sub-attributes which represent more basic attributes with independent meanings

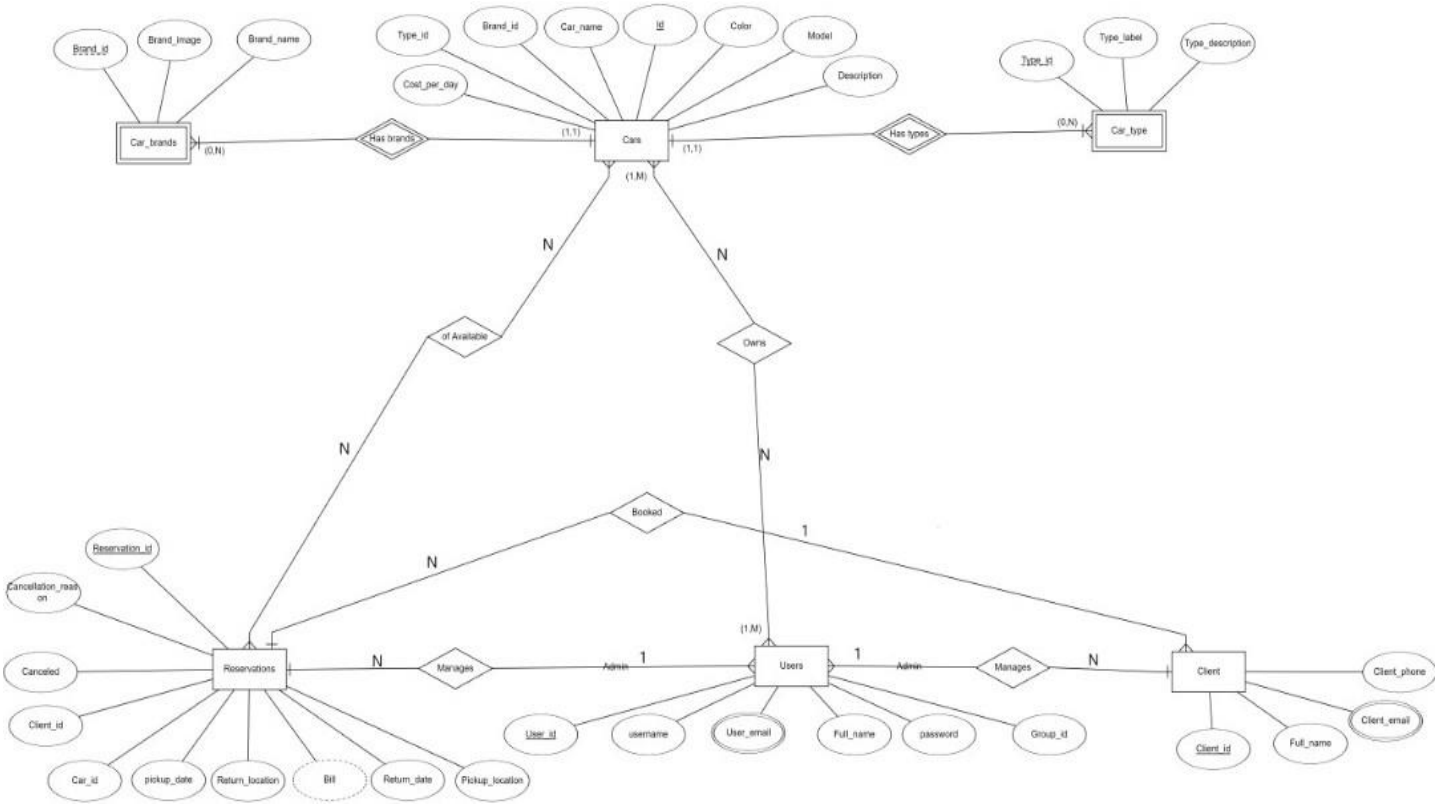
Multi-valued attribute–There are many instances where an attribute has a set of values for a specific entity, known as Multivalued attributes

Derived attribute–The value for this type of attribute can be derived from the values of other related attributes or entities instances.

Complex attribute–Complex attributes are formed by nesting composite and multivalued attributes arbitrarily. These attributes are rarely used in DBMS(Data Base Management System). That's why they are not so popular

A relationship, in the context of databases, is a situation that exists between two relational database tables when one table has a foreign key that references the primary key of the other table. Relationships allow relational databases to split and store data in different tables while linking disparate data items.

6.2 ER DIAGRAM



6.3 SCHEMA CLASS DIAGRAM

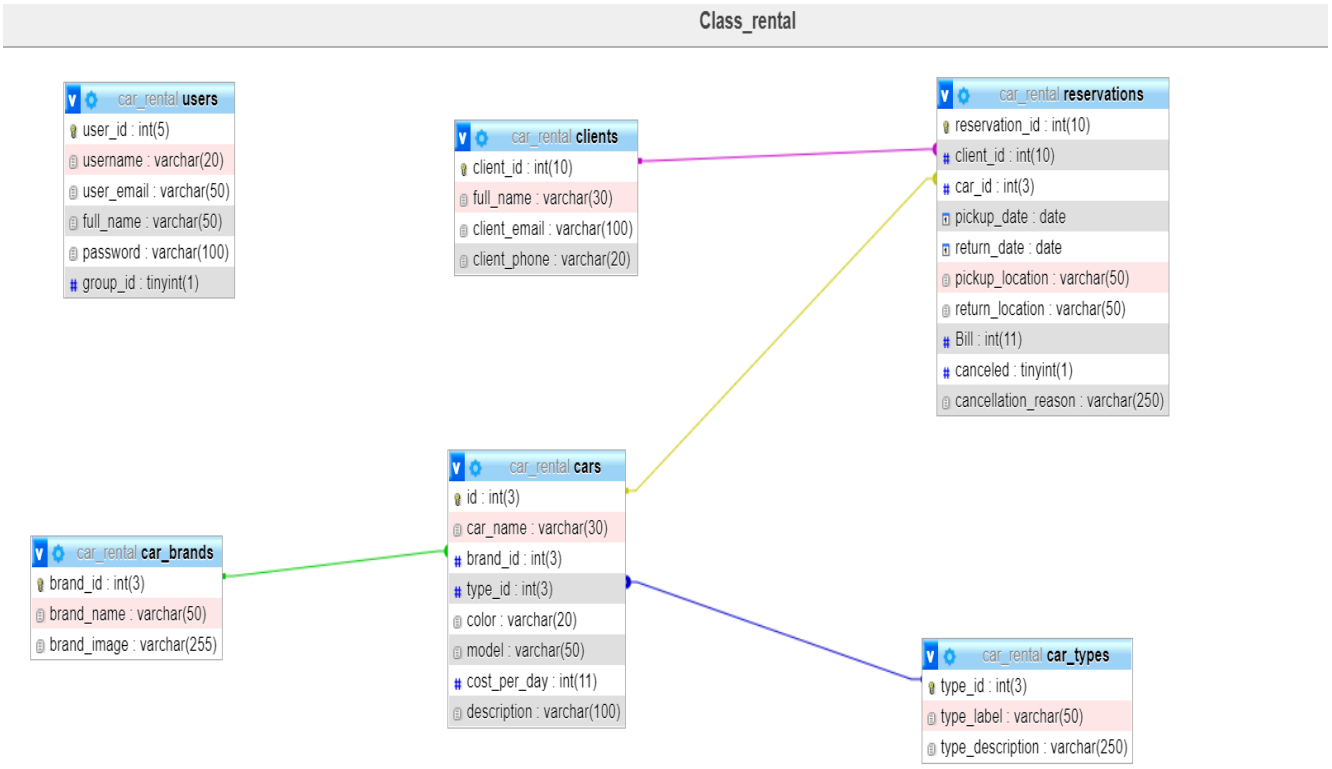


Fig 6.3 Schema class Diagram

6.4 Entities and Attributes

ADMIN	Contains the admin information
CUSTOMER	Contains the information of customer
CAR	Contains all details related to car
BOOKING	Contains the booking information

6.5 Table names and their description

6.5.1 Admin table

NAME	DESCRIPTION	TYPE
USERNAME	Contains username	VARCHAR(20)
ADMIN_NAME	Stores admin_name	VARCHAR(20)
PASSWORD	Contains the password	VARCHAR(10)
ID	Contains login id	VARCHAR(20)

6.5.2 Customer table

NAME	DESCRIPTION	TYPE
CUST_NAME	Stores Cust_name	VARCHAR(20)
ADDRESS	Stores address	VARCHAR(30)
GENDER	Stores cust_sex	VARCHAR(2)
MOB_NO	Stores mob_no	VARCHAR(10)
CUS_ID	Stores cus_id	INTEGER

6.5.3 Car table

NAME	DESCRIPTION	TYPE
CAR_NAME	Stores name of car	VARCHAR(20)
CAR_NO	Store number of car	VARCHAR(10)
VECH_YEAR	Store year of manufacture	INTEGER
STATUS	Stores the current status	VARCHAR(5)

6.5.3 Car table

NAME	DESCRIPTION	TYPE
CAR_NAME	Stores name of car	VARCHAR(20)
CAR_NO	Store number of car	VARCHAR(10)
VECH_YEAR	Store year of manufacture	INTEGER
STATUS	Stores the current status	VARCHAR(5)

CHAPTER 7

IMPLEMENTATION

7.1 Code Snippets

7.1.1. Create table commands

1.ADMIN

```
CREATE TABLE `admin` (
 `admin_id` int(11) NOT NULL,
 `admin_name` varchar(255) NOT NULL,
 `admin_username` varchar(255) NOT NULL,
 `admin_password` varchar(255) NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
```

2.CUSTOMER

```
CREATE TABLE `customer` (
 `customer_id` int(11) NOT NULL,
 `customer_name` varchar(255) NOT NULL,
 `customer_gender` text NOT NULL,
 `customer_address` varchar(255) NOT NULL,
 `customer_mobile` varchar(20) NOT NULL,
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
```

3.CAR

```
CREATE TABLE `car` (
 `car_id` int(11) NOT NULL,
`car_merk` varchar(30) NOT NULL,
 `mobil_plat` varchar(20) NOT NULL,
`mobil_warna` varchar(30) NOT NULL,
```

```
  `mobil_tahun` int(11) NOT NULL,
  `mobil_status` int(11) NOT NULL,
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
```

5.TRANSCITION

```
CREATE TABLE `transcition` (
  `transiction_id` int(11) NOT NULL,
  `transaksi_karyawan` int(11) NOT NULL,
  `transaksi_kostumer` int(11) NOT NULL,
  `transaksi_mobil` int(11) NOT NULL,
  `transaksi_tgl_pinjam` date NOT NULL,
  `transaksi_tgl_kembali` date NOT NULL,
  `transaksi_harga` int(11) NOT NULL,
  `transaksi_denda` int(11) NOT NULL,
  `transaksi_tgl` date NOT NULL,
  `transaksi_totaldenda` int(11) NOT NULL,
  `transaksi_status` int(11) NOT NULL,
  `transaksi_tgldikembalikan` date NOT NULL
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
```

7.2 Config-To Establish Connection DB

```
<?php
$servername = "localhost";
$database = "database";
$username = "username";
$password = "password";

// Create connection

$conn = mysqli_connect($servername, $username, $password, $database);
```

```
// Check connection

if ($conn->connect_error) {
die("Connection failed: " . $conn->connect_error);

}
echo “Connected successfully”;

mysqli_close($conn);

?>
```

CHAPTER 8

SNAPSHOTS

8.1 HOME PAGE

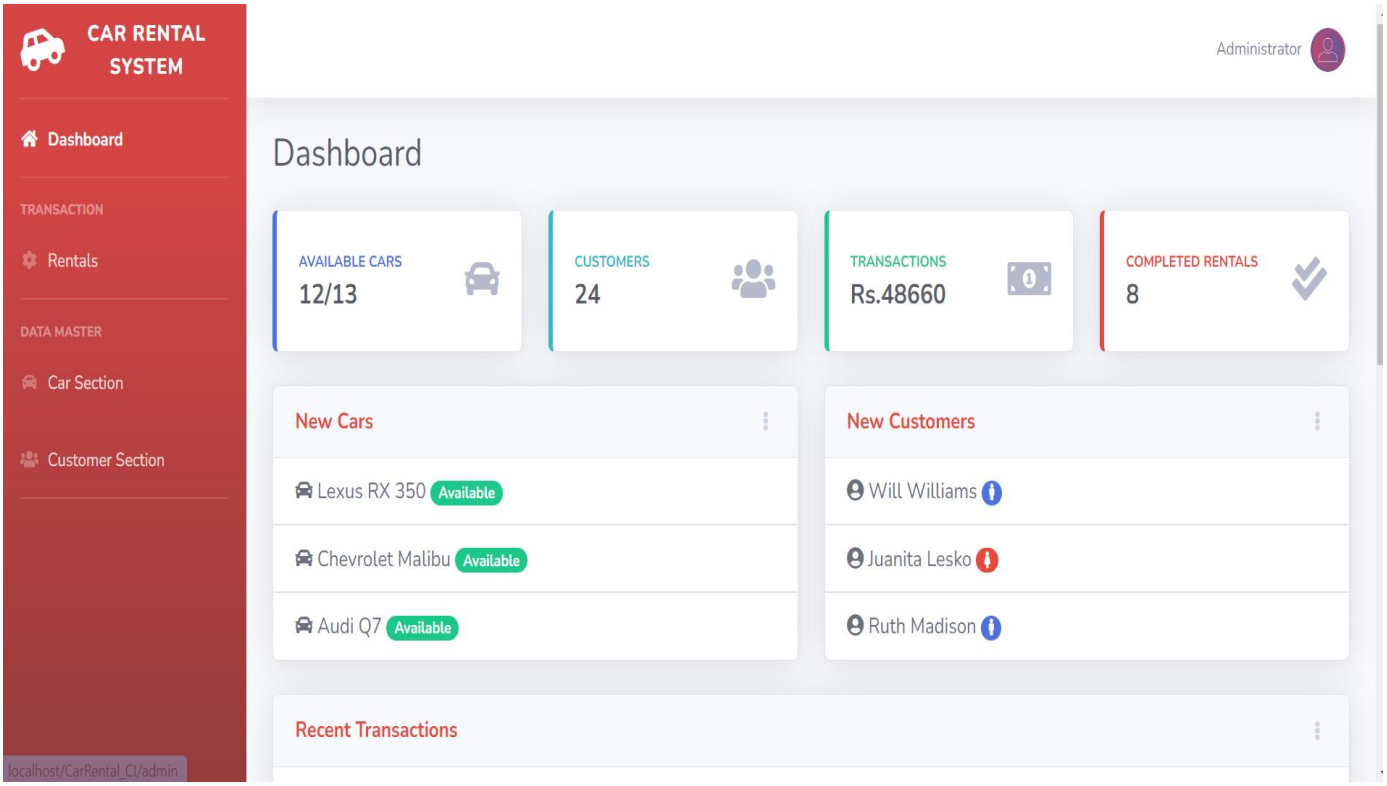


Fig 8.1 Home page

A home page is a webpage that severs as the starting point of car rental system website. It is a default webpage that loads when you visit a web address that only contain a domain name as shown in fig 8.1.

8.2 Transaction page

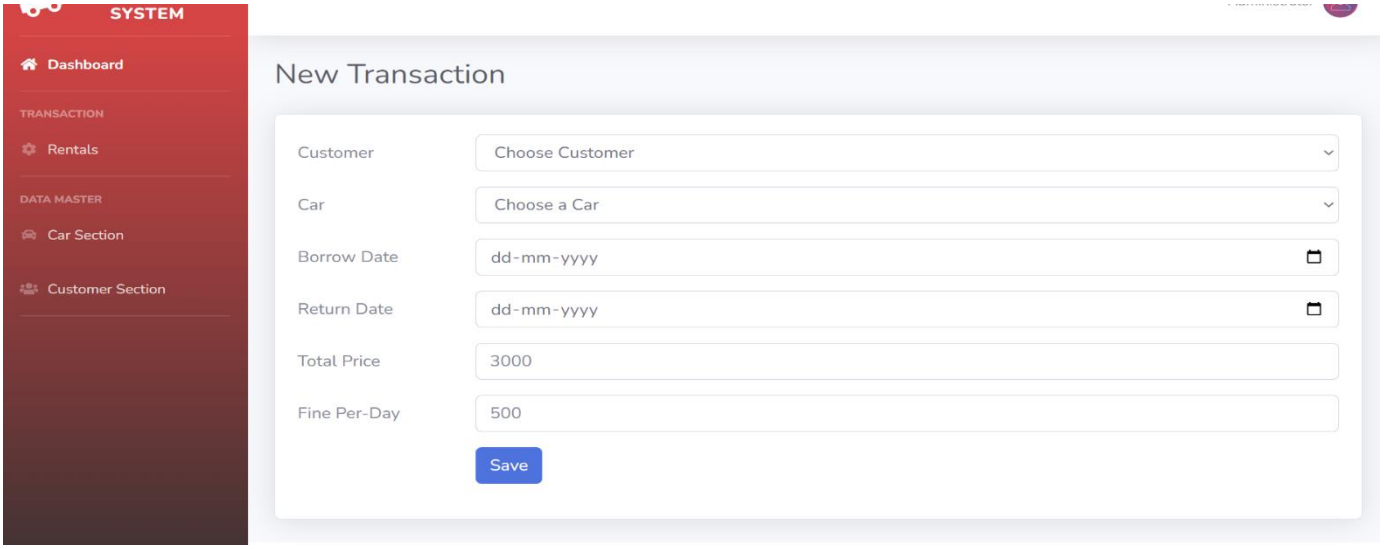


Fig 8.2 Transaction page

This page contains all the details of the transaction while booking a car through this portal, it includes customer name ,car details, details about the total price and the date of return and borrow

8.3 Customer details

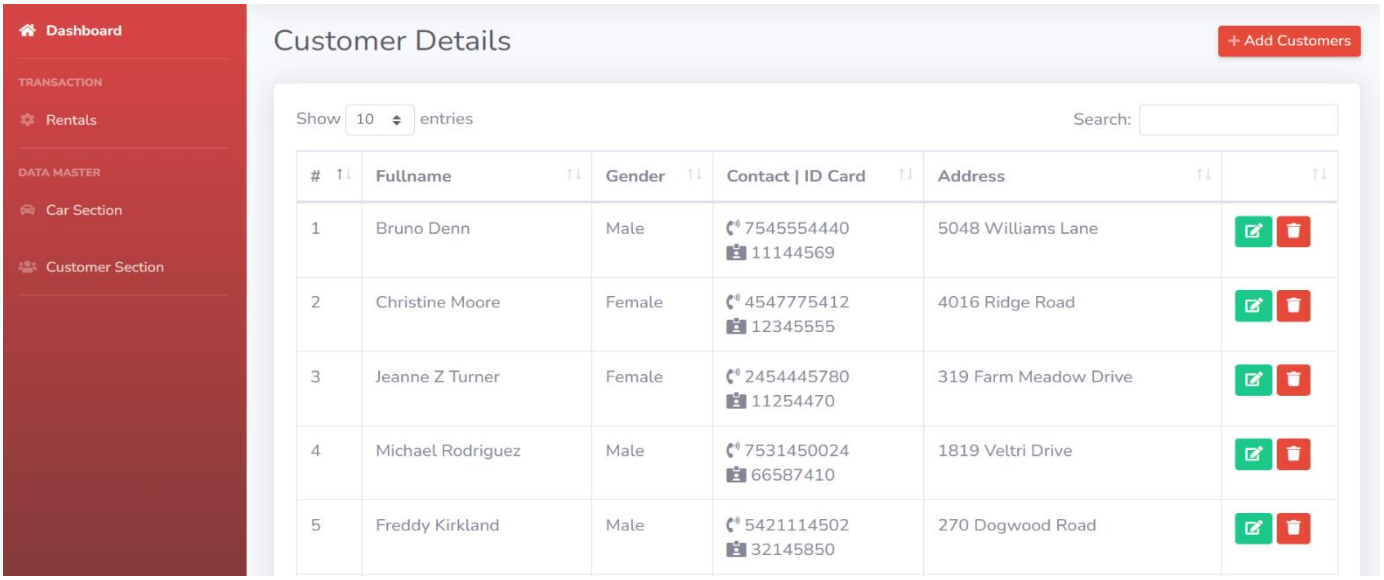


Fig 8.3 Customer details

A customer details page helps admin to render the data of the customer ,delete a data and update the data of the customer by the admin.

8.4 Admin Page

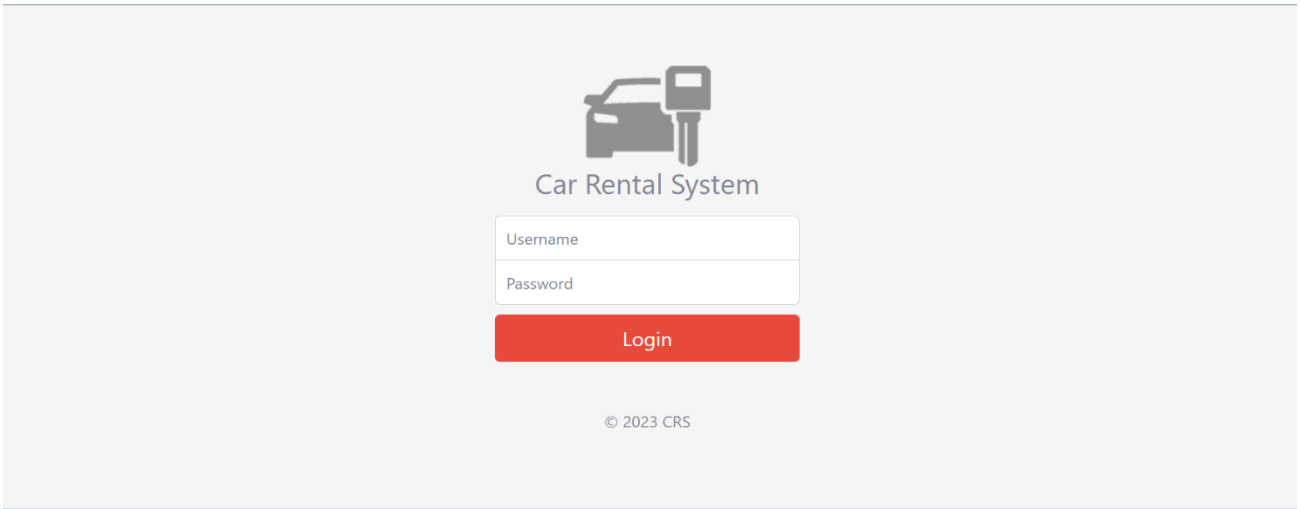


Fig 8.4 Admin page

Admin page where admin can enter the username and password that is the login credentials to access the car rental portal.

8.5 Car Rental Details

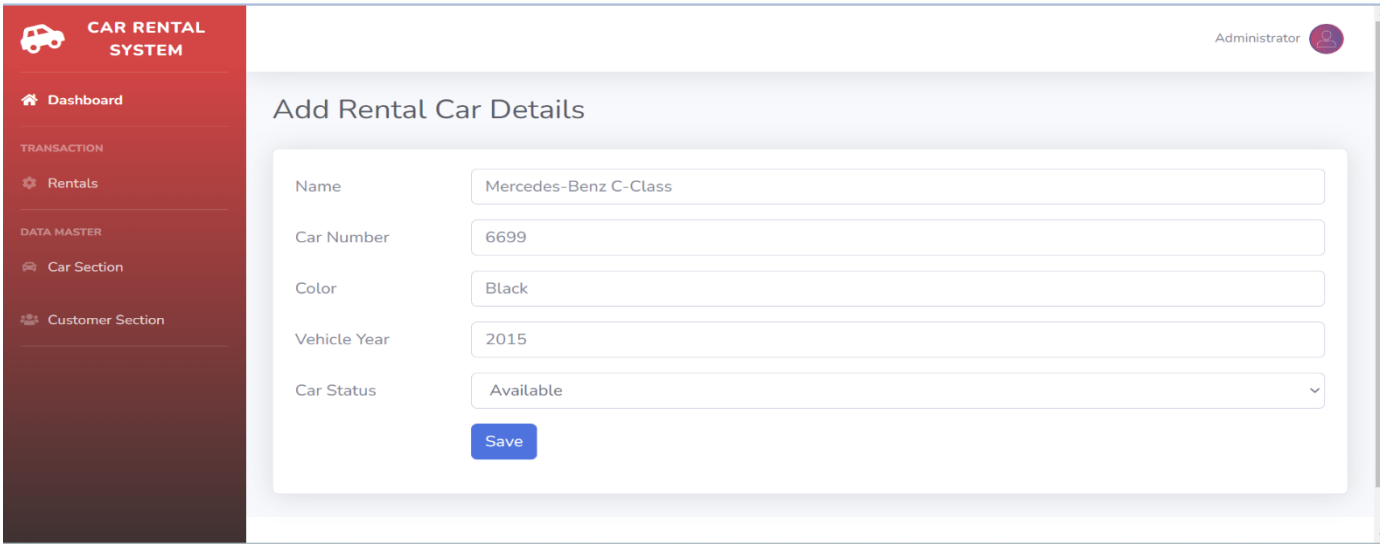


Fig 8.5 Car rental

The admin can add the details of the car that is to be rented to the customer and can also update the status of the car.

8.6 DATABASE

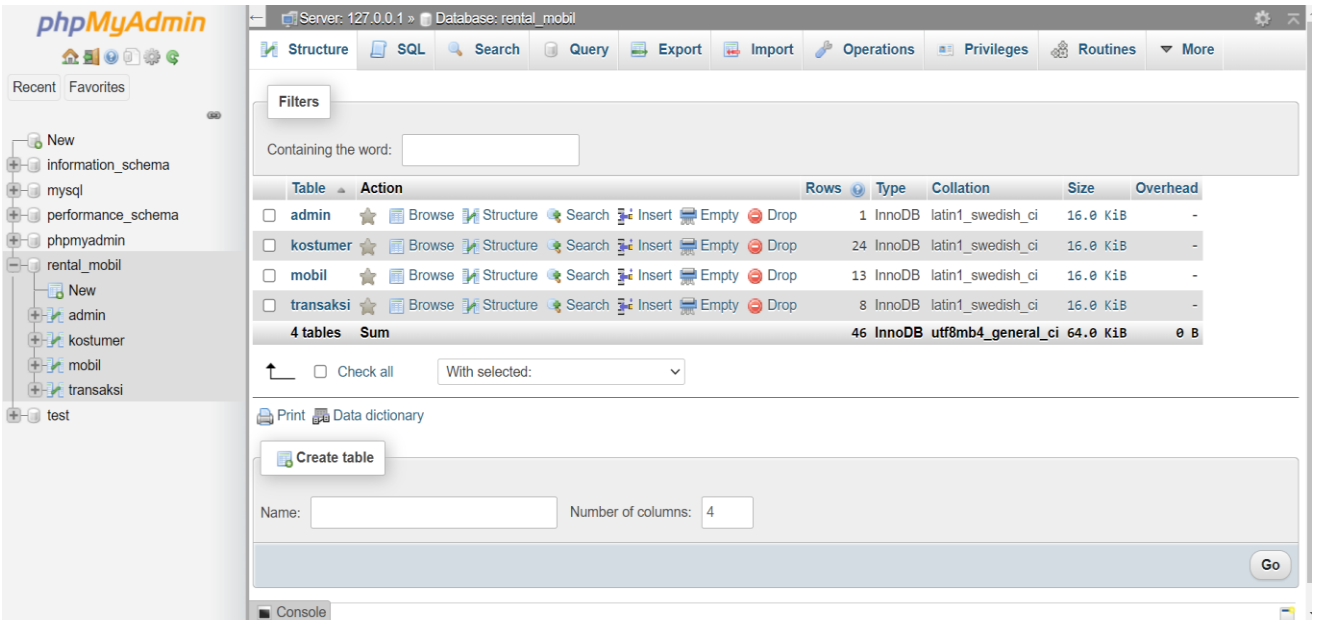


Fig 8.6 Database

Every piece of data in sql server is stored in 8kb database pages. A page is a basic unit of I/O operation shown in fig 8.6 shows the amount of space and allocation of datatypes stored in the database in phpMyAdmin

CHAPTER 9

CONCLUSION & FUTURE ENHANCEMENT

Car rental business has emerged with a new goodies compared to the past experience where every activity concerning car rental business is limited to a physical location only. Even though the physical location has not been totally eradicated; the nature of functions and how these functions are achieved has been reshaped by the power of internet. Nowadays, customers can reserve cars online, rent car online, and have the car brought to their door step once the customer is a registered member or go to the office to pick the car. Our web based car rental system has offered an advantage to both customers as well as Car Rental Company to efficiently and effectively manage the business and satisfies customers need at the click of a button.

There is always a scope of improvement and Future Enhancement in a project. We are also looking towards the Future Enhancement of the project by the following manner. First We have thought of knowing the location our Car which has been reserved by our client and also imply late fee if the user return the car after the return date. Second we have thought of a promocodes and discounts for the service to our clients on the basis of. Third to provide driver with the car service to the required clients. Fourth to have real secured Based payment in our project.

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CHAPTER

TESTING

Black Box Testing

The Black Box Test is a test that only considers the external behaviour of the system; the internal workings of the software is not taken into account. It is carried out by testers. This method is used in System Testing or Acceptance Testing. It is the least time consuming. It is the behaviour testing of the software. It is also known as data-driven testing, functional testing, and closed box testing. Black Box Test is not considered for algorithm testing.

In the case of conventional software development, models are made testable by using a test oracle, such as testers, test engineers or testing mechanisms working alongside the test program. An oracle can verify the outcome of a test against expected values. ML models, however, are often considered untestable because of the difficulty in performing black-box testing on them. Since ML models output some sort of prediction, there are no expected values against which to verify test outcomes.

White Box Testing

The White Box Test is a method used to test a software taking into consideration its internal functioning. It is carried out by software developers. This method is used in Unit Testing or Integration Testing. It is most time consuming. It is the logic testing of the software. It is also known as clear box testing, code-based testing, structural testing, and transparent testing. White Box Test is well suitable for algorithm testing.

More and more ML/AI models are being implemented in businesses to accelerate automated decision-making. As more organisations are adopting data science into their business process, there are increasing social concerns about decisions made based on personal/discriminatory information.

For example, in the use case of a loan application, race and gender should not be used to determine people's eligibility for a loan product. Black-box models exacerbate this issue, where less is known about what influencing variables are actually driving the final decision. White-box models help organisations stay accountable for their data-driven decisions, and compliant with law and legal audits.

CHAPTER 8

RESULTS

TABLE 4. ACCURACY AND TIME ANALYSIS FOR MAP REDUCE BASED ALGORITHMS

Algorithm	Accuracy	Time (in secs) (Local Machine)	Time (in secs) (Apache Spark)
Decision Tree	0.44593	0.3028407096862793	0.19620919227600098
Random Forest	0.92678	1.4025077819824219	0.5628937271890073
Naïve Bayes	0.88354	0.5545685291290283	0.07920020191828390
Logistic Regression	0.66345	0.9850611686706543	0.09921083838444400

Here, we have compared the accuracy and time of the different algorithms called decision Tree,Naïve Bayes, Logistic Regression and Random Forest. The code performs analysis on different algorithms related to time and accuracy. The accuracy for different algorithm is noted when the code is run in local machine without spark and then run in cluster of Apache spark. The conclusion is drawn that the cluster takes very lass time to run the algorithm and efficiently find out the result.

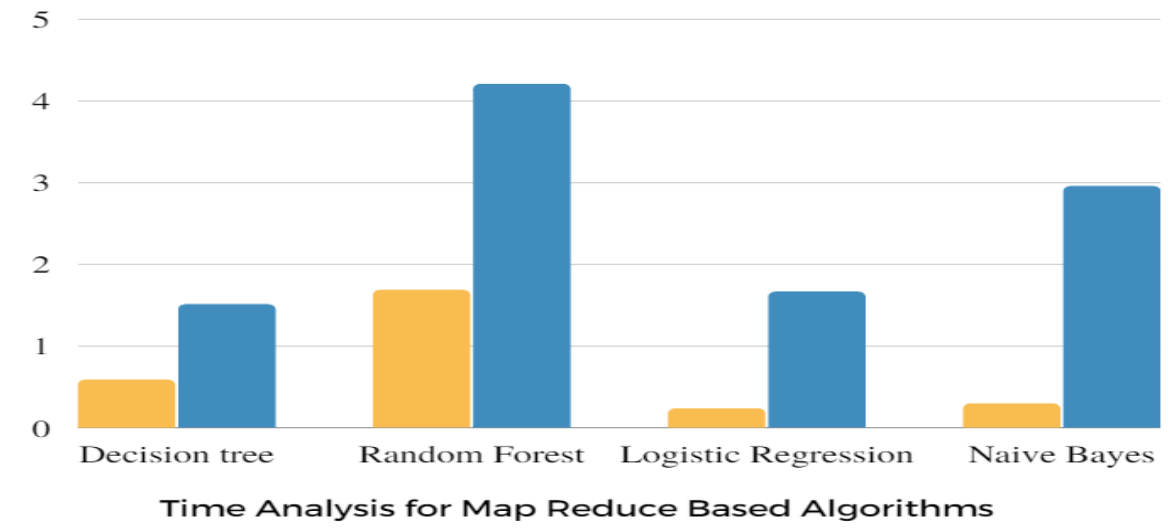

TABLE 4. TIME ANALYSIS FOR MAP REDUCE PREPROCESSING

Algorithm	**Time (in secs) (Local Machine)**	**Time (in secs) (Apache Spark)**
Decision Tree	1.87738200007	0.292229284834
Random Forest	2.38948002220	0.030222919990
Naïve Bayes	4.92923435001	0.073928394400
Logistic Regression	2.33902284739	0.056758939443

The process of collecting data, building an algorithm selection model, and testing that model, was divided into four phases. The first phase examined the hyper-parameters for each learning algorithm to determine their relative effects on learning time and model quality with the goal of eliminating any insignificant hyper-parameters. The second phase trained models using a variety of hyper-parameters to find a set of hyper-parameters that produced the highest scoring models. The third phase reran select iterations of the model training processes on various numbers of compute cores to estimate the parallel performance of each algorithm on each dataset. The fourth and final phase combined all of the data from phases two and three to build an algorithm selection model.

- preprocessing time with Apache spark

- preprocessing time without Apache spark

CHAPTER

CONCLUSION

To recommend the crops in advance by the proper analysis of the soil and environment conditions in future scenario within a short span of time so that farmers can select the right crops to strategize crop production.

The proposed technique selects eight soil characteristics (N, P, K, Zn, Cu, Fe, Mn, and EC) and two environmental characteristics (seasons and rainfall) as important features. N, P, and K are macro nutrients of soil which helps to increase the crop growth as well as quality of crop. Zn, Cu, Fe, and Mn are micronutrients of soil which are involved in photosynthesis and respiration. This work utilizes nine classes of crops to identify suitable crops for cultivation. The classes include pulses like Black Gram (Bl G), Bengal Gram (BG), Chick Peas (CP), and Green Gram (GG); vegetables like Brinjal, Lady's Fingers (LF), and Tomatoes, and cereals like Maize and Paddy.

The future enhancement of this project can be done by using huge dataset on large cluster when the demand for the storage is large and processing time is high. Also there can enhancement in the making a web app using frontend so that it could help farmers to predict crop easily and in user friendly manner. This project can be implemented at large scale with live data of particular place to get the prediction of crop using mobile app.

The major enhancements include:

1. Prediction of the crop yield for specific regions by executing various Machine Learning algorithms, with a comparison of error rate and accuracy.
2. A user-friendly mobile application to recommend the most profitable crop.
3. A GPS based location identifier to retrieve the rainfall estimation at the given area.
4. A recommender system to suggest the right time for using fertilizers.

CHAPTER 10

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CHAPTER 11

SNAPSHOTS

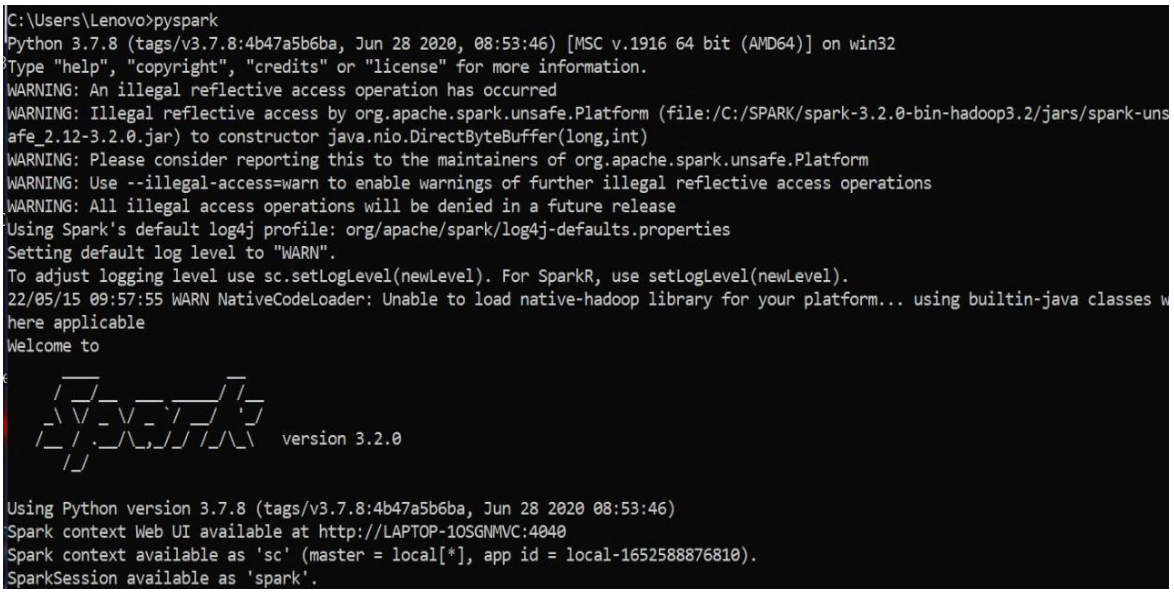

Fig. 11.1 Running pyspark in command prompt

By default, pyspark creates a Spark context which internally creates a Web UI with URL http://localhost:4040. Since it is unable to bind on 4040 for me it was created on 4042 port.

1.Spark context created with app id local-*

2.By default it uses local[*] as master

3. Spark context and session are created with variables 'sc' and 'spark' respectively.

4.Displays Spark, and Python versions.

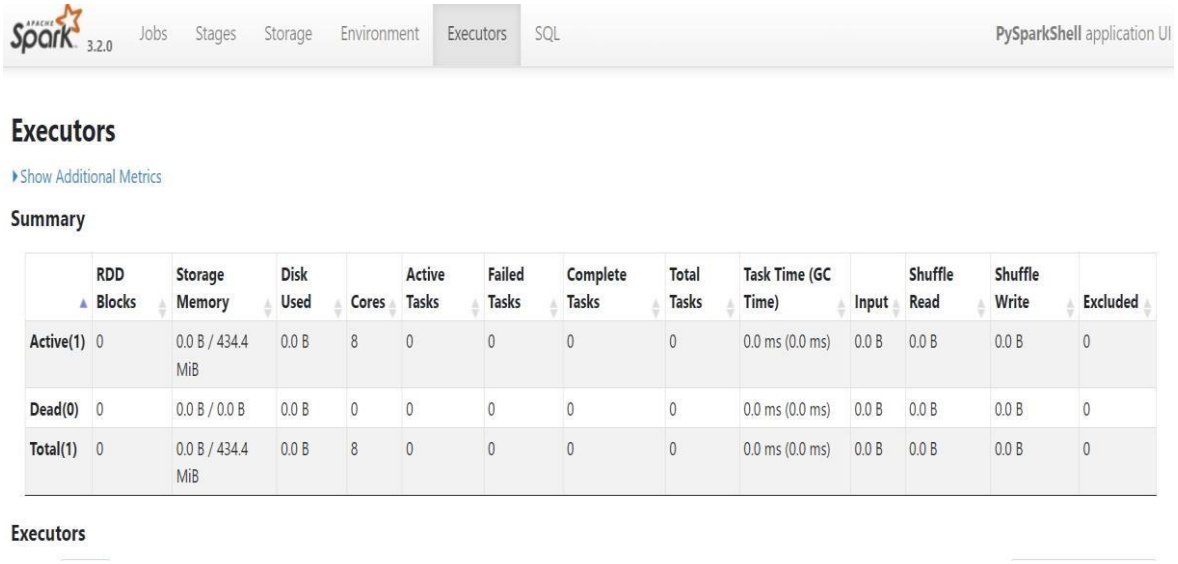

Fig.11.2 Pyspark Web UI

Apache Spark provides a suite of Web UI/User Interfaces (Jobs, Stages, Tasks, Storage, Environment, Executors, and SQL) to monitor the status of your Spark/PySpark application, resource consumption of Spark cluster, and Spark configurations.

Spark UI is separated into below tabs.

- Spark Jobs
- Stages
- Tasks
- Storage
- Environment
- Executors
- SQL

If you are running the Spark application locally, Spark UI can be accessed using the http://localhost:4040/ . Spark UI by default runs on port 4040 and below are some of the additional UI's that would be helpful to track Spark application.

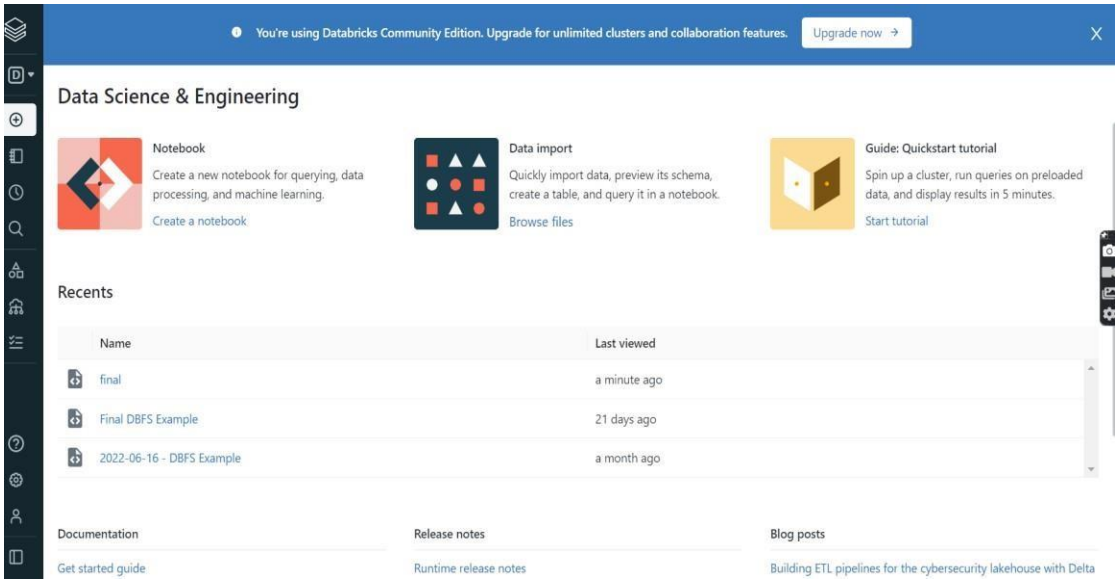

Fig. 11.3 Databricks Platform

With origins in academia and the open source community, Databricks was founded in 2013 by the original creators of Apache Spark™, Delta Lake and MLflow. As the world's first and only lakehouse platform in the cloud, Databricks combines the best of data warehouses and data lakes to offer an open and unified platform for data and AI.

Today, more than 7,000 organizations worldwide — including ABN AMRO, Condé Nast, H&M Group, Regeneron and Shell — rely on Databricks to enable massive-scale data engineering, collaborative data science, full-lifecycle machine learning and business analytics.

Headquartered in San Francisco, with offices around the world and hundreds of global partners, including Microsoft, Amazon, Tableau, Informatica, Cap Gemini and Booz Allen Hamilton, Databricks is on a mission to simplify and democratize data and AI, helping data teams solve the world's toughest problem.

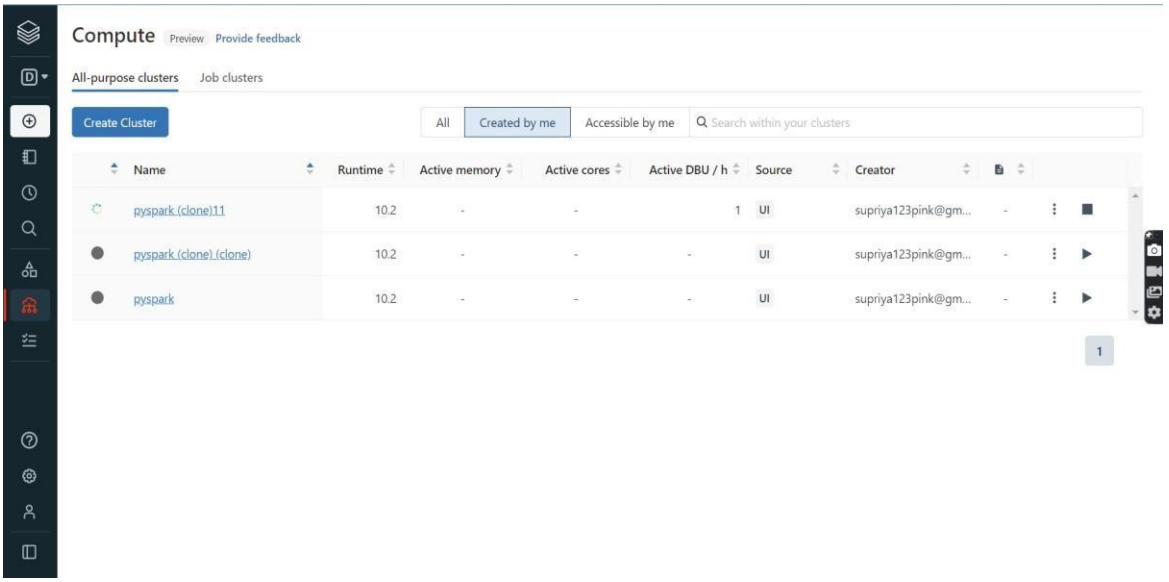

Fig. 11.4 Creating cluster

There are two types of clusters:

- All-Purpose clusters can be shared by multiple users. These are typically used to run notebooks. All-Purpose clusters remain active until you terminate them.
- Job clusters run a job. You create a job cluster when you create a job. Such clusters are terminated automatically after the job is completed.

This article describes how to create an all-purpose cluster. To learn how to create job clusters, see Create a job.

The easiest way to create a new cluster is to use the **Create** button:

1. Click **Create** in the sidebar and select **Cluster** from the menu. The Create Cluster page appears.

2. Name and configure the cluster.There are many cluster configuration options, which are described in detail in cluster configuration

3. Click the **Create Cluster** button.

The cluster **Configuration** tab displays a spinning progress indicator while the cluster is in a pending state. When the cluster has started and is ready to use, the progress spinner turns into a green circle with a check mark. This indicates that cluster is in the running state, and you can now attach notebooks and start running commands and queries.

Decision Tree

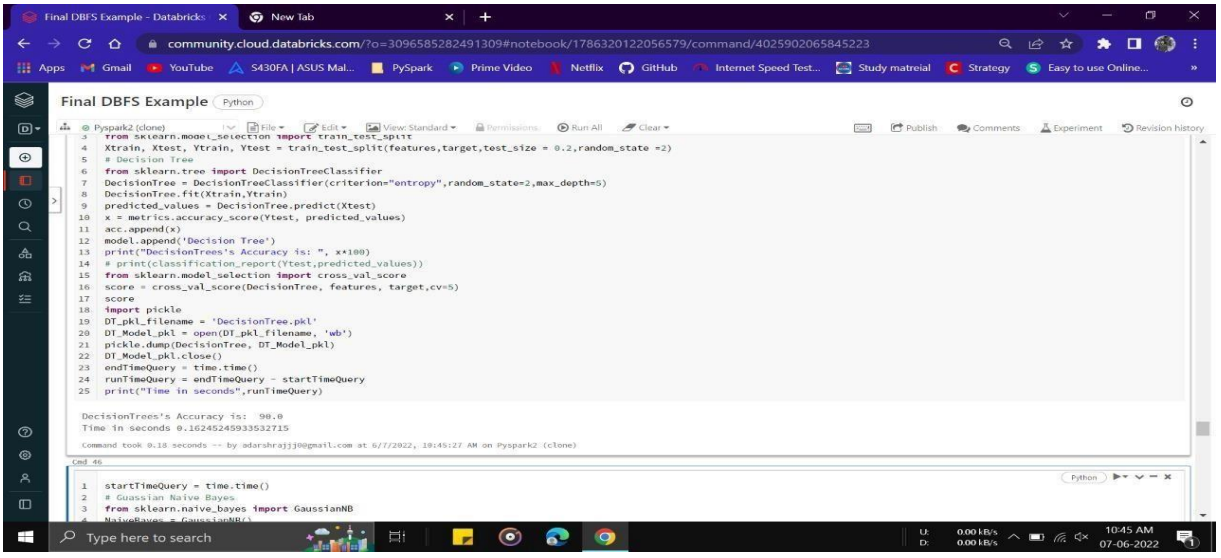

Fig. 11.5. Decision Tree Accuracy

The DT is a supervised learning model with a tree-like structure. Each internal node is labeled with an input feature and follows a top-down approach. Each leaf node is labeled with the class used to predict the target variable. For the DT, which holds the prediction class, tree splitting is important. Using the splitting, data values from the testing set are used to identify a suitable crop.

Random Forest

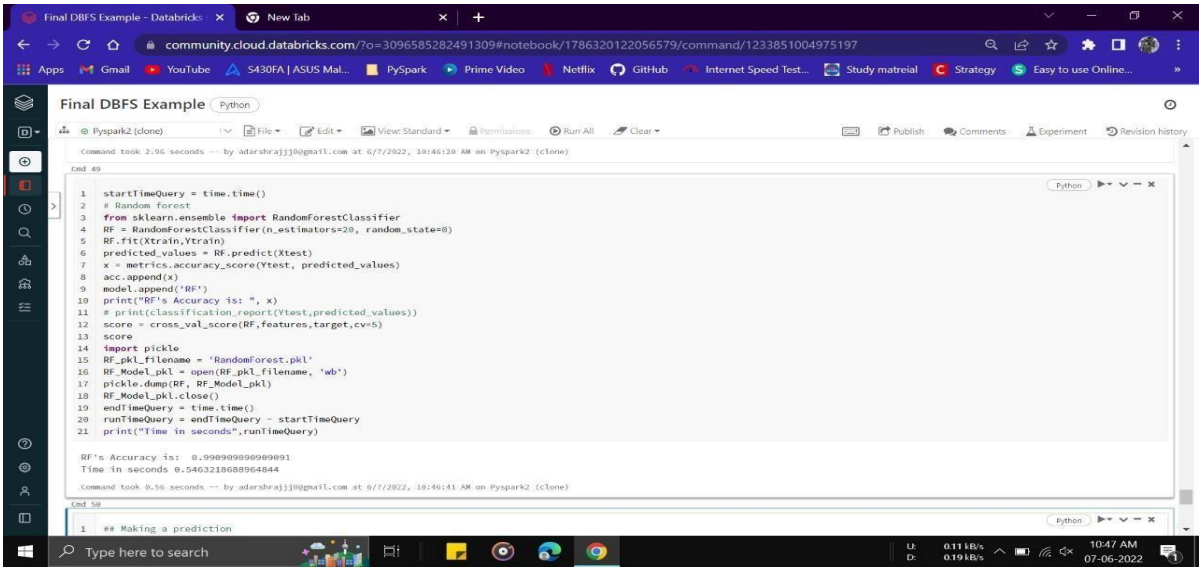

Fig. 11.6. Random Forest Accuracy

The RF classifier is a collection of binary DTs. The RF creates a set of DTs from a randomly selected subset of the training set. Each individual tree splits a class for crop prediction, and the split is chosen from the Gini index value. The class of a new sample from the testing set is determined by the majority of the votes of all the trees in the RF.

Logistic Regression

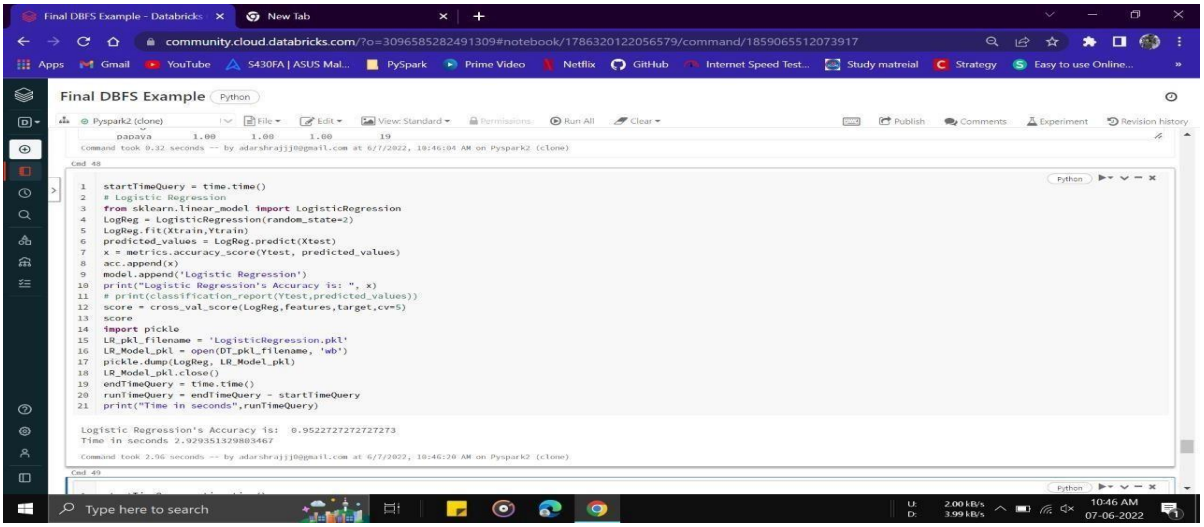

Fig. 11.7. Logistic Regression Accuracy

Logistic regression is also used to estimate the relationship between a dependent variable and one or more independent variables, but it is used to make a prediction about a categorical variable versus a continuous one. A categorical variable can be true or false, yes or no, 1 or 0, et cetera. The unit of measure also differs from linear regression as it produces a probability, but the logit function transforms the S-curve into straight line.

Naïve Bayes

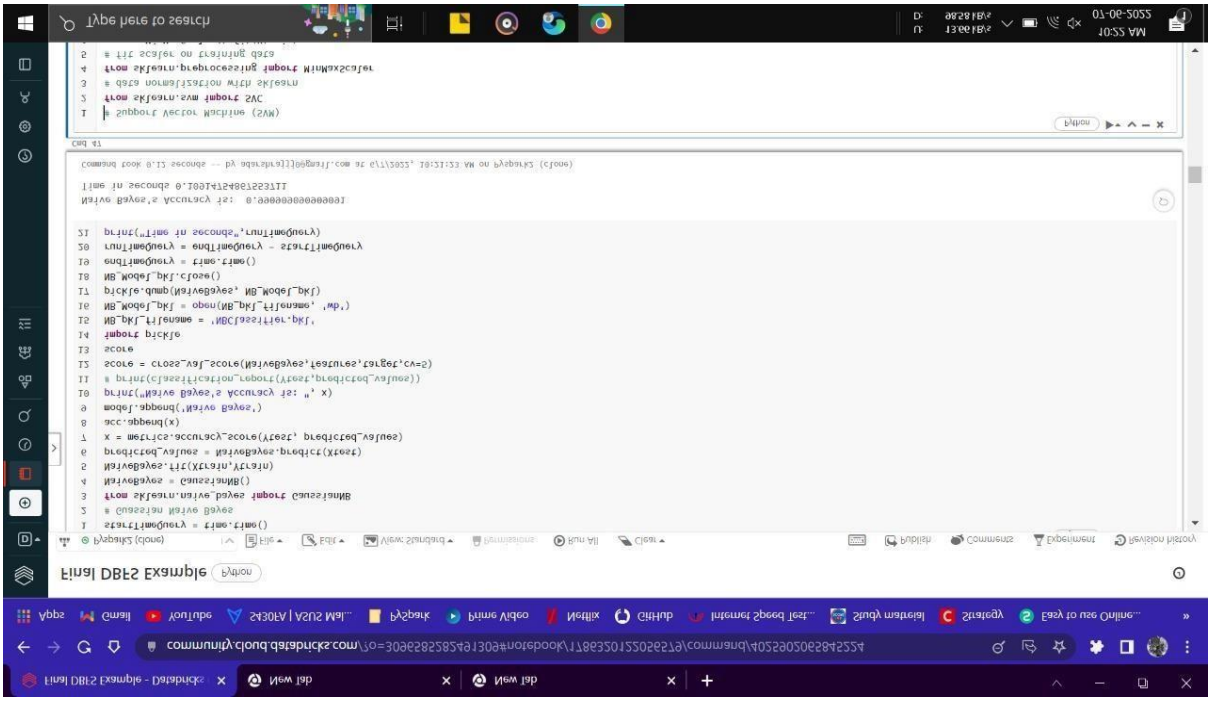

Fig. 11.8. Naïve Bayes Accuracy

The NB classifier is a simple classification algorithm that estimates the probability of every class and chooses a suitable crop with the maximum probability. The NB classifier is trained with the training samples, and its performance is evaluated by using testing samples from the testing set to find the most appropriate crop for cultivation.