Managing Data in the Car Manufacturing Industry

Abstract: The proposed Database management System is based on providing a larger network area of the database system for efficient working of an automobile manufacturing unit. This database design makes it easier for storing multiple data in one, single place where the client can store their data covering everything under the company's roof. It will cover every data of the whole manufacturing unit such as the paint shop, financial figures, employee information, raw materials, suppliers, sales and everything else necessary for the smooth conduct of the manufacturing line. This platform will not only provide an all in one platform to store data but will also provide an opportunity for manufacturing units to be time efficient and will help them to scale up production rate and hence the revenue and profits, by providing the required data on demand regarding products and its supply chains.

Keywords: Data; Database Design; Car Industry; Manufacturing; Database Management System; Relational Model; Entity Relationship Model; Data Management; Automobile Industry

1. Introduction

Automotive industries are one of the evergreen industries of all time. They have revolutionised the development of entire countries and lifestyles of people. They have been an integral part of the society since they came into existence. They provide multiple jobs and employment opportunities to the people, create a smooth working environment, and generate an enormous amount of wealth for the betterment of the society. However, the automobile industry is a huge

industry, with multiple departments working together to ensure a smooth process. As indicated by an examination by Nikita Arya, "the vehicle area in India has monstrous potential for driving financial development and business and furthermore supporting a large group of other assembling enterprises like auto-segments, machine devices, steel, aluminum, plastics, synthetic substances, gadgets, and so on Moreover, the auto area likewise upholds the administrations area which incorporates IT and programming, banking, protection, fix and upkeep, transport and coordinations including public vehicle and so on The Car business created an aggregate of 29,075,605 vehicles in April-Walk 2018 as against 25,330,967 in April-Walk 2017, recording a development of 14.78% in the course of the most recent year's creation."

The vehicle fabrication industry or car industry contains a wide scope of organizations and associations engaged with the plan, improvement, assembling, advertising, and selling of engine vehicles. It is one of the world's biggest businesses by income. As indicated by a paper by Dr. A Srivastava, "The auto business in India is one of the bigger business sectors on the planet. It has recently been one of the quickest developing internationally, yet is presently encountering level or negative development rates. India's traveler vehicle and business vehicle fabricating industry is the 6th biggest on the planet, with a yearly creation of more than 3.9 million units in 2011. The FDI inflow into India for the auto area is chiefly for the Traveler vehicles. Traveler vehicles have most of speculation of the unfamiliar organizations and this is relied upon to be so later on too. The business volumes are additionally on the ascent for the Indian auto makers."
The auto business does exclude enterprises devoted to the support of vehicles following conveyance to the end-client, for example, car fix shops and engine fuel filling stations.

In 2007, there were around 806 million vehicles and light trucks out and about, devouring more than 980 billion liters (980,000,000 m3) of gas and diesel fuel yearly. The vehicle is an essential method of transportation for some created economies. The Detroit part of Boston Counseling Gathering anticipated that, by 2014, 33% of world interest would be in the four BRIC markets (Brazil, Russia, India and China). Then, in the created nations, the car business has eased back. It is additionally expected that this pattern will proceed, particularly as the more youthful ages of individuals (in exceptionally urbanized nations) presently don't have any desire to claim a vehicle any longer, and incline toward different methods of transport. Other conceivably amazing car markets are Iran and Indonesia. Arising vehicle showcases as of now purchase a bigger number of vehicles than set up business sectors. As per a J.D. Force study, developing business sectors represented 51% of the worldwide light-vehicle deals in 2010. The examination, conducted in 2010 anticipated that this trend would speed up. In any case, later reports (2012) affirmed the inverse; in particular that the auto business was easing back down even in BRIC nations. In the US, vehicle deals topped in 2000, at 17.8 million units.

In the last decade, automotive systems changed from traditional mechanical or mechatronics systems towards software intensive systems, because more and more functionality has been implemented by software. Currently, this trend is still ongo- ing. Due to this increased use of software, more and more data accumulates and thus, has to be handled. Since it was no subject up to now to manage this data with software separately, we think that it is indispensable to establish a data management system in automotive systems. In this paper we point out the necessity of implementing data management system to automotive industry which is not only fast growing but is also fast adapting industry and implementing Database to it will not only

manage its resources efficiently but will also help the industry in cutting down the extra costs and will help them to scale up their profits vividly. As indicated by an examination by Sakshi Modi and Dr Tapasya Jhulka, "Indian car makers are constantly putting immense emphasis in Research and development for additional item enhancements and in growing new impetus frameworks." Hence our database system will help them develop what is necessary.

The Automotive industry has been one of the worst hit industries due to the COVID 19 pandemic and tough times require tough measures to be taken with new and innovative ideas to overcome challenges. During these difficult times if the industry has managed proper data it will help them in managing the industry efficiently and preventing them from booking big losses. As indicated by a paper by Dr. AK Rastogi and NG Gupta, "Auto Industry should accept the lull time frame as a development time, and work towards making new procedures that will make colossal benefits later on. During the pandemic concepts like work from home have changed the whole working environment of companies as work from home is not only comfortable for employees but also helps companies in avoiding hefty bills on electricity and on providing proper work spaces to its employees, So during these times if proper and accurate data is managed it can help them in scaling up the profits.

1.1 Our Contributions

Conventional models of car manufacturing databases has certain flaws:

- Data redundancy
- Data inconsistency

- Difficulty in accessing data
- Data Isolation
- Integrity Problems
- Atomicity of updates
- Data Security
- Concurrent access by multiple users

Our proposed system tries to resolve tries to resolve these issues by:

- Accurate designing of database to ensure the data is not duplicated and the database is free of any data redundancy
- As the database has been designed to get rid of the data redundancy, the database will be free of any data inconsistency and hence will provide an accurate database.
- The relationships between data tables and the data have been designed in such a way that the data can be easily and correctly accessed by the users by creating the respective queries.
- Every detail and codes regarding the database has been accumulated in a single place and file to prevent any data isolation in the database.
- The database has been defined in such a way that it will provide options for upgradability in the future to meet the demands of changes in the automobile industry to resolve the integrity problems.
- As the database provides options for upgradation it will not provide any room for atomicity of updates.

- Data security is one of the major and key components of databases hence it is ensured that the database is secure from any malware and hacking attempts made.
- Databases can be edited by multiple people but by only who have been given access to the database hence to prevent any changes by the outsiders and the other people in the organization who don't have the access.

1.2 Paper Organization

➔ Section 2: Compares our proposed database system with previously implemented systems.

➔ Section 3: Detailed explanation of our proposed Car Manufacturing Industry Database System.

➔ Section 4: We show the experimental analysis of our proposed database system.

➔ Section 5: We conclude our research paper on managing data in the car manufacturing industry and express the future scope of this database system.

2. Literature Survey

S. No	Authors	Year	Description
1.	Yugal Nauhria, Makarand S Kulkarni, Sunil Pandey	2017	The author proposed and developed a strategic value chain framework for the car manufacturing industry. It describes the methodology to create values for the shareholders i.e. suppliers, customers, employees and society.
2.	Nikita Arya	2019	The authors proposed a review of the growing automobile industry and the technological advancements. They aim at faster adoption and manufacturing of hybrid and electrical vehicles.
3.	Sarita Devi	2015	The authors proposed that the automobile industry is a sector that combines innovation, creativity, science, technology,

			ideas that bring momentum to the economy, people and the whole nation. The objective is to reach the people by using social media marketing to maximize the sales.
4.	Smita Miglani	2017	The author proposed the analysis of the roles of the government policy, infrastructure and other enabling factors in the expansion of the car industry. It also analyzes India's National policy in light of these developments.
5.	Dr. Gopalakrishnan	2014	The authors proposed the analysis of production, domestic sales, and export trends of the automobile sector and to find out the estimate percentage change in this sector
6.	Steven Peter, Gisela Lanza, Jun Ni, Jin Xiaoning,	2014	The authors has proposed the detailed analysis of different types of production processes of automobile industries of

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developed countries all around the world

3. <u>Proposed System</u>

Creating a well designed framework for a car manufacturing industry is very important to ensure proper work flow and generating revenues and profits. It will help boost the productivity and profitability of operating an automobile manufacturing industry.

The Database Management System of the car manufacturing unit that we have proposed is completely server based so that we can provide a larger network area to our users without any interruption caused to them so they'll require a stable internet connectivity so that they can use our management system efficiently. Our system is mainly accessible to the admin staff of the company with which we have tied up. Our system maintains the privacy of the system by not sharing the stored data at any cause. We have made it easier for the user by dividing the system department wise and giving them a unique Dept_ID so that the user can manage large multiple data by easily dividing it department wise. Our Database is divided so efficiently that even small information can be stored and retrieved efficiently.

To make the system efficient and secure and to maintain anonymity of the data entered by the data and protect their privacy we have assigned Unique IDs in every department so that if we encounter any intruder during the process he won't be able to access any viable information of the company.

Our Database even provides some latest smart unique features which currently are not available in some major database companies like:

- Our system tracks the details regarding car manufacturing and assembly.
- Keeps records of all the employees working within the car industry.
- Keeps record of all the suppliers and raw materials bought from them.
- Keeps record of all the designs of cars with regard to their exterior and interior with their model number.
- Tracks all the financial spendings, expenditures and salaries given to the employees.

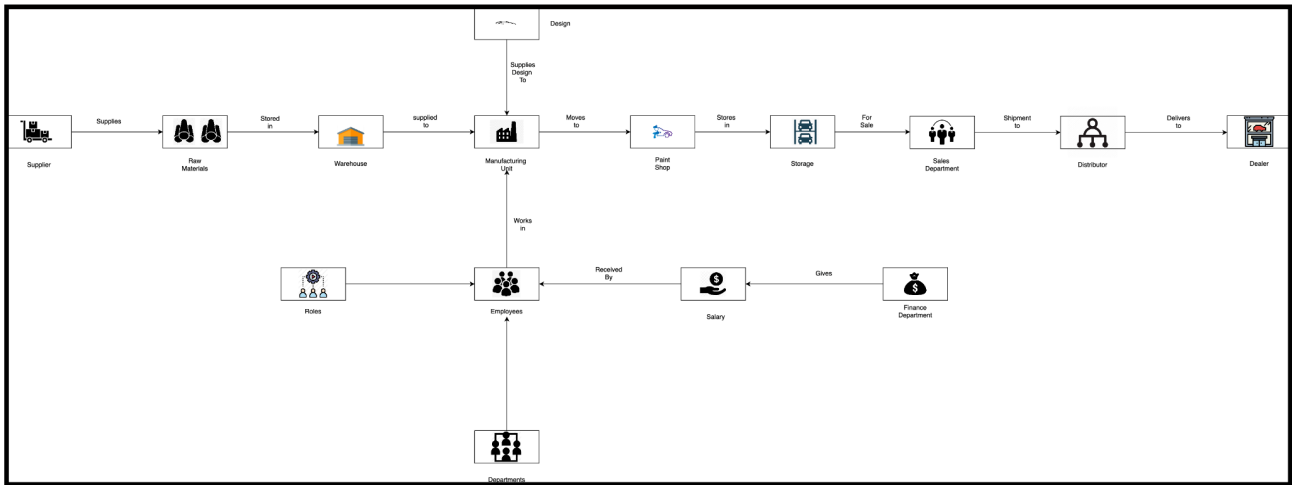

Figure 1: Proposed Database Design

3.1 Relational Model

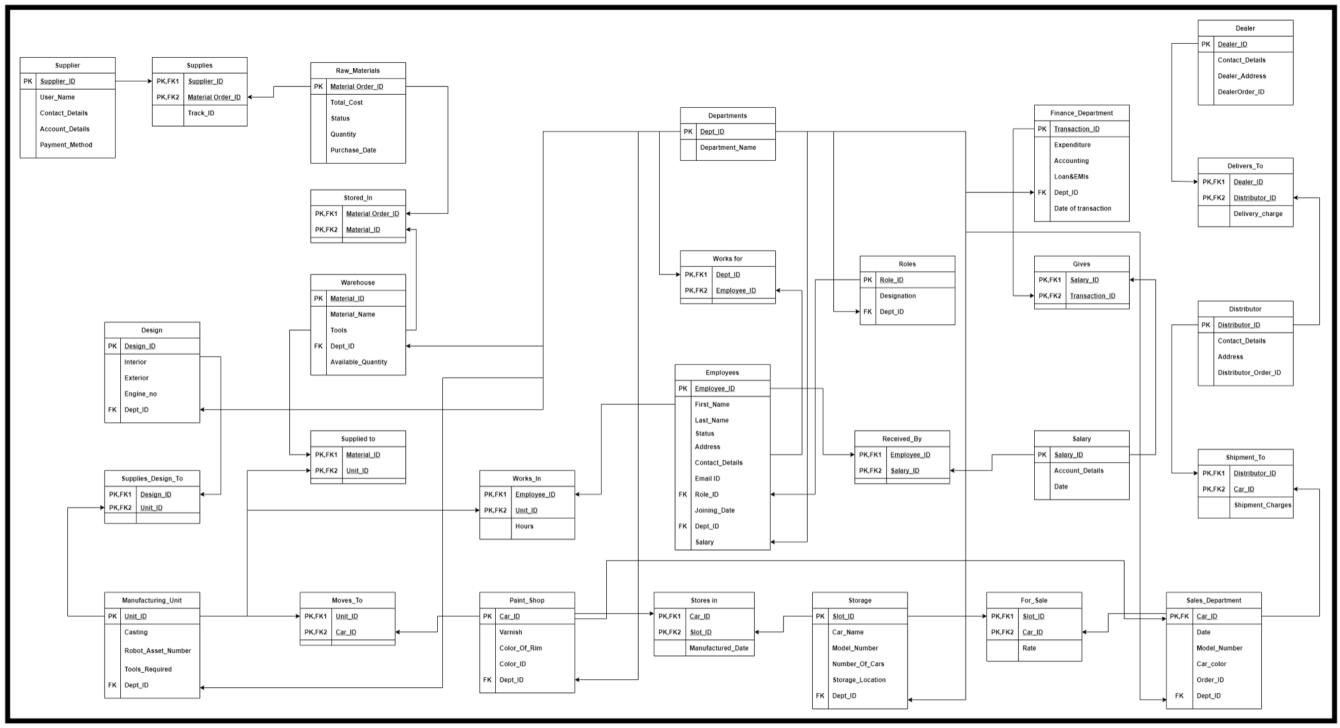

Figure 2: Relational Model

3.2 Entity Relationship Model

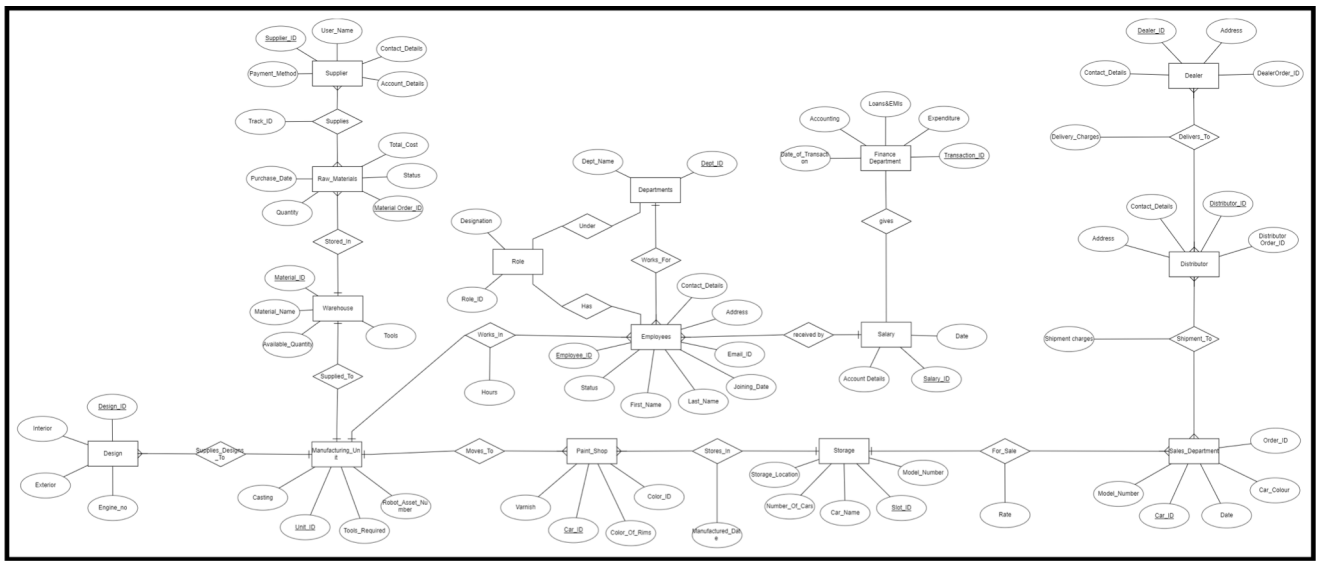

Figure 3: Entity Relationship Model

3.3 SWOT ANALYSIS OF AUTOMOBILE INDUSTRY

Strengths

→ India a huge market for this sector

→ Low Labour cost and their ease of availability

→ Ever Increasing Demands

Weakness

→ Government Taxation increases the manufacturing cost

→ Low labour productivity due to lack of research and development

→ Local demand towards low cost vehicles

Opportunities

→ Increase in population

→ Due to the growth in living standards a car is must

→ Demand of better car technology

Threats

→ Unskilled Labour

→ Lack of technological advancements

→ Competition

3. Experimental Analysis (Queries)

1. **Finding the price of cars between 5 Lakh - 12 Lakh and is white in color.**

```
SELECT Car_ID, Rate
FROM For Sale WHERE rate >= 5,00,000
INTERSECT
FROM For Sale WHERE rate <= 12,00,000
UNION
SELECT Car Color
FROM Sales Department WHERE Color=white;
```

2. **List raw materials with order quantity more than 100 and cost is less than 1000.**

```
SELECT Material Order_ID, quantity, Total Cost
FROM Raw Materials WHERE quantity>= 100
INTERSECT
SELECT Total Cost
FROM Raw Materials WHERE Total cost<= 10,000;
```

3. **Retrieve the Car_IDs supplied to the dealers by distributors with delivery charge less than 5000.**

```
SELECT Car_ID
```

FROM Shipment To

UNION

SELECT Delivery Charge

FROM Delivers To WHERE Delivery Charge<=5000;

4. **Number of Cars sold in 2017 and finding out which colors were sold other than Blue.**

SELECT Date,Car_ID,Car Color

FROM Sales Department WHERE Year(Date)=2017

MINUS

SELECT Car Color

FROM Sales Department WHERE Color=Blue;

5. **Retrieve the Car_IDs of cars stored in slots with Slot_ID 1110 to 1119 in storage and the color of cars is Yellow.**

SELECT Slot_ID,CAR_ID, Car Color

FROM Storage WHERE Slot_ID>=1110

INTERSECT

FROM Storage WHERE Slot_ID<=1119

UNION

FROM Sales Department WHERE Car Color = Yellow;

Table 1. Comparing proposed scheme with others

Literatures	F1	F2	F3	F4	F5	F6
Literature-1	✓	✓	✓	✓	✗	✗
Literature-2	✓	✗	✓	✗	✓	✓
Literature-3	✓	✗	✗	✗	✓	✓
Literature-4	✓	✓	✗	✓	✓	✓
Literature-5	✓	✗	✓	✗	✓	✗
Literature-6	✓	✗	✓	✓	✗	✓
Proposed Work	✓	✓	✓	✓	✓	✓

Table 2. Description of Features

Features	Meaning
F1	Tracks the details regarding car manufacturing and assembly.
F2	Keeps record of all the employees working within the Car Industry.
F3	Keeps record of all the suppliers and raw materials bought from them.
F4	Keeps record of all the raw materials, their quantities available for assembly of car.
F5	Keeps record of all the designs of cars with regard to their exterior and interior with their model number.
F6	Tracks all the financial spending, expenditures and salaries given to the employees.

4. Conclusion and Future Works

There has been vast growth and development in the automotive industry in our country. With the best technological innovations and advancements we aim to provide the best products to our customers. We have created a Database Management System in order to manage the whole company's data in one platform. Our Database would provide fast and easy outcomes regarding any queries generated.We aim to provide flexibility in our model.We have designed this model in such a way that owners can easily access all this data anywhere through wireless internet connection.This Database Management System can be applied in the real world and this system is flexible for any addition or deletion of any of its features. As per a paper by B. Bother, S. Banerjee and R Chatterjee, "The present worldwide car industry is brimming with promising circumstances and dangers which are all over — in arising and developing showcases the same. Notwithstanding, beneficial development is getting more hard to accomplish because of difficulties won from the store network to the retail climate. As of now, the auto business has a lot of everything — a lot of limitations, an excessive number of contenders and a lot of repetition and cover. The industry is in the holds of a worldwide value war. For value decrease, organizations need to take arrangement of choices at each phase of creation and selling; beginning from overseeing components of creation and production network to arrangement with sellers. Cost is one of the components that impacts the inconstancy of items and administrations essentially.Organizations require fitting approaches to be played keenly for dealing with the arrangement of choices."

The future seems very promising in the Automobile Sector with the increasing population and the rising demands of the public. As indicated by a paper by R. Shukla and A. Banerjie, "The auto area's commitment to Gross domestic product development rate is 5% — which was projected to increase to 10% by 2016". This shows the effect of a car industry to the economy of a country. Future work can include some addition of new features or updation of the existing features like making advancements in the design department. Or adding a whole new department that is an integral part of the entire manufacturing process to meet the upgradation requirements and the standards.

There has always been room for improvement in all industries, especially in the automotive industries as they need to adjust their strategies and production facilities according to the changing times. Quality Control is one of the most important parts of the automobile industry. As per a paper by Utkarsh Somvanshi, "Quality Control has a Huge arrangement of apparatuses, strategies and rules that when appropriately applied, can achieve unrivaled hierarchical administration and furthermore monetary objectives. Its execution standards should be related in the complete modern framework to get all the more altogether the impacts in work environments and viable creation frameworks. Makers who have effectively carried out Quality Control are bringing down help costs, improving effectiveness in efficiency, and improving quality." Hence if a company wishes to store every aspect of their tests, a database can be created for the same.

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