A Project Report

on

APPLICATION OF DATA SCIENCE IN INDUSTRY 4.0

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In

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Under The Supervision of

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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
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CANDIDATE'S DECLARATION

We hereby certify that the work which is being presented in the thesis/project/dissertation, entitled **"APPLICATION OF DATA SCIENCE IN INDUSTRY 4.0"** in partial fulfillment of the requirements for the award of the **Bachelors of Technology in Computer science and Engineering** submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of January, 2023 to May and 2023, under the supervision of **Dr. Aanjey Mani Tripathi Associate Professor**, Department of Computer Science and Engineering/Computer Application and Information and Science, of School of Computing Science and Engineering , Galgotias University, Greater Noida The matter presented in the thesis/project/dissertation has not been submitted by me/us for the award of any other degree of this or any other places.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Dr. Aanjey Mani Tripathi
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CERTIFICATE

The Final Project Viva-Voce examination of **Ankit 19SCSE1010013 and Shambhavi Agrawal 19SCSE1010023** has been held on 15th May 2023 and his/her work is recommended for the award of **Bachelor of Technology in Computer Science and Engineering.**

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Program Chair **Signature of Dean**

Date: May, 2023

Place: Greater Noida

Abstract

This abstract discusses the application of data science in the context of Industry 4.0. Industry 4.0, also known as the fourth industrial revolution, represents the integration of advanced technologies such as the Internet of Things, Artificial Intelligence, and Big Data into the industrial sector. Data science plays a crucial role in Industry 4.0 by leveraging data to drive insights, improve decision-making, and optimize processes across various industries.

It provides an overview of the key applications of data science in Industry 4.0, including predictive analytics, machine learning, optimization algorithms, and real-time monitoring. It also highlights the benefits and challenges associated with implementing data science in this context, emphasizing the potential for enhanced efficiency, productivity, and competitiveness. By understanding the application of data science in Industry 4.0, businesses can harness the power of data-driven approaches to unlock new opportunities and drive transformative change in their operations.

In today's fast-paced era, industries must embrace digitalization in order to ensure their survival. Technology has become the driving force of our time, and companies' ability to meet customer needs through tailored solutions is heavily reliant on being connected through technological advancements such as the Internet of Things, Artificial Intelligence, and Big Data, by incorporating these technological applications, businesses can experience a significant growth rate boost. This phenomenon, often referred to as the fourth industrial revolution or 4IR, represents the integration of technology into the industrial sector. As a futuristic concept that is

already prevalent in today's world, virtually every business in the market has embraced it. The purpose of this paper is to provide an overview of how data science is applied in the context of Industry 4. 0.

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Acronyms

B.Tech.	Bachelor of Technology
M.Tech.	Master of Technology
BCA	Bachelor of Computer Applications
MCA	Master of Computer Applications
B.Sc. (CS)	Bachelor of Science in Computer Science
M.Sc. (CS)	Master of Science in Computer Science
SCSE	School of Computing Science and Engineering

CHAPTER 1:
INTRODUCTION

In the era of Industry 4.0, data science has emerged as a powerful tool for transforming industrial operations and revolutionizing the manufacturing landscape. Industry 4.0 refers to the integration of advanced technologies such as IoT, artificial intelligence, big data, and automation to create smart factories and enable more efficient and agile production processes.

Data science plays a pivotal role in harnessing the vast amount of data generated within these smart factories and extracting valuable insights to drive decision-making, optimize operations, and enhance overall productivity. One of the key applications of data science in Industry 4.0 is predictive maintenance. By analyzing real-time sensor data from machines and equipment, data science techniques can identify patterns, anomalies, and failure indicators.

This enables proactive maintenance scheduling, preventing costly breakdowns and minimizing unplanned downtime. Predictive maintenance not only improves the reliability of equipment but also maximizes operational efficiency by reducing unnecessary maintenance activities.Data science also plays a crucial role in optimizing production processes. By analyzing data from various sources, such as sensors, supply chain systems, and quality control measurements, manufacturers can gain insights into process inefficiencies, bottlenecks, and quality issues.

Data science techniques, including machine learning and statistical analysis, enable the identification of optimization opportunities, the prediction of optimal process parameters, and the detection of anomalies or defects in real-time. This leads to enhanced productivity, improved product quality, and reduced waste. Another application of data science in Industry 4.0 is in supply chain management. By analyzing data from multiple stakeholders along the supply chain, such as suppliers, manufacturers, and logistics providers, data science enables better demand forecasting, inventory optimization, and efficient resource allocation. This facilitates streamlined production planning, reduced lead times, and improved customer satisfaction.

Furthermore, data science empowers decision-makers in Industry 4.0 by providing actionable insights derived from data analytics and machine learning models. By integrating data from multiple sources and applying advanced analytics techniques, data scientists can support strategic decision-making, optimize resource allocation, and enable data-driven innovation.

In summary, data science plays a transformative role in Industry 4.0 by leveraging advanced technologies and data analytics to drive operational efficiency, enhance decision-making, and enable smart manufacturing. It enables predictive maintenance, process optimization, and supply chain management, ultimately leading to improved productivity, reduced costs, and enhanced customer satisfaction. As Industry 4.0 continues to evolve, data science will remain a critical enabler of innovation and competitive advantage for organizations embracing the digital transformation of manufacturing.

CHAPTER 2:
LITERATURE SURVEY

The python-based program is the example of the use of data science in the automobile industry. This technology is helping the people to develop and maintain their business with the less time consumption.

[3] have developed a SVMS that consists of a mobile device that uses CDMA protocol for the vehicle that alerts the user if any major breakdown happens in the vehicle. The gateway is connected to the engine of the car and checks the RPM and automatically determines the health of the vehicle based on it.

[4] developed a model based on VANET embedded with the IOT, which is not called Internet of Vehicles. This algorithm has application in logistics vehicles and is mainly concerned for improving the management of these vehicles. They have used a wide range of sensors for this functionality and in future they aim to develop a website for the same.

[5] have given various theories to improve the supply chain management which ranges from blockchain to application of Industry 4.0 using IOT and embedding the MATLAB software for the same.

The article [6] given a vision that after successful implementation of Industry 4.0 Industry 5.0 is also possible. This concept aims at making the next industrial revolution more human centric where skilled workers will be utilized as much as technology. An embedded structure have been proposed by the authors to prevent mass redundancy in the industrial sector.

1. "Data Science in Industry 4.0: A State-of-the-Art Survey" by A. Kusiak (2018): This survey provides an overview of the application of data science techniques, including machine learning and data analytics, in Industry 4.0. It explores various domains such as smart manufacturing, predictive maintenance, supply chain management, and quality control.

2. "Data Science in Industry 4.0: A Systematic Literature Review" by R. Petrillo et al. (2019): This review focuses on the role of data science in Industry 4.0, analyzing relevant literature to identify key trends, challenges, and opportunities. It discusses the application of data science in areas such as smart factories, cyber-physical systems, and data-driven decision making.

3. "Big Data Analytics in Industry 4.0: A Review" by L. Xu et al. (2020): This review explores the application of big data analytics in the context of Industry 4.0. It discusses the challenges and opportunities of leveraging big data, data mining, and machine learning techniques in smart manufacturing, quality control, and supply chain management.

4. "Industrial Big Data Analytics for Cyber-Physical Systems in the Context of Industry 4.0" by L. Wang et al. (2019): This paper focuses on the use of big data analytics for cyber-physical systems in Industry 4.0. It discusses the integration of data science techniques with cyber-physical systems, emphasizing their impact on smart manufacturing, energy efficiency, and predictive maintenance.

5. "Data-Driven Decision Making in Industry 4.0: A Survey" by M. J. Sánchez et al. (2020): This survey explores the role of data-driven decision making in Industry 4.0. It discusses the application of data science techniques, such as predictive analytics and optimization, in decision support systems for resource allocation, production planning, and quality management.

6. "Machine Learning Applications in Manufacturing" by T. R. Browning et al. (2020): This article focuses on machine learning applications specifically in the manufacturing industry. It discusses the use of machine learning algorithms for process optimization, fault detection, predictive maintenance, and quality control in the context of Industry 4.0.

CHAPTER 3:
METHODOLOGY

A. Block Diagram

The overwhelming growth of technology over the years has shown that the fourth industrial revolution is around the corner this paper aims to highlight the application of data science in Industry 4.0. A vehicle Management system has been developed which shows the utility of data science and DBMS in Industry 4.0.[7-9]

Admin: The admin needs to register using the desired credentials from the backend the admin takes overall control of the system, where they can check the mechanics and customers registered in the portal, furthermore there is the functionality of generating a bill with the details of the changes made to the vehicle.[9-12]

Mechanic: The mechanic can register on the portal and can view the inquiries made by the customers and reply to them using this portal, they have the functionality of updating the user's vehicle details and can view the list of customers registered along with their problem.[12-14]

Customer: The customer can register on the portal and can view if they[15-18] have been approved by the admin or not, they can enquire about their vehicle and get a detailed description of the service done on the vehicle. The customer can download the bill as well.

Django: This is a complex algorithm of python that uses an ORM tool to change the database from PostgreSQL this system has the functionality of embedding both HTML and CSS for the development. Migrations are applied to the system; it automatically creates tables in the database without the use of MySQL.[19-21]

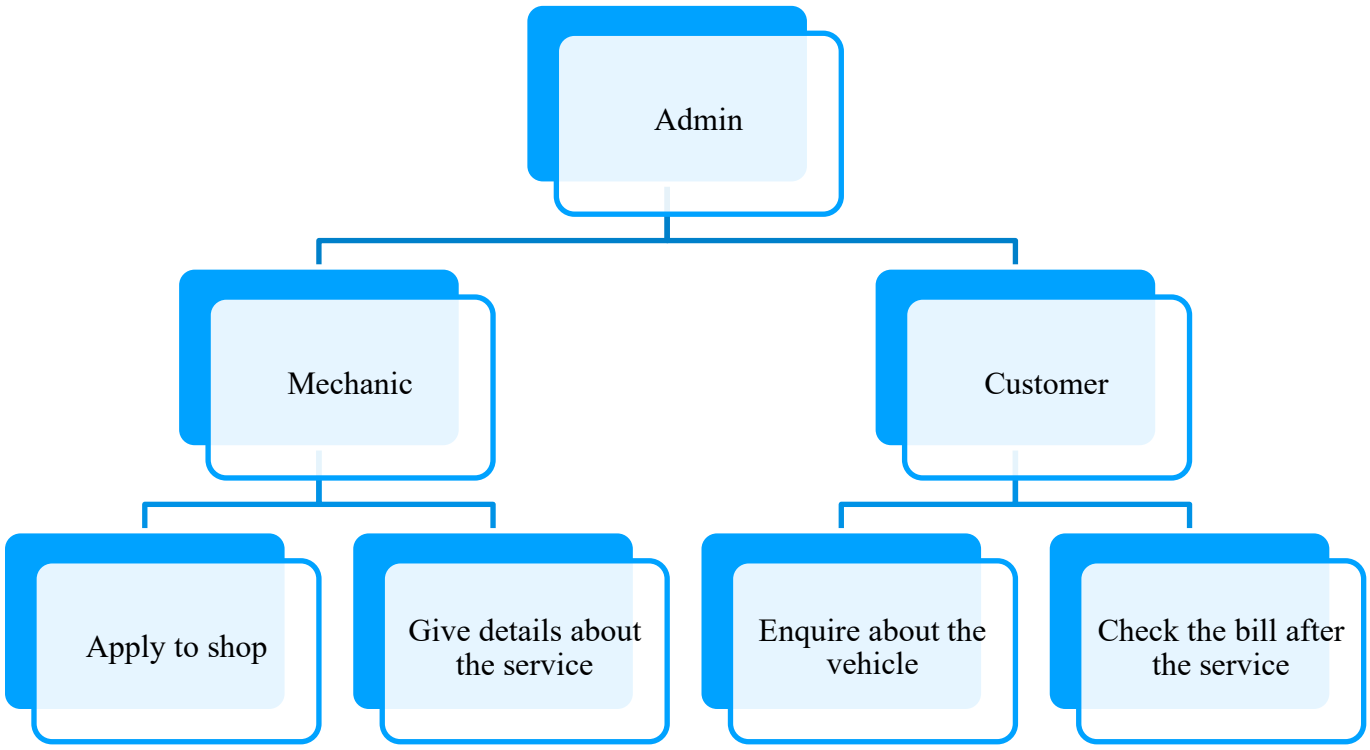

Fig1:The hierarchical structure of the system.

B. Database Description

Table 1: The status of the Mechanic as shown in the portal.

Mechanic name	**Skills**	**Salary**
Anup Jain	Engine	35000
Ajay Shetty	Brakes	20000
Amir Yadav	Clutch	25000
Rajpal Singh	Interior	28000
Shivam Rana	Assistant	15000
Rishab Raj	Driver	10000
Harsh Srivastav	Assistant	9500
Sharukh Hasmi	Driver	10000
Subham	Engine	30000
Dhruv Bhati	Driver	10000

Table I. shows the status of the mechanics/working personals enrolled in the firm with salary ranging from 9500 to 30000. It is very important for the admin to have these details as it portrays good image of the company. The table here is varied and displays the skills of the individual registered.[22]

Table 2: The status of the customer as shown in the portal.

Customer Name	**Problem Description**	**Vehicle**
Rashid Khan	Brakes change	Car
Manav Gupta	Basic servicing	SUV
Manya Sharma	Cleaning	Car
Surbhi Sharan	Breakdown	Scotty
Murad Chaudhary	Cleaning	SUV
Rohit Raj	Breaks repair	Car
Dharmedra	Engine noise	Bike
Akul Rohan	Speaker installation	SUV
Ananya Singh	Dent work	Car
Mansi Verma	Headlights change	Scotty

Table II. shows the customers registered along with the problem with problem that they are encountering, this table shows the vehicle type as well.[23-25]

CHAPTER 4

RESULTS AND DISCUSSION

The app mainly has three signup pages, admin, customer, and mechanic.

2. Admin Login page.

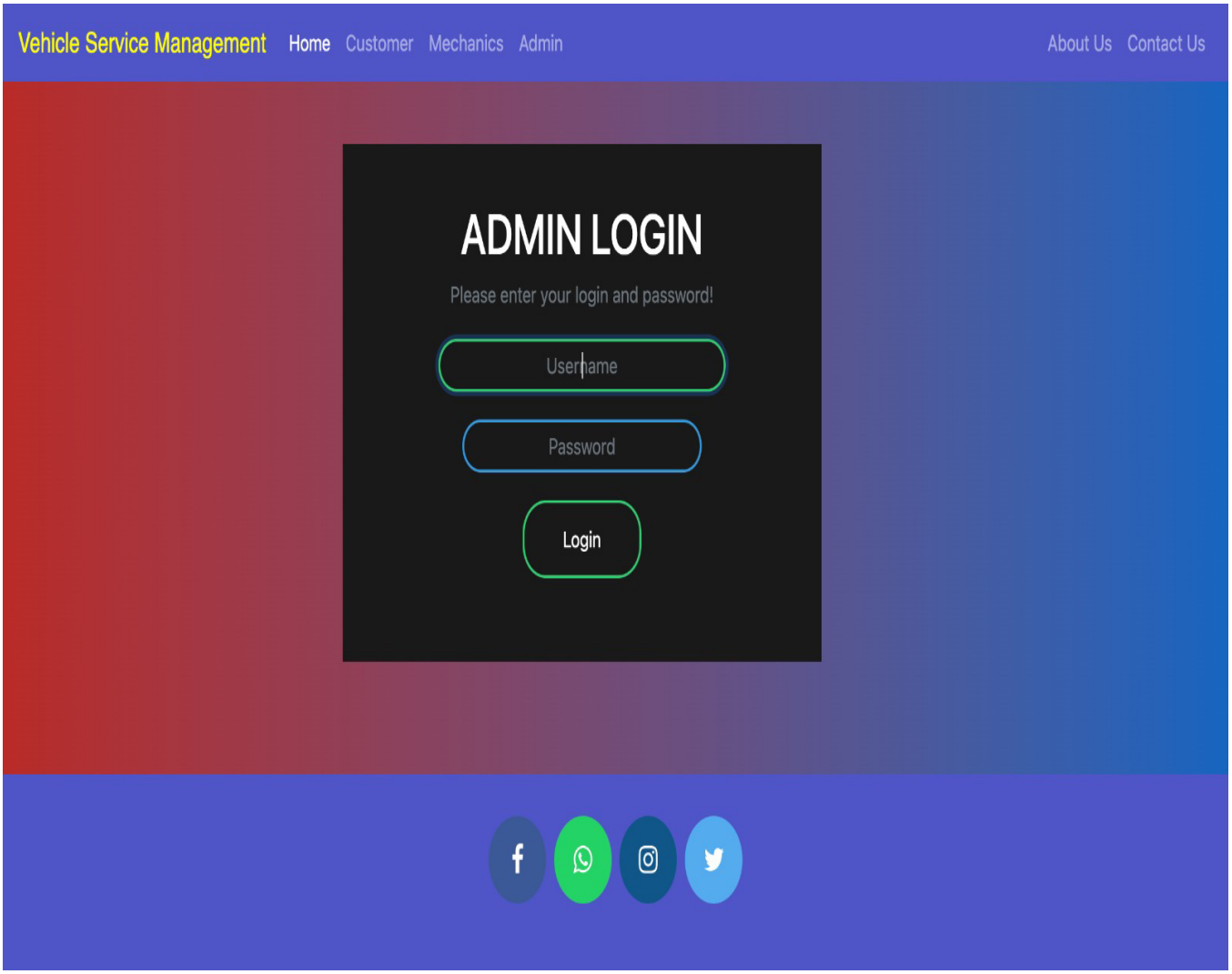

Fig2:Admin Login Page

Fig.2. depicts the admin sign-up and login page where after successful registration the admin user will be allowed to login and see various information available on the portal.

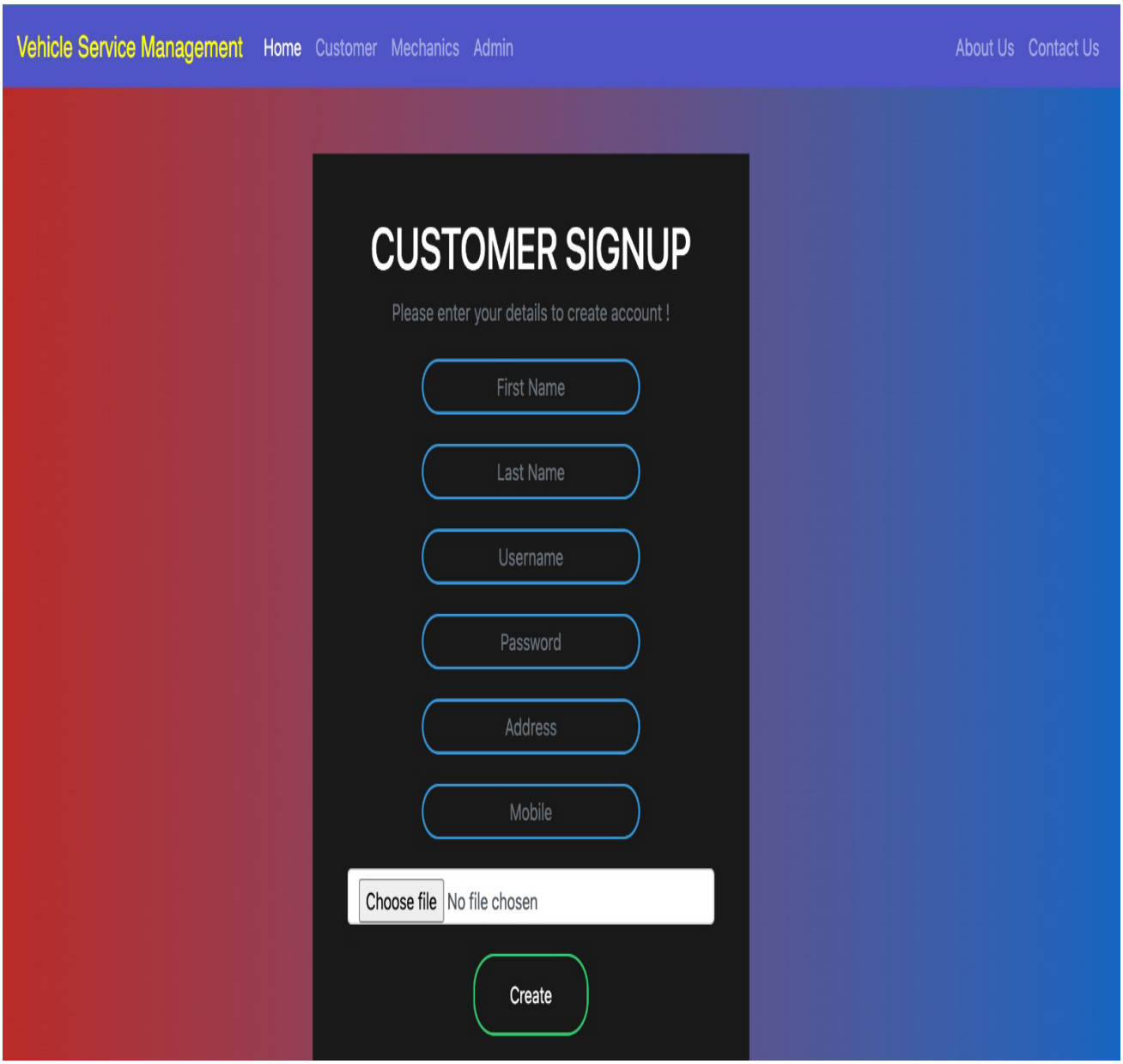

Fig3:Customer Signup Page

Fig.3. depicts the customer sign-up page where after successful registration, customer will be able to visit the portal and can view various reports of the vehicle and can even download the bill once the service is finished.

Fig.4. depicts the mechanic sign-up page where after successful registration, mechanic will be able to visit the portal and can view various reports of the vehicle and can upload the problem report after the service is done.

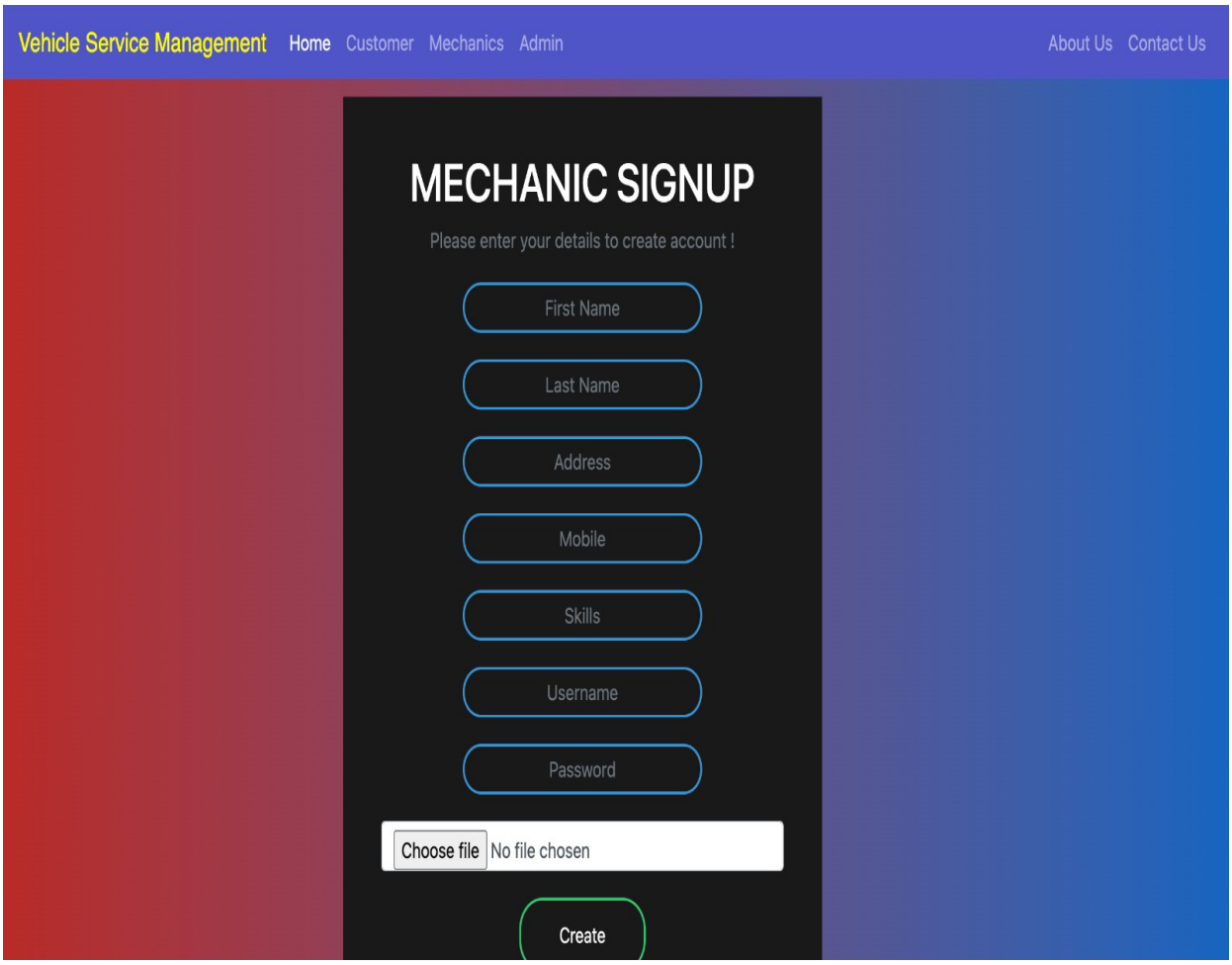

Fig4:Mechanic Signup Page

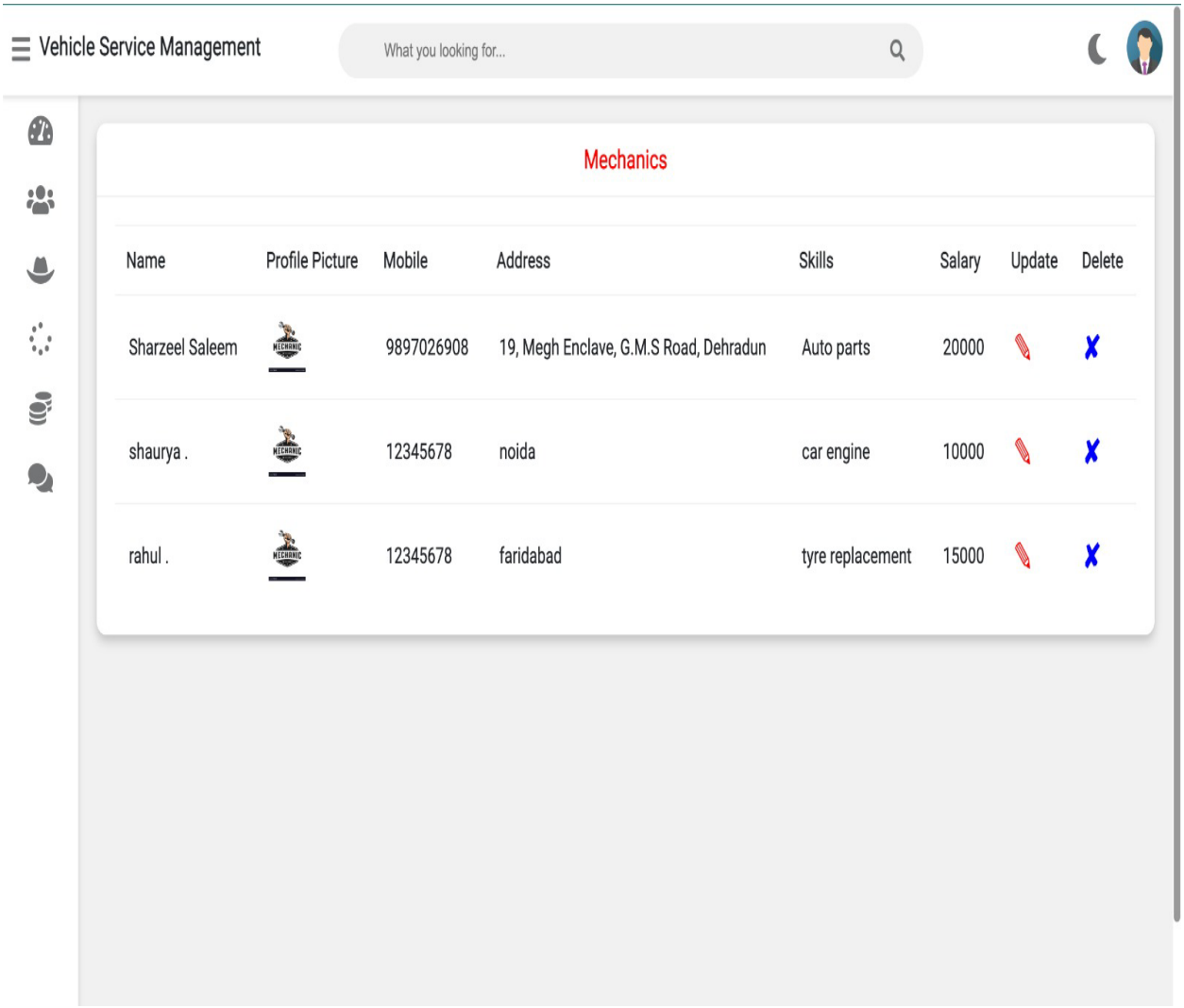

Fig5:Admin Login Page (Mechanics)

Fig.5. shows the admin portal with the registered mechanics and their salary details, the database contains the address as well as the skills of the workers.

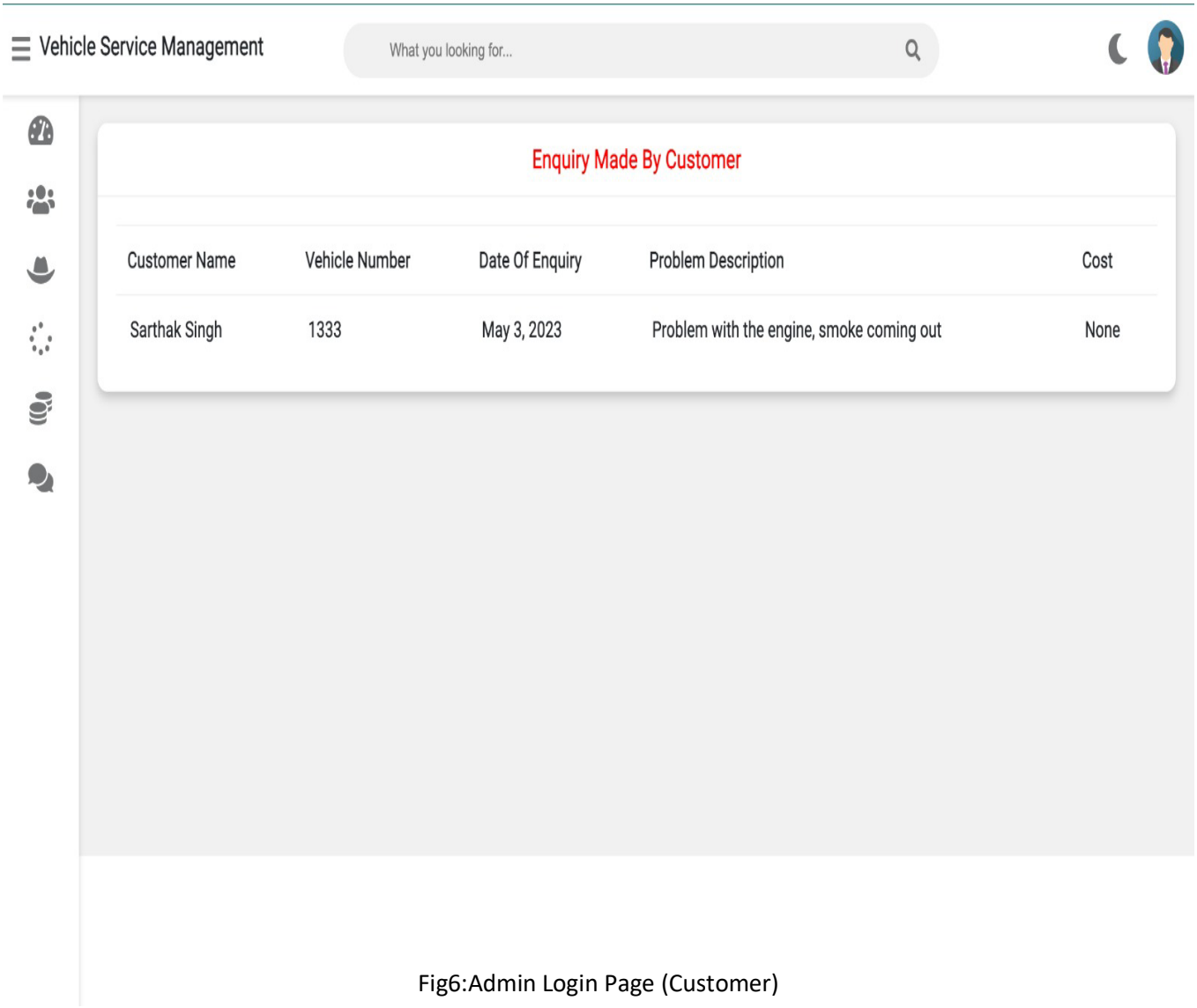

Fig6:Admin Login Page (Customer)

Fig 6. shows the mechanic portal with the registered customers and their problems, the database contains the details of the vehicle as well as the estimated cost of the part that has to be replaced or worked on.

CHAPTER 5
CONCLUSION AND FUTURE SCOPE

This system aims to make it easier for the shop owners and the customers to have an extensive application that is beneficial for Industry 4.0, the main aim of this research is to develop a methodology that is convenient to use and is more user-friendly than pre-existing systems. This research aims to help in logistics as well as in personal auto care centres.[26-27]

The Future aims of this system can be hosting this application online and adding more functionalities to the web application such as uploading the images and audio for the support and directly linking the app to the RTO portals so that if any stolen or outdated vehicle is there, it can be identified. [28-29]

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