A Project Report
On
Smart Vehicle System

Submitted by

Rudrik Prajapati (202212013)

Sarvik Vaghasiya (202212031)

In fulfilment for the award of the degree

of

Master of Science

in

Information Technology

Guided by

Prof. Minal Bhise

DA-IICT, *Near Indroda Circle,*
***Gandhinagar 382 007, Gujarat (India*)**

November, 2022

Table of Content

ACKNOWLEDGEMENT

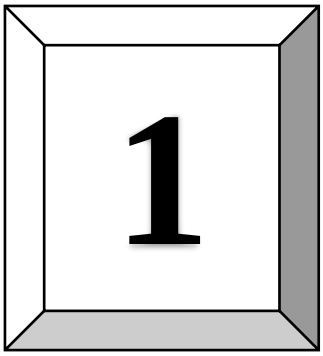
We would like to give our sincere acknowledgement to everybody responsible for the successful completion of our project "**Smart Vehicle System"**.

The success and final outcome of this project required a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the completion of this project.

We owe our deepest gratitude to our project guide **Ta.Vedant Dave** , who took interest on our project work and guided us all along till the completion of our project work by providing all the necessary help for developing a good Database System. We would also like to admiringly acknowledge **Prof. Minal Bhise** for moral support which helped us to accomplish our goal.

We would also like to thank all our lecturers.

Last but not the least we are also thankful to all friends & those who have contributed directly or indirectly by giving their suggestions or even a advice for the completion of this project.



Section : SRS Document

- ## Introduction

The smart car can be recognized as a mix between the self-driving car and the connectedcar. It cannot only drive autonomously but, thanks to the Internet connection, can share the access to the network with user and allow the usage of its data to devices that are located insiders remotely. In a short time, it will be possible to misremember **"the old metal box on four wheels"** because the cars that will be driven shortly will be smarter and will allow performing actions unimaginable until recently.

However, a significant difficulty to be faced in the development of driverless vehicles concerns the skills of the passenger. In fact, should he/she be only transported or could he/she decide from time to time? As every commuter knows, everyday driving is often dull, and being a mere passenger can be even more so. Furthermore, there are still many problems to be solved, so that the massive diffusion of the autonomous vehicles (AV) is realized: here are five issues that must be resolved before autonomously driven cars can take diffusion furrow the roads

- **Higher performance and redundant software**
- **More advanced and capillary maps**
- **More efficient and precise sensors**
- **Better vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications**

- ## Purpose of System :

In recent years, the smart car sector has been increasing enormously in the **Internet of Things (IoT)** market. Furthermore, the number of smart cars seems set to increase over the next few years.

This goal will be achieved because the application of recent IoT technologies to the automotive sector opens up innovative opportunities for the mobility of the future, in which connected cars will be more and more prominent in smart cities. This paper aims to provide an overview of the current status and future perspectives of smart cars, taking into accounttechnological, transport, and social features.

An analysis concerning the approaches to making smart a generic car, the possible evolutions that could occur in the coming decades, the characteristics of 5G, ADAS (advanced driver assistance systems), and the power sources is carried out in this paper.

- ## Existing Problem :

- Creating and maintaining maps for self-driving cars is difficult work
- Dead or Discharged Battery
- Engine Overheating
- Low fuel mileage
- Exhaust Smoke
- Low AC Cooling
- The Car Keeps Overheating

- ## Scope :

- Car sensors make driving an easy task.
- The sensors can easily detect faulty components in a vehicle.
- Sensors ensure that the engine is maintained correctly.
- Sensors also enable automatic control of specific functions such as windscreen wipers, headlights, etc.
- The ECU can make precise adjustments with the information received from sensors.
- Sensors can also relay warning information to the driver if there is any fault/malfunction with the car's components.

• Literature Review :

➢ AI (Artificial Intelligence) :

Smart cars rely on AI in relation to three specific domains: sensor fusion, route planning, and the use of AI and Big Data for multiple levels of data classification and delivery of results.

Smart cars are projected to use on-board AI capabilities in the immediate future, withfurther support provided by cloud-based AI services. But as cloud and ICT technologies improve and innovate, cloud-based AI support is expected to become the primary director of smart cars, allowing them to perform functions such as determining the speed and direction at which other cars and people are moving, or indeed whether the objects it senses are people or cars oreven a barrier.

➢ IoT (Internet of Things) :

By endowing cars with more sensors, processors and software, passenger vehicles will become integrated carriers of digital transformation.

Indeed, companies which have traditionally belonged to the manufacturing industry are converting to be more service-oriented. In order to fully investigate IoT's capabilities in relation to the development of smart cars, we need to understand what exactly is IoT.

• Assumption

- ➢ Vehicles are already available for use
- ➢ Roles and responsibilities are already established.
- ➢ "Driving" with smart vehicle will be significantly safer than with human-operated vehicles.
- ➢ Smart Vehicle will integrate into the Smart City
- ➢ Smart vehicle will substantially increase road efficiency, as well as roadway usage.
- ➢ Smart vehicle will comprise a mobility platform.
- ➢ Whether or when and to what extent technological barriers to fully smart vehicles will beovercome.

A) Requirements Collection Documentation

- **Requirement collection phase :**

In our system we have different types of requirement collection phases like:

Brainstorming: Brainstorming is used in requirement gathering to get as many ideas as possible from group of people. Generally used to identify possible solutions to problems, and clarify details of opportunities.

Interview: Interviews of stakeholders and users are critical to creating the great software. Without understanding the goals and expectations of the users and stakeholders, we are very unlikely to satisfy them. We also have to recognize the perspective of each interviewee, so that, we can properly weigh and address their inputs. Listening is the skill that helps a great analyst to get more value from an interview than an average analyst.

Observation: By observing users, an analyst can identify a process flow, steps, pain points and opportunities for improvement. Observations can be passive or active (asking questions while observing). Passive observation is better for getting feedback on a prototype (to refine requirements), where active observation is more effective at getting an understanding of an existing business process. Either approach can be used.

Survey/Questionnaire: When collecting information from many people – too many to interview with budget and time constraints – a survey or questionnaire can be used. The survey can force users to select from choices, rate something ("Agree Strongly, agree…"), or have open ended questions allowing free-form responses. Survey design is hard – questions can bias the respondents.

Document Analysis: Reviewing the documentation of an existing system can help. In anideal world, we would even be reviewing the requirements that drove creation of the existingsystem – a starting point for documenting current requirements.

- **FACT FINDING CHART**

Objective	**Technique**	**Subject(s)**	**Time commitment**
To Enhance Productivity and Achieve Innovation	Background reading	Business reports, Different platforms websites	Half day
To get an idea of users' observation and requirements for the smart vehicle system	Questionnaire	users of the smart vehicle system	One Day
To find out how the existing smart system is used. to evaluate the effectiveness of the existing system	Interview	Computer manager, E.C. Engineer	Two Hour
To provide more specifications for a new system	Interview	Creative Team of Three people	Three Hour

- **AlphaTech: Interview Plan**

System: Smart Vehicle

Project Reference: SF/SJ/2003/12

Participants: Suresh Kumar (AlphaTech)

Sarvik Vaghasiya
Rudrik Prajapati

Date: 01/09/2022

Time: 15:00 To 16:00

Duration: 1 Hour

Place: Suresh's Office

Purpose of Interview:

To discuss the most common problems encountered in smart cars and to see how to approach solutions.

Agenda:

- Problems with sensors and other facilities
- Present system process
- Implement action

Documents to be brought to the interview:

- A rough idea about the system
- Additional requirements for the system

- **AlphaTech: Interview Summary**

System: Smart Vehicle

Project Reference: SF/SJ/2003/12

Participants: Suresh Kumar (AlphaTech)

Sarvik Vaghasiya
Rudrik Prajapati

Date: 01/09/2022 **Duration:** 1 Hour

Time: 15:00 To 16:00 **Place:** Suresh's Office

Summary of Interview:

1. Noises from the engine and fuel spills are also forms of pollution to theenvironment.
2. Most smart cars are designed with this in mind. They may be lighter but thesafety features can match any normal vehicle.
3. Injury Reduction & Accident Prevention because of a smart system. Since they havean automatic system, they aren't going to do as much damage.
4. A Smart Vehicle could be a wonderful investment that will definitely help theenvironment and save you tasks of money in the long run.
5. Attacker groups range from the owner of the vehicle to a specialized hacker withadvanced tools
6. By driving more efficiently when in search of parking space, you will save on fuel waste.Resulting in spending less money on petrol.
7. There are fewer chances for vehicle vandalism.
8. It may be a bit confusing for unfamiliar users.
9. It requires a maintenance contract with the supplier.
10. The use of redundant systems will result in a greater cost.
11. There may be a fear of breakdown.

SMART VEHICLE SYSTEM - SURVEY

Please mark your answers to the following questions

---

1. **What details do you frequently observe?**
   Car temperature / Service reminder / Tyre pressure / Petrol-Oil indicator

2. **Does the collision sensor-warning system work properly?**
   Perfect /Sometimes / Doesn't work

3. **Does the lane departure warning system work properly?**
   Perfect/ Sometimes / Doesn't work

4. **Does your added family member get vehicle data from time to time?**
   Yes / No/ Hasn't shared it with anyone yet

5. **Does the Onboard diagnostics (OBD) system that performs diagnosis and reports any trouble like how many KM vehicles will run, service reminders etc…work perfectly?**
   Yes / No / Not Accurate

6. **How old is the vehicle (In Year)?**
   1-2-3-4-5-6-7-8-9-10

7. **How often does a vehicle need to be serviced to fix a vehicle problem (In Month)?**
   3-6-9-12

8. **How much does the smart vehicle park assist system help you while parking?(Rate in 1-5)**
   1-2-3-4-5

9. **Would you like to see any more details about the vehicle if yes then what is it?**
   Yes / No / Don't mind

   _____

   _____

10. Please note any comments you have on the current smart vehicle system.

   _____

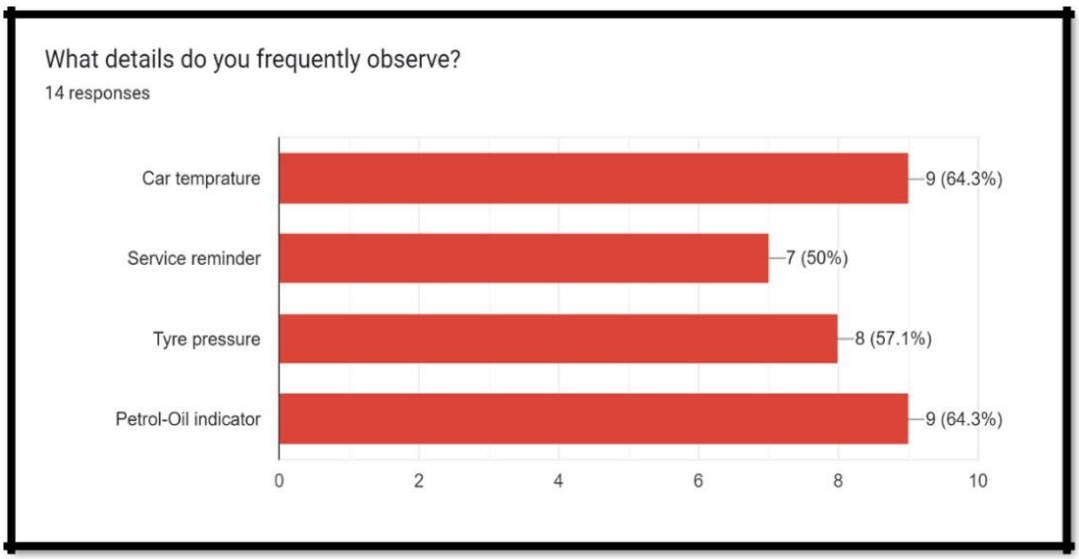
   _____

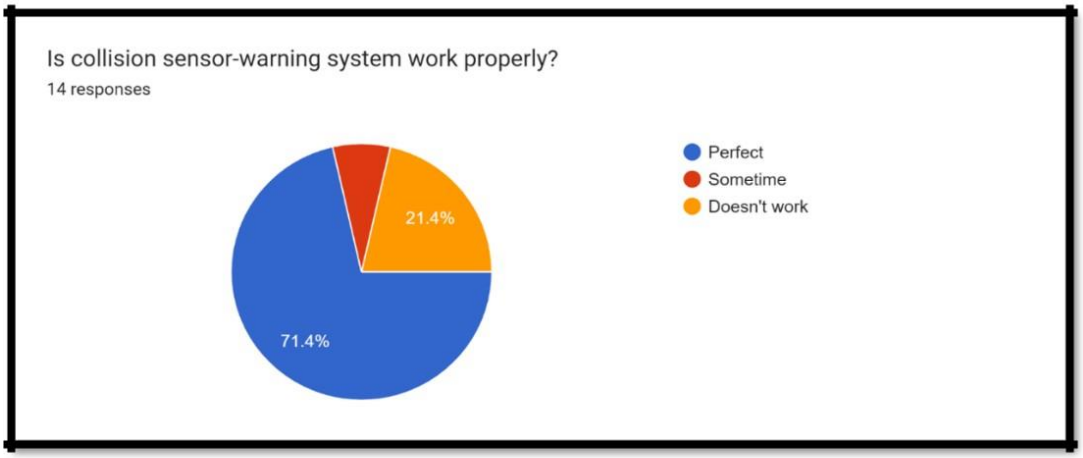
11. Please note any suggestions for improving the smart vehicle system.

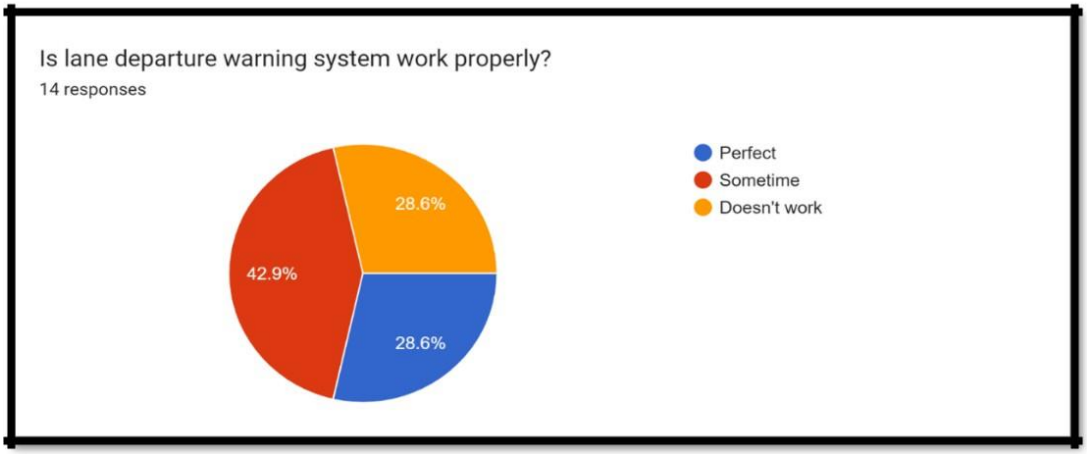
   _____

   _____

- **Observation of Survey:**

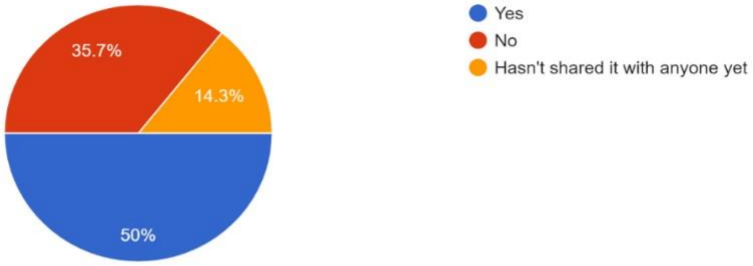






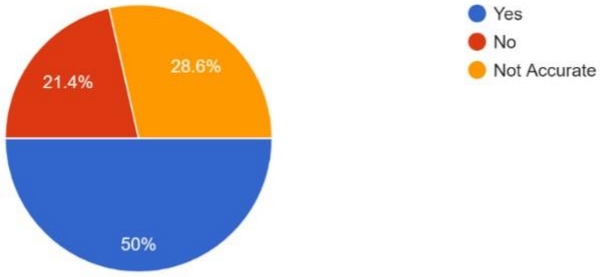
Does your added family member get vehicle data from time to time?

14 responses



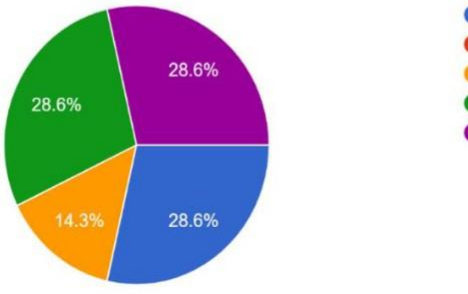
Is On-board diagnostics (OBD) system that performs diagnosis and reports any trouble like how many KM vehicle will run,service reminder etc...work perfectly?

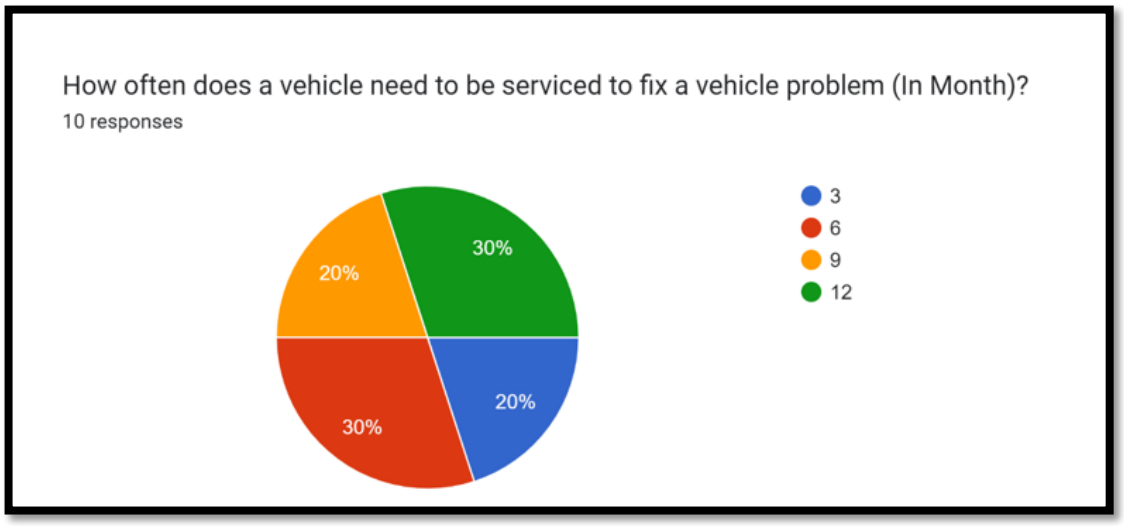
14 responses

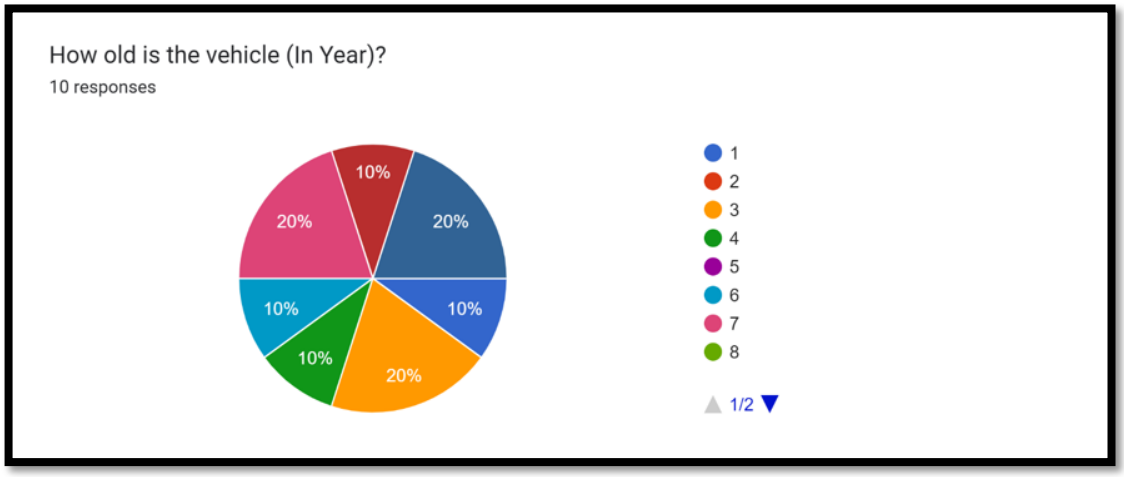


How much does the smart vehicle park assist system help you while parking?

14 responses







Observations:

- We have observed that most people review that collision sensor work almost perfect but over lane departure warning system only sometimes they are not confidence about it and also. To solve these problems, we have to work on lane departure warning system and also sharing data with family is not work that accurately, so lots of engineering work we need to improve.

- We have observed that most people have lots of confusion about Data sharing system with family and they see all these system processes very difficult.

- So, we will provide proper information about smart vehicle features and make the system more user friendly. We will give better and easier experience for using all smart vehicle system features.

B) List of requirements

- Remote Monitoring for
  - Individual Vehicle's location
  - Identification of each vehicle with time-stamp
  - Identification of each vehicle's driver
  - Vehicle status like fuel level, light, Door, Ignition.
- Remote Control for
  - Individual Vehicle's Ignition On / OFF
  - Individual vehicle's Door Open / Close
  - Each Vehicle's Fuel ON / CUT-OFF
  - Each Vehicle's Light ON / OFF
- Detection of unauthorized access of the vehicle for theft control.
- Fuel management like usage, available, mileage purpose.
- In places where GSM coverage is not there, system should store the updates and forward itwhen it returns to GSM coverage area.
- Should allow automatic switching between SMS and GPRS, when vehicle moves to a location where there is poor GSM coverage or GPRS is not present.

C) Identification of Constraints

- **Business Constraints**

Business constraints are unchangeable business decisions that in some way restrict the software architecture design. Business constraints are similar to technical constraints in that they are decisions that cannot be changed, but rather than influencing structures directly through technology, the influence occurs indirectly through business decisions. It might be easiest to discuss some examples.

Time: it will take lots of time to manufacture smart vehicle because we can't manufacture vehicle without knowing any requirements and also research on particular sensor.

Materials: for manufacture or production we require uses of heavy materials because We don't know what kind of problems may occur in smart vehicles after a long time. We will make only after analyzing the materials.

People and manpower: for manufacture smart vehicle we require average manpower, those who are in good in sensor related and automobile related filed**.**

Money: this system is very costly because the production of smart vehicle will use more equipment such as sensors, materials are more expensive

Team composition and make-up: In some cases, there may be requirements that specific personnel be used or not used during project. For example, someone may be unavailable, already committed to another project or you may be required to include specific individuals, perhaps for training purposes.

Capital resources: here lots of sensors are use so our main requirement is sensors materials and IoT related things.

D) Identification of various categories of users and their privileges

- **User Categories**

- System Admin
- Customer
- Different type of Employee (manager, staff etc...)
- Service contractor
- Vehicle Approver

- **Privileges**

Control policies in order to issue privileges to drivers or applications (such as the deployment ofair bags or speed limit control) according to their credentials or claims. These privileges are used to decide whether to allow access to the car or not. It also continuously monitors subject claims, resource attributes and environmental conditions such as time or location so that if a change is made. Moreover, the system can re-evaluate policies, provide updates or revoke issued privileges and usage decisions accordingly.

The claims within the credentials can be continuously evaluated in order to ensure that the vehicle is safe. According to the researchers, this work is vital in comprehensively taking care of the safety and security of the smart cars of the future.

Infotainment and content
- Web Browsing
- Media and entertainment
- Communication

Telematics
- Navigation
- Insurance
- Emergency Services
- Diagnostics, prognostics

Vehicle-to-X communications
- Infrastructure (e.g., toll plazas, traffic signals)
- Other vehicles (e.g., crash avoidance)

Autonomous operation
- Cruise control
- Lane detection
- Auto Park
- Collision avoidance
- Self-driving vehicles

E) Any other relevant information

Sensors Summary :

- **Air-flow sensor**

  It measures the density and volume of the air entering the combustion chamber.

- **Engine knock sensor**

  It monitors engine knocking and ensures the air-fuel mixture is ignited correctly.

- **Engine speed sensor**

  It monitors the spinning speed and position of the crankshaft.

- **Camshaft position sensor**

  It monitors the position and proper timing of the camshaft.

- **Manifold Absolute Pressure (MAP) sensor**

  Monitors engine load by measuring the difference between the manifold and outside pressure.

- **Throttle position sensor**

  Monitor the position of the throttle valve.

- **Voltage sensor**

  It manages the idling speed of the vehicle.

- **Temperature sensor**

  It monitors the engine temperature.

- **Speed sensor**

  It measures the speed of the wheels.

- **Parking sensor**

  It recognizes any obstacle present in the front or rear of the vehicle.

- **Noun Analysis Table :**

All noun	Useful noun	Repeated noun
• Sensor • Measures • Engine • Years • Car • Sector • IoT • Cars • Paper • Driver • Speed • Position • Vehicle • Low • Car • Sensors • Components • Sensors • Information • Summary • Density • Volume • Air • Combustion • chamber • air-fuel • Mixture • Crankshaft • Camshaft • timing, • Manifold, • Pressure, • MAP, • Monitors, • load, • difference, • manifold, • pressure, • Throttle, • Monitor, • throttle, • valve, • Voltage, • Temperature,	• Sensor • Engine • Car • IoT • Driver • Speed • Position • Vehicle • Components • Density • Volume • Air • Chamber • Air-fuel • Manifold • Pressure • Map • Monitors • Throttle • Valve • Voltage • Temperature • Wheels • Parking • Obstacle • system • Internet • Market • Number • Goal • Technology • Opportunities • Mobility • Cities • Account • Transport • Features • Analysis • Approaches • Assistance • Sources • Work • Dead • Battery	• Sensor • Measures • Engine • Years • Car • Sector • IoT • Cars • Paper • Driver • Speed • Position • Vehicle • Low • Sensors • Components • Information • Summary • Density • Volume • Air • Combustion • chamber • air-fuel • Mixture • Crankshaft • Camshaft • timing • Manifold • Pressure • MAP • Monitors • load • difference • manifold • pressure • Throttle • Monitor • throttle • valve • Voltage • Temperature • temperature • wheels

• temperature, • Speed, • wheels, • Parking, • obstacle, • front, • Purpose, • System, • Internet, • Things, • market, • number, • increase, • goal, • application, • technologies, • opportunities, • mobility, • cities, • overview, • status, • perspectives, • account, • Transport, • features, • analysis, • approaches, • decades, • characteristics, • ADAS, • Assistance, • systems, • power, • sources, • Problem, • maps, • self-driving, • work, • Dead, • Battery, • fuel, • mileage, • Exhaust, • Smoke, • AC, • Cooling, • Scope, • task, • control,	• Fuel • Mileage • Exhaust • Scope • Task • Function • ECU • Adjustment • Warning • Fault • Subject • Time' • Commitment • Enhance • Productivity • Business • Report • Half • Innovation • Trade • Publication • Interview • Hours • Function • Staff • Structure • Management • Employees • Supervisor • Company • Executives • Range • Growth • Observation • Finance • Analyst • Knowledge • Admin • Manager • Engineer • Effectiveness • Team • Specification People • Filing • Clerk • Librarian • Resources • Sampling	• Parking • obstacle • front • Purpose • System • Internet • Things • market • number • increase • goal • application • technologies • opportunities • mobility • cities • overview • status • perspectives • account • Transport • features • analysis • approaches • decades • characteristics • Assistance • systems • power • sources • Problem • maps • self-driving • work • Dead • Battery • mileage • Exhaust • Smoke • AC • Cooling • Scope • task • control • functions • headlights • ECU • adjustments • warning

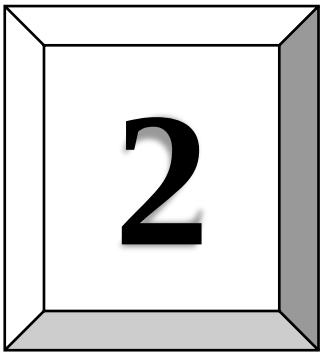
• functions, • headlights, • ECU, • adjustments, • warning, • fault, • malfunction, • components • Objective, • Technique, • Subject, • Time, • commitment, • Enhance, • Productivity, • Background, • Business, • reports, • Half, • day, • Innovation, • reading, • trade, • publications, • Interview, • Heads, • Hours, • function, • departments, • Department's, • staff, • structure, • line, • management, • interviewers, • employees, • Account, • supervisor, • hours, • business, • company, • Executives, • Hour, • goals, • range, • system, • growth, • Observation, • Finance,	• Assumption • Roles • Responsibilities • Efficiency • Constrains • Decisions • Software • Architecture • Design • Influence • Requirement • Research • Production • Materials • Manpower • Automobile • Money • Equipment • Composition • Cases • Project • Training • Capital • Alphatech • Reference • Office • Noises • Pollution • Environment • Safety • Injury • Prevention • Damage • Investment • Customer • User • Service Contractor • Vehicle • Vehicle approver • Sensor • Fuel • Engine • Group • Attacker • Owner • Software • Sensors • Devices • Data	• fault • malfunction • components • Objective • Technique • Subject • Time • commitment • Enhance • Productivity • Background • Business • reports • Half • day • Innovation • reading • trade • publications • Interview • Heads • Hours • function • departments • Department's • staff • structure • line • management • interviewers • employees • Account • supervisor • hours • business • company • Executives • Hour • goals • range • system • growth, • Observation • Finance • Analyst • Day • knowledge • hour • admin

• Analyst, • Day, • knowledge, • hour, • admin, • Manager, • Computer, • manager, • E.C., • Engineer, • effectiveness, • Team, • specifications, • people, • documents, • Filing, • clerk, • librarian, • resources, • Document, • sampling, • Assumption, • use, • Roles, • responsibilities, • vehicles, • Smart, • Vehicle, • City, • road, • efficiency, • roadway, • usage, • platform, • extent, • barriers, • Constraints, • constraints, • decisions, • way, • Software • architecture, • design, • structures, • technology, • influence, • lots, • Time, • requirements,	• Location • AI • Speed • Direction • Cloud • Stakeholder • Address • Brainstorming • Gathering • Skill • Flow • Passive • Feedback • Prototype • Finance • Mileage • Coverage • Area • SMS • GPRS • Employee • Contractor • Approver • Policies • Air bag • Id • Name • Age • Address • MobileNo • Email • Model • Color • Size • Fuel • ID • type • Status • Material • Desc • quality • density • material • Id • RPM • Speed • Power	• Manager • Computer • manager • Engineer • effectiveness • Team • specifications • people • documents • clerk • librarian • resources • Document • sampling • Assumption • use • Roles • responsibilities • vehicles • Smart • City • road • efficiency • roadway • platform • extent • barriers • Constraints • decisions • way • Software • architecture • design • structures • technology • influence • lots • requirements • research • production • materials • kind • problems • People • manpower • automobile • Money • equipment • composition

• research, • production, • materials, • kind, • problems, • People, • manpower, • automobile, • Money, • equipment, • composition, • make-up, • cases, • personnel, • project, • example, • someone,		• make-up • cases • personnel • project • example • someone • individuals • training • purposes • Capital • requirement • sensor • AlphaTech • Project • Participants • Date • Duration • Place • Office

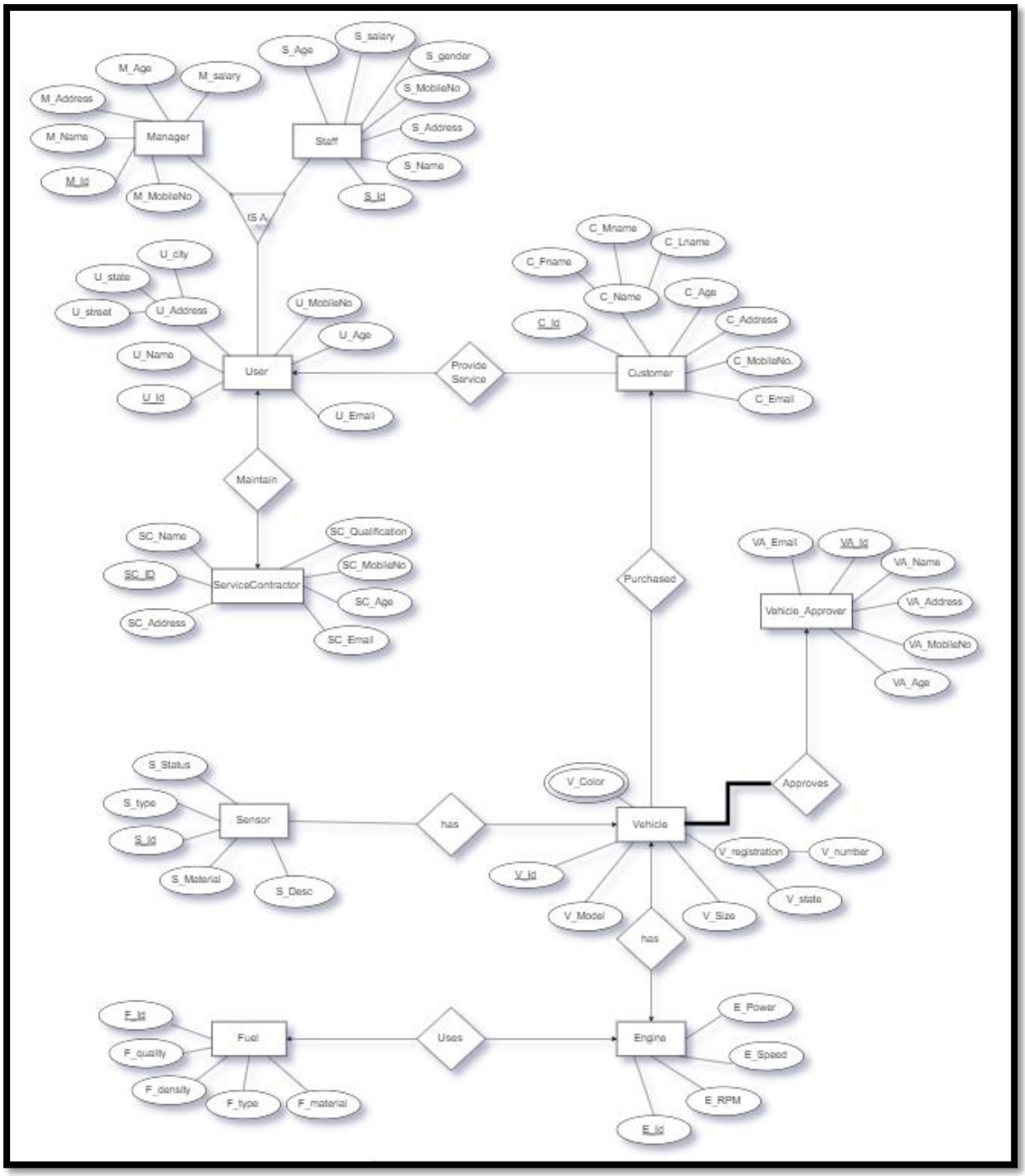
- **Table (Rejected Noun, Reason for Rejecting it)**

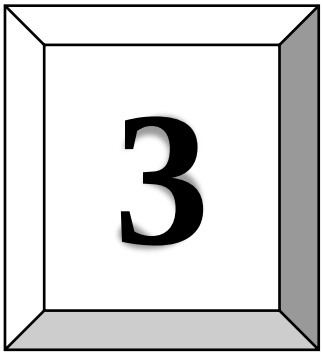
Rejected Noun	Reason
Driver	Irrelevant
Chamber	General
Manifold	Irrelevant
Map	General
Throttle	Irrelevant
Trade	Irrelevant
Publication	Irrelevant
Librarian	Irrelevant
Influence	General
Manpower	General
Investment	Irrelevant
Stakeholder	Irrelevant
Brainstorming	Irrelevant
Skill	General
Feedback	General
Research	Irrelevant
Environment	General
Crankshaft	Irrelevant
Architecture	General



Section : ER Diagram

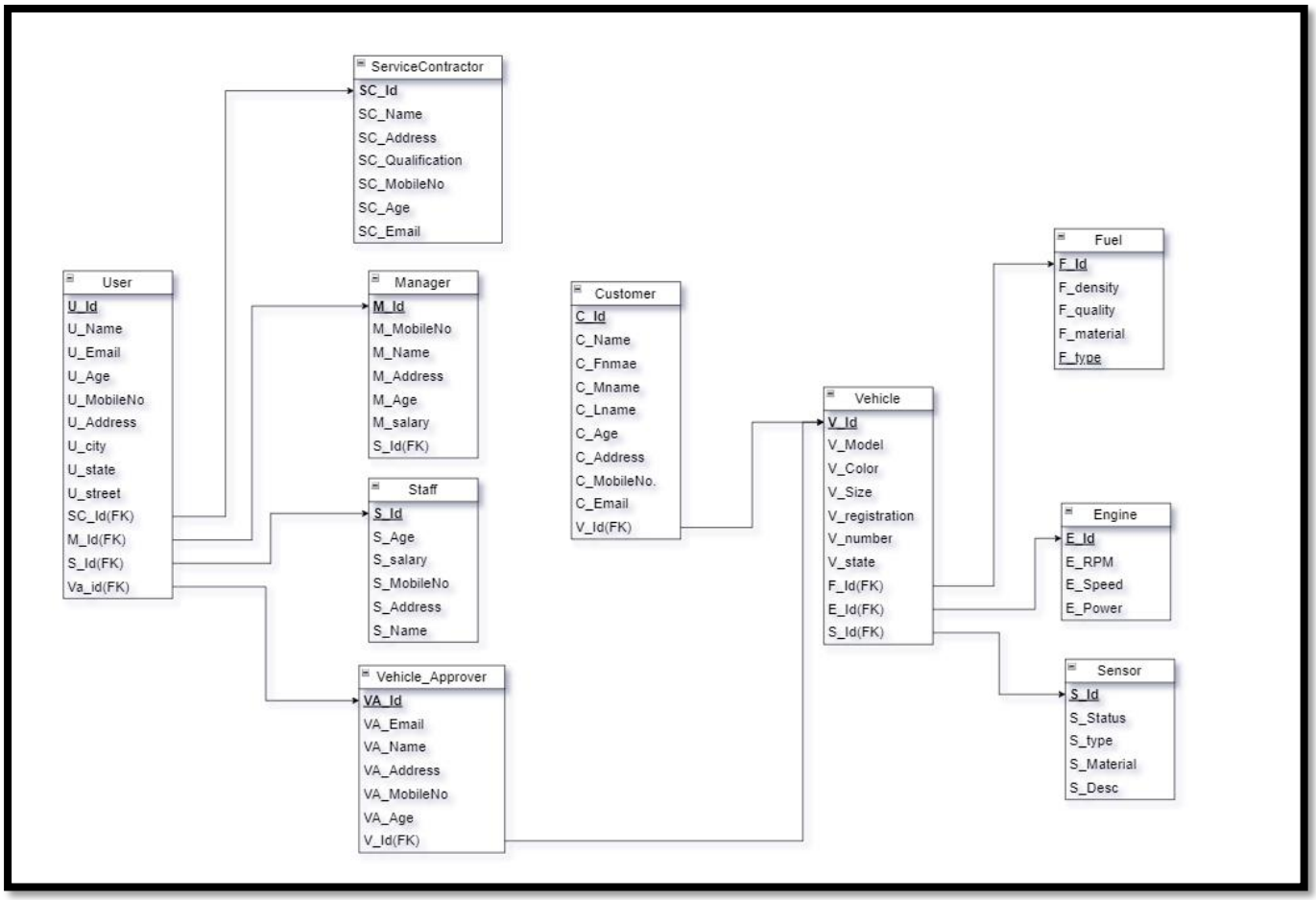
- **ER Diagram**

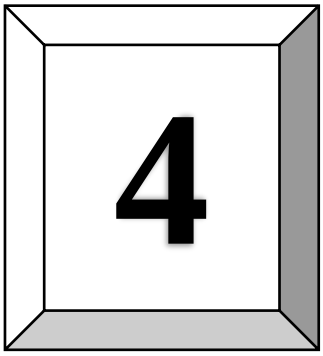

S_Age
S_salary
S_gender
S_MobileNo
S_Address
S_Name
S_Id
Staff
M_Age
M_salary
M_Address
M_Name
M_Id
M_MobileNo
Manager
IS A
C_Mname
C_Lname
C_Fname
C_Name
C_Age
C_Id
C_Address
C_MobileNo.
C_Email
Customer
U_city
U_state
U_street
U_Address
U_MobileNo
U_Age
U_Name
U_Id
U_Email
User
Provide Service
Maintain
SC_Name
SC_ID
SC_Address
SC_Qualification
SC_MobileNo
SC_Age
SC_Email
ServiceContractor
Purchased
VA_Email
VA_Id
VA_Name
VA_Address
VA_MobileNo
VA_Age
Vehicle_Approver
Approves
S_Status
S_type
S_Id
S_Material
S_Desc
Sensor
has
V_Color
Vehicle
V_registration
V_number
V_state
V_Id
V_Model
V_Size
has
F_Id
F_quality
F_density
F_type
F_material
Fuel
Uses
E_Power
E_Speed
E_RPM
E_Id
Engine



Section : ER to relational mapping document

- **Schema Diagram**





Section : Final list of relations with attributes and constraints

- **Relational Table :**

➢ **Customer**

Field Name	Data Type	Description	Constraints
c_id	Integer	ID of Customer	Primary Key
v_id	Integer	ID of vehicle	Foreign Key
c_fname	varchar(20)	First Name of customer	NOT NULL
c_lname	varchar(20)	Last Name of customer	NOT NULL
c_age	Integer	Age of customer	NOT NULL
c_address	varchar(50)	Address of customer	NOT NULL
c_mobileno	Integer	Mobile number of customer	NOT NULL
c_email	varchar(50)	Email of customer	NOT NULL

➢ **Engine**

Field Name	Data Type	Description	Constraints
e_id	Integer	Id of engine	Primary Key
e_rpm	Integer	Revolution per minute of engine	NOT NULL
e_speed	Integer	Speed of engine	NOT NULL
e_power	Integer	Power of engine	NOT NULL

➢ **Fuel**

Field Name	Data Type	Description	Constraints
f_id	Integer	Id of fueltype	Primary Key
f_type	varchar(20)	Fuel type e.g. gas , liquid, solid	NOT NULL
f_quality	varchar(20)	Quality of fuel	NOT NULL
f_density	varchar(20)	Density of fuel	NOT NULL
f_material	varchar(20)	Major material in fuel	NOT NULL

- **Manager**

Field Name	Data Type	Description	Constraints
m_id	Integer	Id of manager	Primary Key
m_name	varchar(30)	Name of manager	NOT NULL
m_age	Integer	Age of manager	NOT NULL
m_address	varchar(50)	Address of manager	NOT NULL
m_mobileno	Integer	Mobile number of manager	NOT NULL
m_salary	integer	Salary of manager	NOT NULL

- **Sensor**

Field Name	Data Type	Description	Constraints
s_id	Integer	Id of sensor	Primary Key
s_type	Varchar(50)	Type of sensor	NOT NULL
s_material	Varchar(50)	Material used in sensor	NOT NULL
s_status	Boolean	Status of sensor active or not active	NOT NULL
s_desc	Char(100)	Description of sensor	NOT NULL

- **Service contractor**

Field Name	Data Type	Description	Constraints
Sc_id	Integer	Id of service contractor	Primary Key
Sc_name	Varchar(20)	Name of service contractor	NOT NULL
Sc_age	Integer	Age of service contractor	NOT NULL
Sc_qualification	Integer	Qualification of service contractor	NOT NULL
Sc_address	Varchar(50)	Address of service contractor	NOT NULL
Sc_mobileno	Integer	Mobile number of service contractor	NOT NULL
Sc_email	Varchar(40)	Email of service contractor	NOT NULL

- **Staff**

Field Name	Data Type	Description	Constraints
S_id	Integer	Id of staff	Primary Key
S_name	Varchar(20)	Name of staff	NOT NULL
S_age	Integer	Age of staff	NOT NULL
S_gender	Varchar(15)	Gender of staff	NOT NULL
S_address	Varchar(50)	Address of staff	NOT NULL
S_mobileno	Integer	Mobile number of staff	NOT NULL
S_salary	integer	Salary of staff	NOT NULL

- **User**

Field Name	Data Type	Description	Constraints
U_id	Integer	Id of user	Primary Key
Sc_id	Integer	Id of service contractor	Foreign Key
Va_id	Integer	Id of Vehicle approver	Foreign Key
U_name	Varchar(25)	Name of user	NOT NULL
U_age	Integer	Age of user	NOT NULL
U_street	Varchar(30)	Street of user	NOT NULL
U_city	Varchar(30)	City of user	NOT NULL
U_state	Varchar(30)	State of user	NOT NULL
U_mobileno	Integer	Mobile number of user	NOT NULL
U_email	Varchar(50)	Email of user	NOT NULL
M_id	Integer	Id of manager	Foreign Key
S_id	Integer	Id of staff	Foreign Key

- **Vehicle**

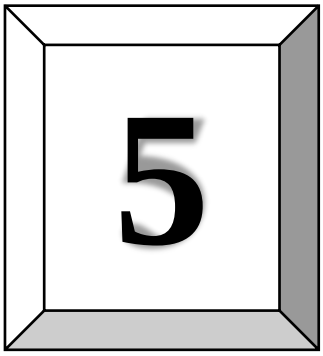
Field Name	Data Type	Description	Constraints
V_id	Integer	Id of vehicle	Primary Key
S_id	Integer	Id of staff	Foreign Key
E_id	Integer	Id of engine	Foreign Key
V_model	Varchar(20)	Model number of vehicle	NOT NULL
V_color	Varchar(20)	Color of vehicle	NOT NULL
V_size	Varchar(20)	Size of vehicle	NOT NULL
V_registration	Date	Registration of vehicle	NOT NULL
V_state	Varchar(50)	State of vehicle	NOT NULL
V_number	Varchar(30)	Number of vehicle	NOT NULL
F_id	integer	Id of fuel type	Foreign Key

- **Vehicle approver**

Field Name	Data Type	Description	Constraints
Va_id	Integer	Id of Vehicle approver	Primary Key
V_id	Integer	Id of vehicle	Foreign Key
Va_name	Varchar(30)	Name of Vehicle approver	NOT NULL
Va_age	Integer	Age of Vehicle approver	NOT NULL
Va_address	Varchar(50)	Address of Vehicle approver	NOT NULL
Va_mobileno	Integer	Mobile number of Vehicle approver	NOT NULL
Va_email	Varchar(50)	Email of Vehicle approver	NOT NULL

- **Relationship Cardinality : -**

Entity 1	Relationship	Entity 2	Cardinality
Engine	Uses	Fuel	One-to-One
Vehicle	Has	Engine	One-to-One
Vehicle	Has	Sensor	One-to-Many (Total participation for many side)
Vehicle Approver	Approves	Vehicle	One-to-Many (Total participation for many side)
Customer	Purchased	Vehicle	One-to-Many (Total participation for many side)
User	Provide Service	Customer	One-to-Many (Total participation for many side)
User	Maintain	Service Contractor	One-to-One
User	IS A	Manager	One-to-One
User	IS A	Staff	One-to-One



Section : DDL statements for creating all the tables

1) Table Name : Customer

```
CREATE TABLE IF NOT EXISTS vehicle.customer
(
    c_id integer NOT NULL,
    v_id integer,
    c_fname character varying(20) COLLATE pg_catalog."default",
    c_mname character varying(20) COLLATE pg_catalog."default",
    c_lname character varying(20) COLLATE pg_catalog."default",
    c_age integer,
    c_address character varying(50) COLLATE pg_catalog."default",
    c_mobileno bigint,
    c_email character varying(50) COLLATE pg_catalog."default",
    CONSTRAINT customer_pkey PRIMARY KEY (c_id),
    CONSTRAINT customer_v_id_fkey FOREIGN KEY (v_id)
        REFERENCES vehicle.vehicle (v_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.customer
    OWNER to postgres;
```

2) Table Name : engine

```
CREATE TABLE IF NOT EXISTS vehicle.engine
(
    e_id integer NOT NULL,
    e_rpm integer,
    e_speed integer,
    e_power integer,
    CONSTRAINT engine_pkey PRIMARY KEY (e_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.engine
    OWNER to postgres;
```

3) Table Name : fuel

```
CREATE TABLE IF NOT EXISTS vehicle.fuel
(
    f_id integer NOT NULL,
    f_type character varying(20) COLLATE pg_catalog."default",
    f_quality character varying(20) COLLATE pg_catalog."default",
    f_density character varying(20) COLLATE pg_catalog."default",
    f_material character varying(20) COLLATE pg_catalog."default",
    CONSTRAINT fuel_pkey PRIMARY KEY (f_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.fuel
    OWNER to postgres;
```

4) Table Name : manager

```
CREATE TABLE IF NOT EXISTS vehicle.manager
(
    m_id integer NOT NULL,
    m_name character varying(30) COLLATE pg_catalog."default",
    m_age integer,
    m_address character varying(50) COLLATE pg_catalog."default",
    m_mobileno bigint,
    m_salary integer,
    CONSTRAINT manager_pkey PRIMARY KEY (m_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.manager
        OWNER to postgres;
```

5) Table Name : Sensor

```
CREATE TABLE IF NOT EXISTS vehicle.sensor
(
    s_id integer NOT NULL,
    s_type character varying(50) COLLATE pg_catalog."default",
    s_material character varying(50) COLLATE pg_catalog."default",
    s_status boolean,
    s_desc character(100) COLLATE pg_catalog."default",
    CONSTRAINT sensor_pkey PRIMARY KEY (s_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.sensor
        OWNER to postgres;
```

6) Table Name : Service contractor

```
CREATE TABLE IF NOT EXISTS vehicle.service_contractor
(
    sc_id integer NOT NULL,
    sc_name character varying(20) COLLATE pg_catalog."default",
    sc_age integer,
    sc_qualification integer,
    sc_address character varying(50) COLLATE pg_catalog."default",
    sc_mobileno bigint,
    sc_email character varying(40) COLLATE pg_catalog."default",
    CONSTRAINT service_contractor_pkey PRIMARY KEY (sc_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.service_contractor
    OWNER to postgres;
```

7) Table Name : staff

```
CREATE TABLE IF NOT EXISTS vehicle.staff
(
    s_id integer NOT NULL,
    s_name character varying(20) COLLATE pg_catalog."default",
    s_age integer,
    s_gender character varying(15) COLLATE pg_catalog."default",
    s_address character varying(50) COLLATE pg_catalog."default",
    s_mobileno bigint,
    s_salary integer,
    CONSTRAINT staff_pkey PRIMARY KEY (s_id)
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.staff
    OWNER to postgres;
```

8) Table Name : User

```
CREATE TABLE IF NOT EXISTS vehicle."user"
(
    u_id integer NOT NULL,
    sc_id integer,
    va_id integer,
    u_name character varying(25) COLLATE pg_catalog."default",
    u_age integer,
    u_street character varying(30) COLLATE pg_catalog."default",
    u_city character varying(30) COLLATE pg_catalog."default",
    u_state character varying(30) COLLATE pg_catalog."default",
    u_mobileno bigint,
    u_email character varying(50) COLLATE pg_catalog."default",
    m_id integer,
    s_id integer,
    CONSTRAINT user_pkey PRIMARY KEY (u_id),
    CONSTRAINT user_m_id_fkey FOREIGN KEY (m_id)
        REFERENCES vehicle.manager (m_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID,
    CONSTRAINT user_s_id_fkey FOREIGN KEY (s_id)
        REFERENCES vehicle.staff (s_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID,
    CONSTRAINT user_sc_id_fkey FOREIGN KEY (sc_id)
        REFERENCES vehicle.service_contractor (sc_id) MATCH SIMPLE
        ON UPDATE NO ACTION
```

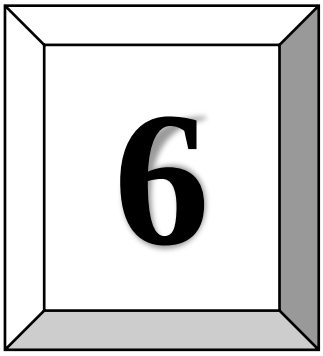
```
    ON DELETE NO ACTION
    NOT VALID,
  CONSTRAINT user_va_id_fkey FOREIGN KEY (va_id)
    REFERENCES vehicle.vehicle_approver (va_id) MATCH SIMPLE
    ON UPDATE NO ACTION
    ON DELETE NO ACTION
    NOT VALID
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle."user"
  OWNER to postgres;
```

9) Table Name : Vehicle

```
CREATE TABLE IF NOT EXISTS vehicle.vehicle
(
  v_id integer NOT NULL,
  s_id integer,
  e_id integer,
  v_model character varying(20) COLLATE pg_catalog."default",
  v_color character varying(20) COLLATE pg_catalog."default",
  v_size character varying(20) COLLATE pg_catalog."default",
  v_registration date,
  v_state character varying(50) COLLATE pg_catalog."default",
  v_number character varying(30) COLLATE pg_catalog."default",
  f_id integer,
  CONSTRAINT vehicle_pkey PRIMARY KEY (v_id),
  CONSTRAINT vehicle_e_id_fkey FOREIGN KEY (e_id)
    REFERENCES vehicle.engine (e_id) MATCH SIMPLE
    ON UPDATE NO ACTION
    ON DELETE NO ACTION
    NOT VALID,
  CONSTRAINT vehicle_f_id_fkey FOREIGN KEY (f_id)
    REFERENCES vehicle.fuel (f_id) MATCH SIMPLE
    ON UPDATE NO ACTION
    ON DELETE NO ACTION
    NOT VALID,
  CONSTRAINT vehicle_s_id_fkey FOREIGN KEY (s_id)
    REFERENCES vehicle.sensor (s_id) MATCH SIMPLE
    ON UPDATE NO ACTION
    ON DELETE NO ACTION
    NOT VALID
)
TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.vehicle
  OWNER to postgres;
```

10) Table Name : Vehicle approver

```
CREATE TABLE IF NOT EXISTS vehicle.vehicle_approver
(
    va_id integer NOT NULL,
    v_id integer,
    va_name character varying(30) COLLATE pg_catalog."default",
    va_age integer,
    va_address character varying(50) COLLATE pg_catalog."default",
    va_mobileno bigint,
    va_email character varying(50) COLLATE pg_catalog."default",
    CONSTRAINT vehicle_approver_pkey PRIMARY KEY (va_id),
    CONSTRAINT vehicle_approver_v_id_fkey FOREIGN KEY (v_id)
        REFERENCES vehicle.vehicle (v_id) MATCH SIMPLE
        ON UPDATE NO ACTION
        ON DELETE NO ACTION
        NOT VALID
)

TABLESPACE pg_default;

ALTER TABLE IF EXISTS vehicle.vehicle_approver
    OWNER to postgres;
```



Section : Details of populating the data in tables

Table Name : Customer

```
INSERT INTO vehicle.customer(
        c_id, v_id, c_fname, c_mname, c_lname, c_age, c_address, c_mobileno, c_email)
        VALUES (?, ?, ?, ?, ?, ?, ?, ?, ?);
```

Data Output | Messages | Notifications

	c_id [PK] integer	v_id integer	c_fname character varying (20)	c_mname character varying (20)	c_lname character varying (20)	c_age integer	c_address character varying (50)	c_mobileno bigint
1	1	1	Waverly	Obidiah	Adrea	75	800 Utah Alley	3454873940
2	2	2	Arlina	Traver	Alaster	44	652 Park Meadow Park	4079980086
3	3	3	Crystal	Mohammed	Rodi	77	6468 Texas Pass	534388485
4	4	4	Modestine	Bryon	Shae	77	602 Arkansas Terrace	1510200304
5	5	5	Mikaela	Norton	Husain	74	71 Warner Parkway	1526624443
6	6	6	Emelyne	Rowland	Giulio	37	2 Shopko Alley	9178997593
7	7	7	Clem	Ford	Cherilynn	75	56155 Dakota Place	1950937143

Total rows: 200 of 200 | Query complete 00:00:00.717 | Ln 1, Col 1

Table Name : Engine

```
INSERT INTO vehicle.engine(
        e_id, e_rpm, e_speed, e_power)
        VALUES (?, ?, ?, ?);
```

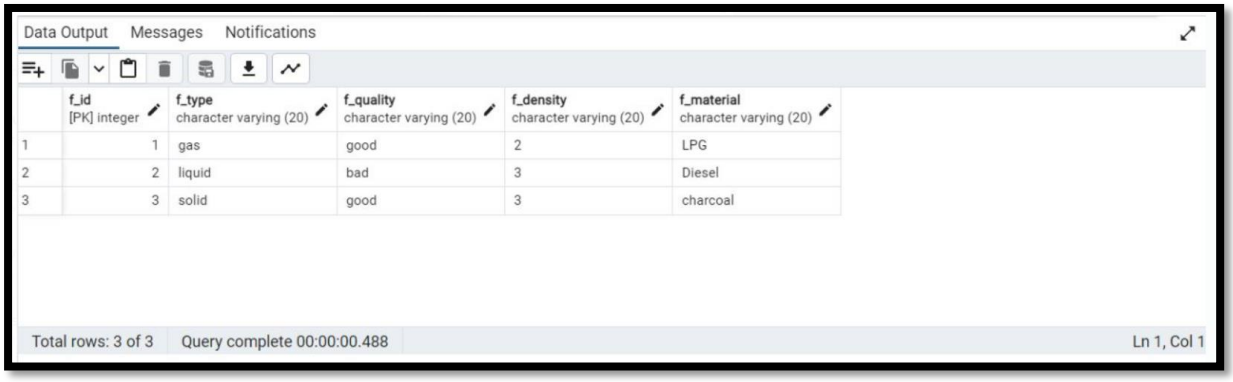
Data Output | Messages | Notifications

	e_id [PK] integer	e_rpm integer	e_speed integer	e_power integer
1	1	25000	250	240
2	2	20000	200	190
3	3	23000	230	220
4	4	35000	350	340
5	5	21000	210	200
6	6	26000	260	250
7	7	19000	190	180

Total rows: 10 of 10 | Query complete 00:00:00.825 | Ln 1, Col 1

Table Name : Fuel

```
INSERT INTO vehicle.fuel(
        f_id, f_type, f_quality, f_density, f_material)
        VALUES (?, ?, ?, ?, ?);
```



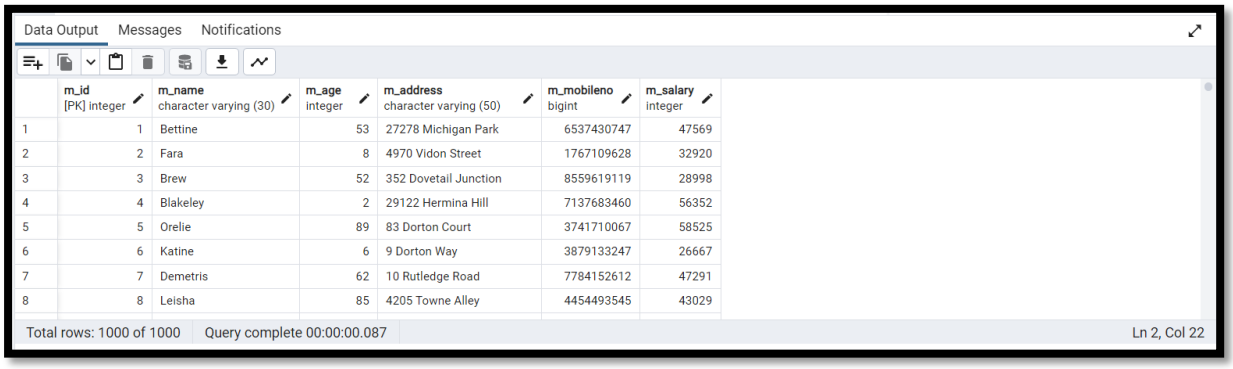
Data Output | Messages | Notifications

	f_id [PK] integer	f_type character varying (20)	f_quality character varying (20)	f_density character varying (20)	f_material character varying (20)
1	1	gas	good	2	LPG
2	2	liquid	bad	3	Diesel
3	3	solid	good	3	charcoal

Total rows: 3 of 3 | Query complete 00:00:00.488 | Ln 1, Col 1

Table Name : Manager

```
INSERT INTO vehicle.manager(
        m_id, m_name, m_age, m_address, m_mobileno, m_salary)
        VALUES (?, ?, ?, ?, ?, ?);
```



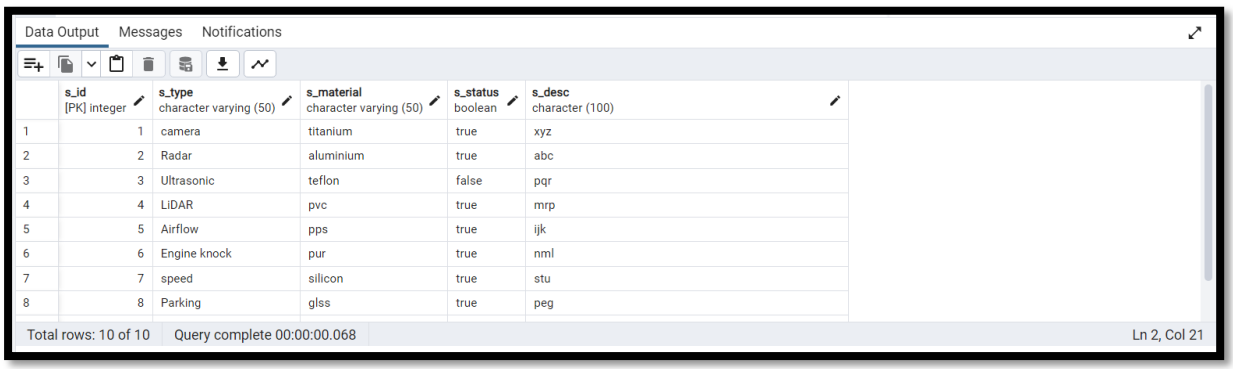
Data Output | Messages | Notifications

	m_id [PK] integer	m_name character varying (30)	m_age integer	m_address character varying (50)	m_mobileno bigint	m_salary integer
1	1	Bettine	53	27278 Michigan Park	6537430747	47569
2	2	Fara	8	4970 Vidon Street	1767109628	32920
3	3	Brew	52	352 Dovetail Junction	8559619119	28998
4	4	Blakeley	2	29122 Hermina Hill	7137683460	56352
5	5	Orelie	89	83 Dorton Court	3741710067	58525
6	6	Katine	6	9 Dorton Way	3879133247	26667
7	7	Demetris	62	10 Rutledge Road	7784152612	47291
8	8	Leisha	85	4205 Towne Alley	4454493545	43029

Total rows: 1000 of 1000 | Query complete 00:00:00.087 | Ln 2, Col 22

Table Name : Sensor

```
INSERT INTO vehicle.sensor(
        s_id, s_type, s_material, s_status, s_desc)
        VALUES (?, ?, ?, ?, ?);
```



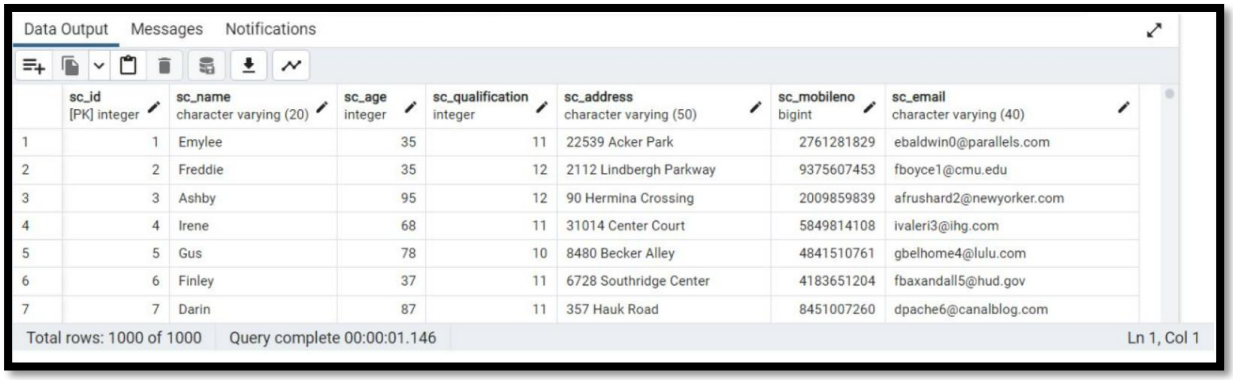
Data Output | Messages | Notifications

	s_id [PK] integer	s_type character varying (50)	s_material character varying (50)	s_status boolean	s_desc character (100)
1	1	camera	titanium	true	xyz
2	2	Radar	aluminium	true	abc
3	3	Ultrasonic	teflon	false	pqr
4	4	LiDAR	pvc	true	mrp
5	5	Airflow	pps	true	ijk
6	6	Engine knock	pur	true	nml
7	7	speed	silicon	true	stu
8	8	Parking	glss	true	peg

Total rows: 10 of 10 | Query complete 00:00:00.068 | Ln 2, Col 21

Table Name : Service contractor

```
INSERT INTO vehicle.service_contractor(
        sc_id, sc_name, sc_age, sc_qualification, sc_address, sc_mobileno, sc_email)
        VALUES (?, ?, ?, ?, ?, ?, ?);
```



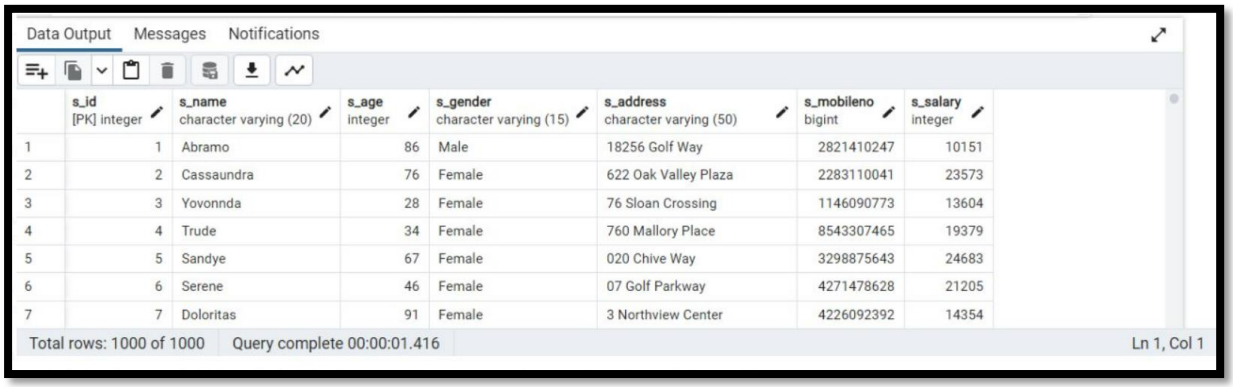
Data Output | Messages | Notifications

	sc_id [PK] integer	sc_name character varying (20)	sc_age integer	sc_qualification integer	sc_address character varying (50)	sc_mobileno bigint	sc_email character varying (40)
1	1	Emylee	35	11	22539 Acker Park	2761281829	ebaldwin0@parallels.com
2	2	Freddie	35	12	2112 Lindbergh Parkway	9375607453	fboyce1@cmu.edu
3	3	Ashby	95	12	90 Hermina Crossing	2009859839	afrushard2@newyorker.com
4	4	Irene	68	11	31014 Center Court	5849814108	ivaleri3@ihg.com
5	5	Gus	78	10	8480 Becker Alley	4841510761	gbelhome4@lulu.com
6	6	Finley	37	11	6728 Southridge Center	4183651204	fbaxandall5@hud.gov
7	7	Darin	87	11	357 Hauk Road	8451007260	dpache6@canalblog.com

Total rows: 1000 of 1000 | Query complete 00:00:01.146 | Ln 1, Col 1

Table Name : Staff

```
INSERT INTO vehicle.staff(s_id, s_name, s_age, s_gender, s_address, s_mobileno, s_salary)
        VALUES (?, ?, ?, ?, ?, ?, ?);
```



Data Output | Messages | Notifications

	s_id [PK] integer	s_name character varying (20)	s_age integer	s_gender character varying (15)	s_address character varying (50)	s_mobileno bigint	s_salary integer
1	1	Abramo	86	Male	18256 Golf Way	2821410247	10151
2	2	Cassaundra	76	Female	622 Oak Valley Plaza	2283110041	23573
3	3	Yovonnda	28	Female	76 Sloan Crossing	1146090773	13604
4	4	Trude	34	Female	760 Mallory Place	8543307465	19379
5	5	Sandye	67	Female	020 Chive Way	3298875643	24683
6	6	Serene	46	Female	07 Golf Parkway	4271478628	21205
7	7	Doloritas	91	Female	3 Northview Center	4226092392	14354

Total rows: 1000 of 1000 | Query complete 00:00:01.416 | Ln 1, Col 1

Table Name : User

```
INSERT INTO vehicle."user"(
        u_id, sc_id, va_id, u_name, u_age, u_street, u_city, u_state, u_mobileno, u_email)
        VALUES (?, ?, ?, ?, ?, ?, ?, ?, ?, ?);
```

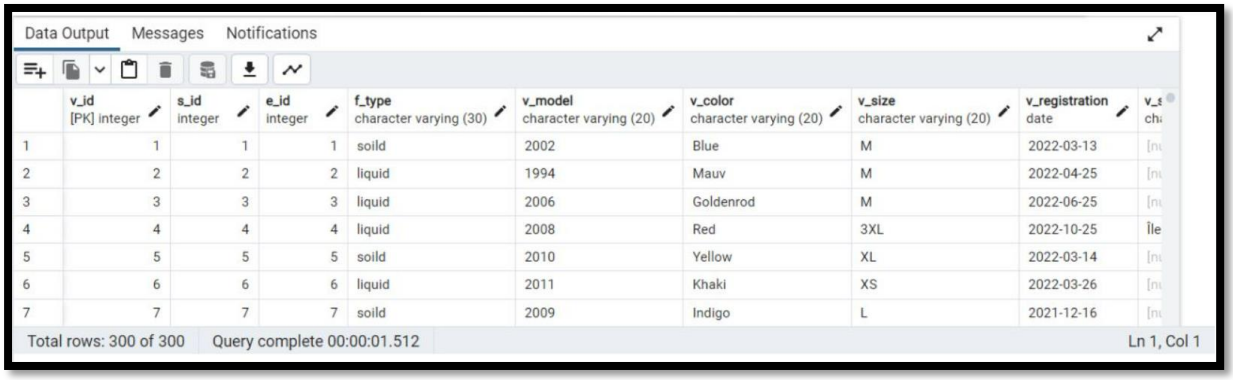
Data Output | Messages | Notifications

	u_id [PK] integer	sc_id integer	va_id integer	u_name character var	u_age integer	u_street character var	u_city character var	u_state character var	u_mobileno bigint	u_email character var	m_id integer	s_id integer
1	1	1	1	Gerick	33	Commerc...	Nungga	NULL	3601892790	gcondell0...	1	1
2	2	2	2	Eveleen	48	Duke	Beauvais	Picardie	6418670337	eblasi1@...	2	2
3	3	3	3	Chan	63	Eastwood	Tagawa	NULL	6502087922	cdoldon2...	3	3
4	4	4	4	Mitzi	44	Duke	La Garde	Provence-...	442625138	mmacairt...	4	4
5	5	5	5	Bianca	33	Tony	Pak Phay...	NULL	3546137663	bbecke4...	5	5
6	6	6	6	Jennifer	57	Lawn	Bugko	NULL	573897662	jeddoes5...	6	6
7	7	7	7	Wyndham	56	Summer ...	Xinzheng	NULL	9788516653	wellingwo...	7	7

Total rows: 300 of 300 | Query complete 00:00:00.266 | Ln 1, Col 1

Table Name : Vehicle

INSERT INTO vehicle.vehicle(
v_id, s_id, e_id, f_type, v_model, v_color, v_size, v_registration, v_state, v_number)
VALUES (?, ?, ?, ?, ?, ?, ?, ?, ?, ?);



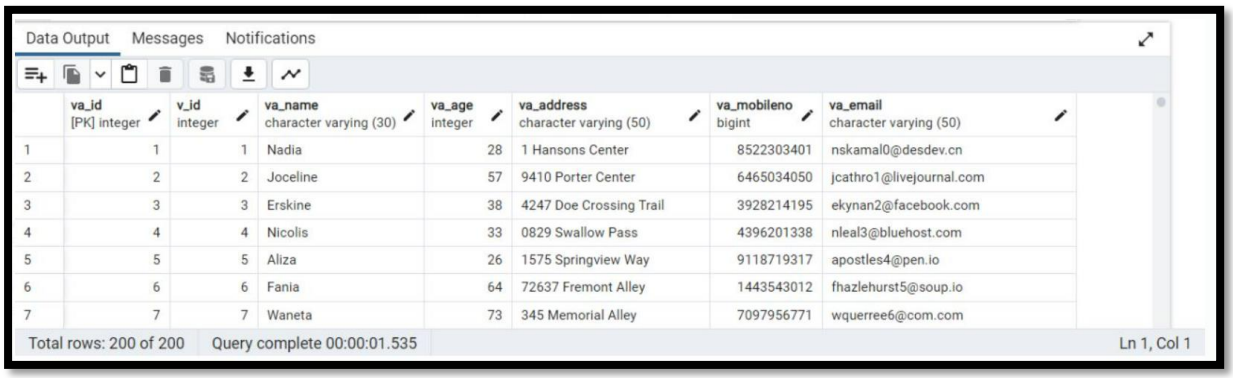
Data Output | Messages | Notifications

	v_id [PK] integer	s_id integer	e_id integer	f_type character varying (30)	v_model character varying (20)	v_color character varying (20)	v_size character varying (20)	v_registration date	v_s ch
1	1	1	1	soild	2002	Blue	M	2022-03-13	[n
2	2	2	2	liquid	1994	Mauv	M	2022-04-25	[n
3	3	3	3	liquid	2006	Goldenrod	M	2022-06-25	[n
4	4	4	4	liquid	2008	Red	3XL	2022-10-25	Île
5	5	5	5	soild	2010	Yellow	XL	2022-03-14	[n
6	6	6	6	liquid	2011	Khaki	XS	2022-03-26	[n
7	7	7	7	soild	2009	Indigo	L	2021-12-16	[n

Total rows: 300 of 300 Query complete 00:00:01.512 Ln 1, Col 1

Table Name : Vehicle Approver

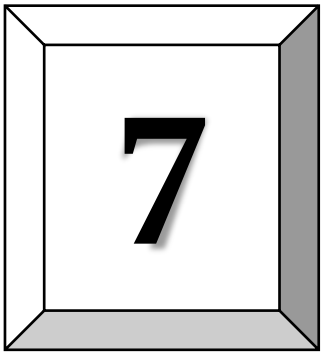
INSERT INTO vehicle.vehicle_approver(
va_id, v_id, va_name, va_age, va_address, va_mobileno, va_email)
VALUES (?, ?, ?, ?, ?, ?, ?);



Data Output | Messages | Notifications

	va_id [PK] integer	v_id integer	va_name character varying (30)	va_age integer	va_address character varying (50)	va_mobileno bigint	va_email character varying (50)
1	1	1	Nadia	28	1 Hansons Center	8522303401	nskamal0@desdev.cn
2	2	2	Joceline	57	9410 Porter Center	6465034050	jcathro1@livejournal.com
3	3	3	Erskine	38	4247 Doe Crossing Trail	3928214195	ekynan2@facebook.com
4	4	4	Nicolis	33	0829 Swallow Pass	4396201338	nleal3@bluehost.com
5	5	5	Aliza	26	1575 Springview Way	9118719317	apostles4@pen.io
6	6	6	Fania	64	72637 Fremont Alley	1443543012	fhazlehurst5@soup.io
7	7	7	Waneta	73	345 Memorial Alley	7097956771	wquerree6@com.com

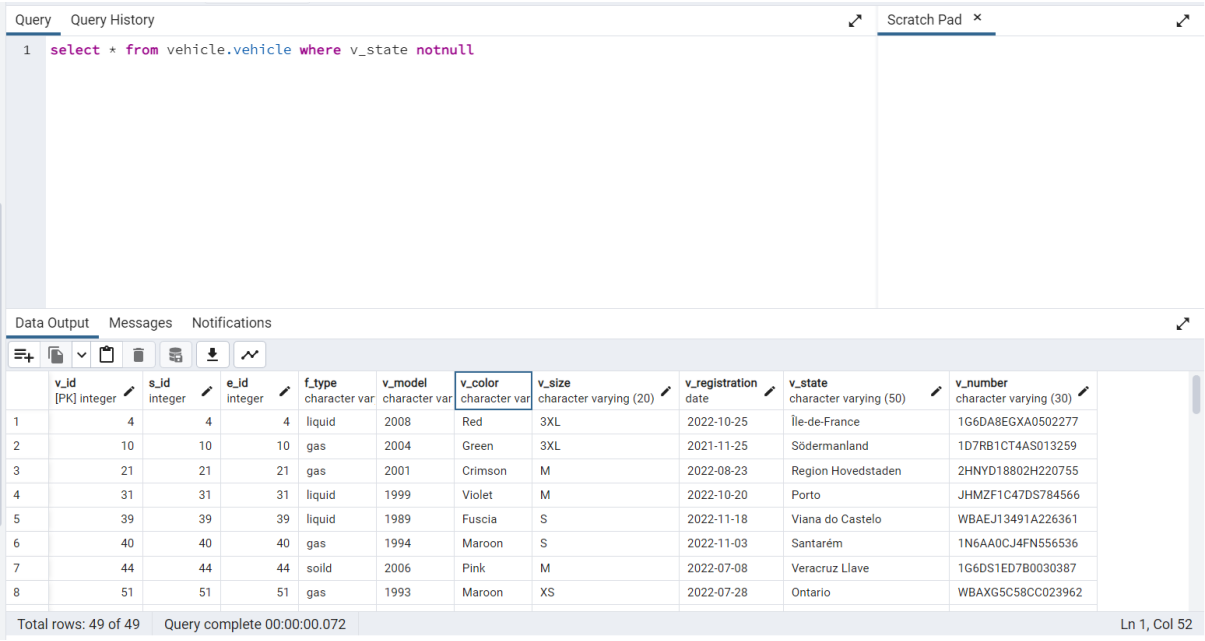
Total rows: 200 of 200 Query complete 00:00:01.535 Ln 1, Col 1



Section : List of Queries for your database

1. Show all vehicle info where state is not null

select * from vehicle.vehicle where v_state notnull



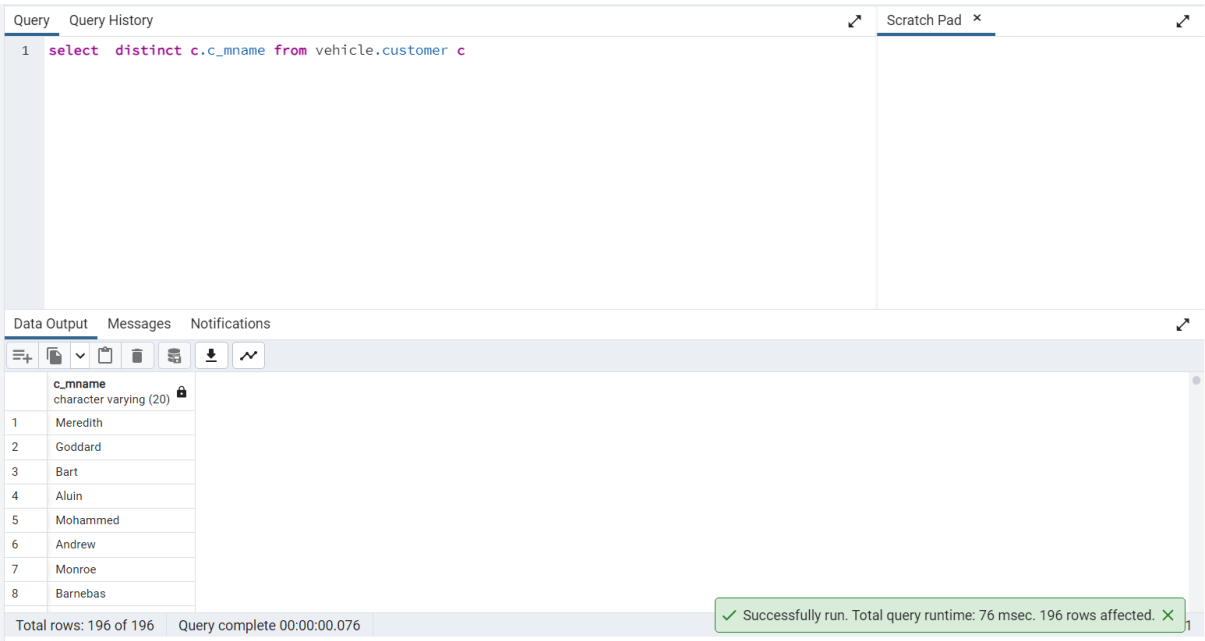
```
select * from vehicle.vehicle where v_state notnull
```

	v_id [PK] integer	s_id integer	e_id integer	f_type character var	v_model character var	v_color character var	v_size character varying (20)	v_registration date	v_state character varying (50)	v_number character varying (30)
1	4	4	4	liquid	2008	Red	3XL	2022-10-25	Île-de-France	1G6DA8EGXA0502277
2	10	10	10	gas	2004	Green	3XL	2021-11-25	Södermanland	1D7RB1CT4AS013259
3	21	21	21	gas	2001	Crimson	M	2022-08-23	Region Hovedstaden	2HNYD18802H220755
4	31	31	31	liquid	1999	Violet	M	2022-10-20	Porto	JHMZF1C47DS784566
5	39	39	39	liquid	1989	Fuscia	S	2022-11-18	Viana do Castelo	WBAEJ13491A226361
6	40	40	40	gas	1994	Maroon	S	2022-11-03	Santarém	1N6AA0CJ4FN556536
7	44	44	44	soild	2006	Pink	M	2022-07-08	Veracruz Llave	1G6DS1ED7B0030387
8	51	51	51	gas	1993	Maroon	XS	2022-07-28	Ontario	WBAXG5C58CC023962

Total rows: 49 of 49 Query complete 00:00:00.072 Ln 1, Col 52

2. Show all distinct customer with middle name

select distinct c.c_mname from vehicle.customer c



```
select distinct c.c_mname from vehicle.customer c
```

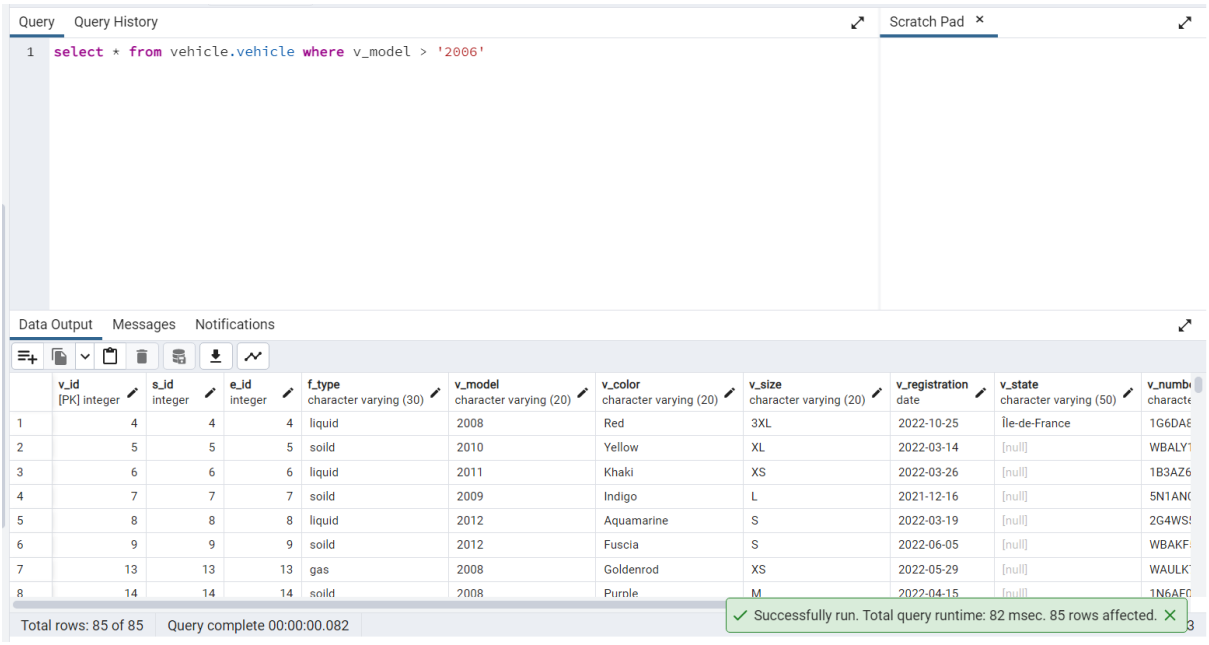
	c_mname character varying (20)
1	Meredith
2	Goddard
3	Bart
4	Aluin
5	Mohammed
6	Andrew
7	Monroe
8	Barnebas

Total rows: 196 of 196 Query complete 00:00:00.076

Successfully run. Total query runtime: 76 msec. 196 rows affected.

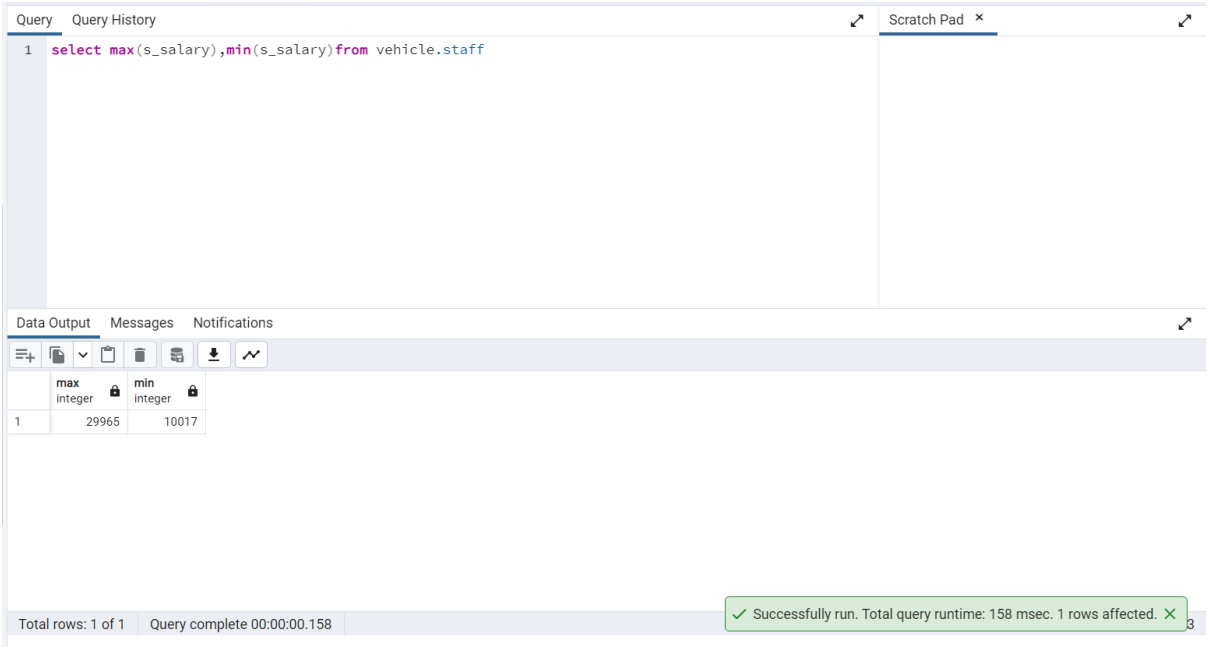
3. List the all details of vehicle where model is greater than 2006

select * from vehicle.vehicle where v_model > '2006'



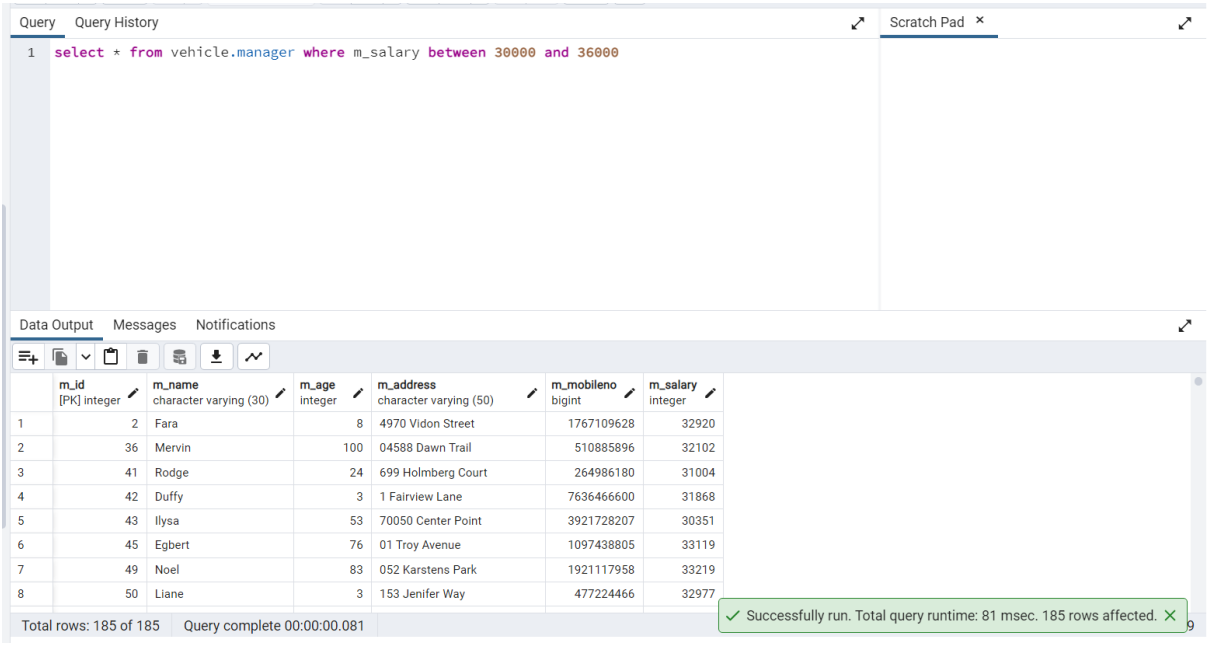
4. Find maximum and minimum salary of user whose role is staff

select max(s_salary),min(s_salary)from vehicle.staff



5. **Find the all details of manager whose salary is between 30000 and 36000 from manager table**

select * from vehicle.manager where m_salary between 30000 and 36000



```
select * from vehicle.manager where m_salary between 30000 and 36000
```

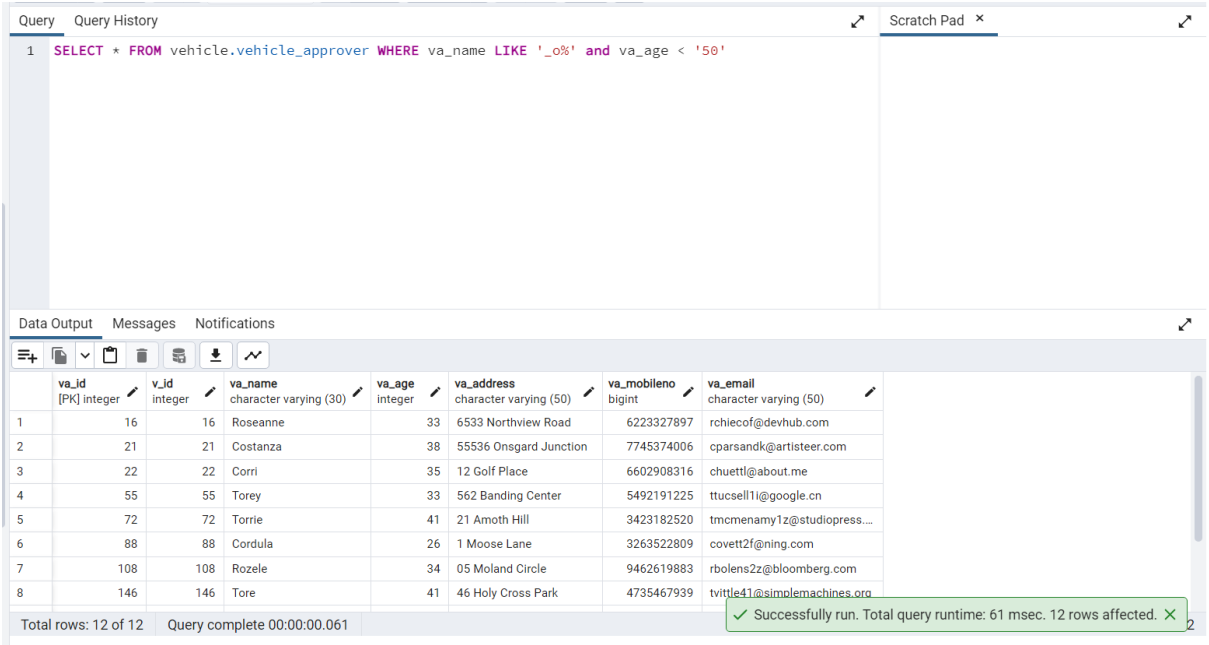
	m_id [PK] integer	m_name character varying (30)	m_age integer	m_address character varying (50)	m_mobileno bigint	m_salary integer
1	2	Fara	8	4970 Vidon Street	1767109628	32920
2	36	Mervin	100	04588 Dawn Trail	510885896	32102
3	41	Rodge	24	699 Holmberg Court	264986180	31004
4	42	Duffy	3	1 Fairview Lane	7636466600	31868
5	43	Ilysa	53	70050 Center Point	3921728207	30351
6	45	Egbert	76	01 Troy Avenue	1097438805	33119
7	49	Noel	83	052 Karstens Park	1921117958	33219
8	50	Liane	3	153 Jenifer Way	477224466	32977

Total rows: 185 of 185 Query complete 00:00:00.081

Successfully run. Total query runtime: 81 msec. 185 rows affected.

6. **Find the information of vehicle approver whose 2nd alphabet of l_name is “o” and age are smaller than 50**

SELECT * FROM vehicle.vehicle_approver WHERE va_name LIKE '_o%' and va_age < '50'



```
SELECT * FROM vehicle.vehicle_approver WHERE va_name LIKE '_o%' and va_age < '50'
```

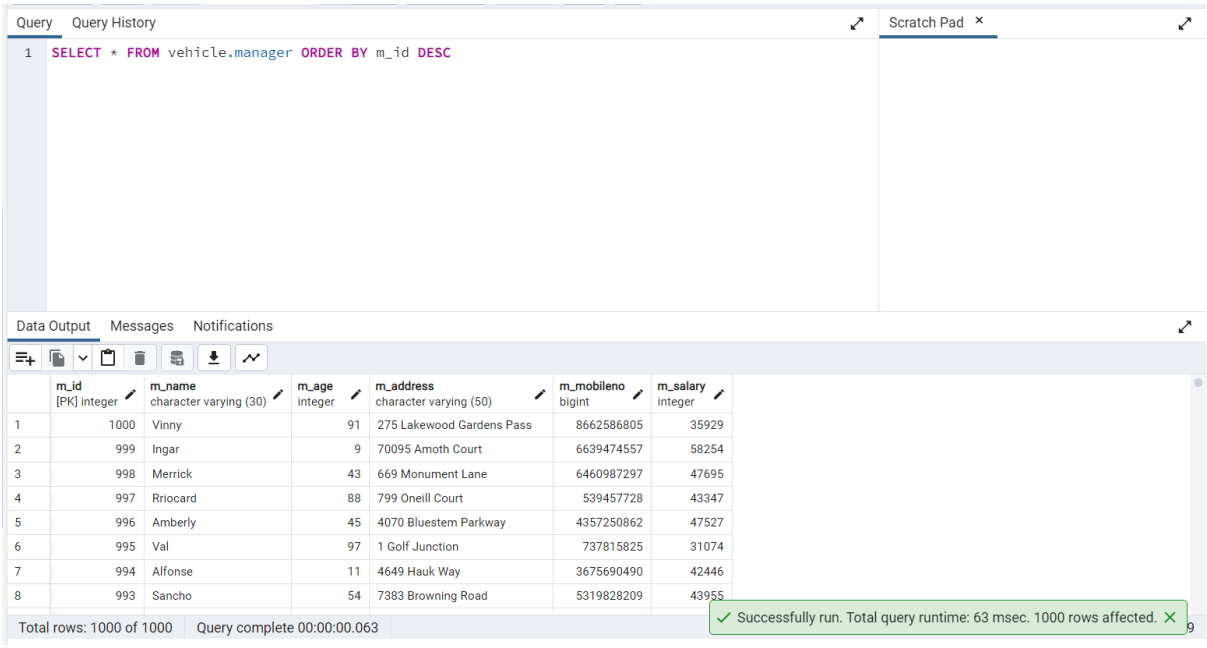
	va_id [PK] integer	v_id integer	va_name character varying (30)	va_age integer	va_address character varying (50)	va_mobileno bigint	va_email character varying (50)
1	16	16	Roseanne	33	6533 Northview Road	6223327897	rchiecof@devhub.com
2	21	21	Costanza	38	55536 Onsgard Junction	7745374006	cparsandk@artisteer.com
3	22	22	Corri	35	12 Golf Place	6602908316	chuettl@about.me
4	55	55	Torey	33	562 Banding Center	5492191225	ttucsell1i@google.cn
5	72	72	Torrie	41	21 Amoth Hill	3423182520	tmcmenamy1z@studiopress....
6	88	88	Cordula	26	1 Moose Lane	3263522809	covett2f@ning.com
7	108	108	Rozele	34	05 Moland Circle	9462619883	rbolens2z@bloomberg.com
8	146	146	Tore	41	46 Holy Cross Park	4735467939	tvittle41@simplemachines.org

Total rows: 12 of 12 Query complete 00:00:00.061

Successfully run. Total query runtime: 61 msec. 12 rows affected.

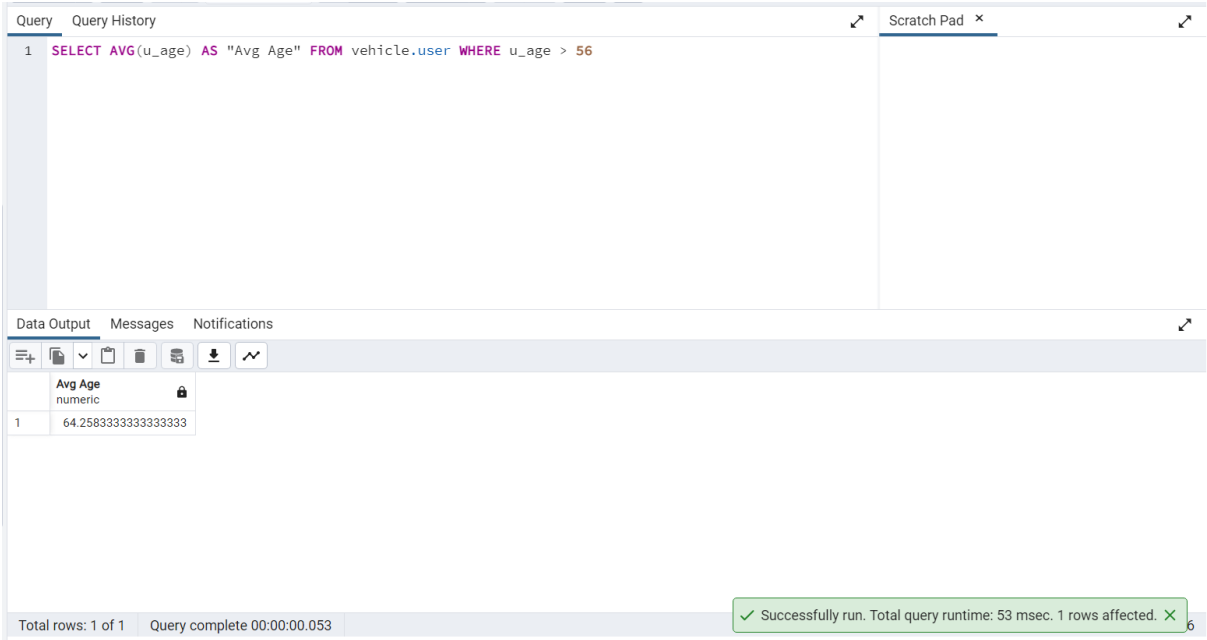
7. Arrange manager id in descending order from manager table using order by clause

SELECT * FROM vehicle.manager ORDER BY m_id DESC



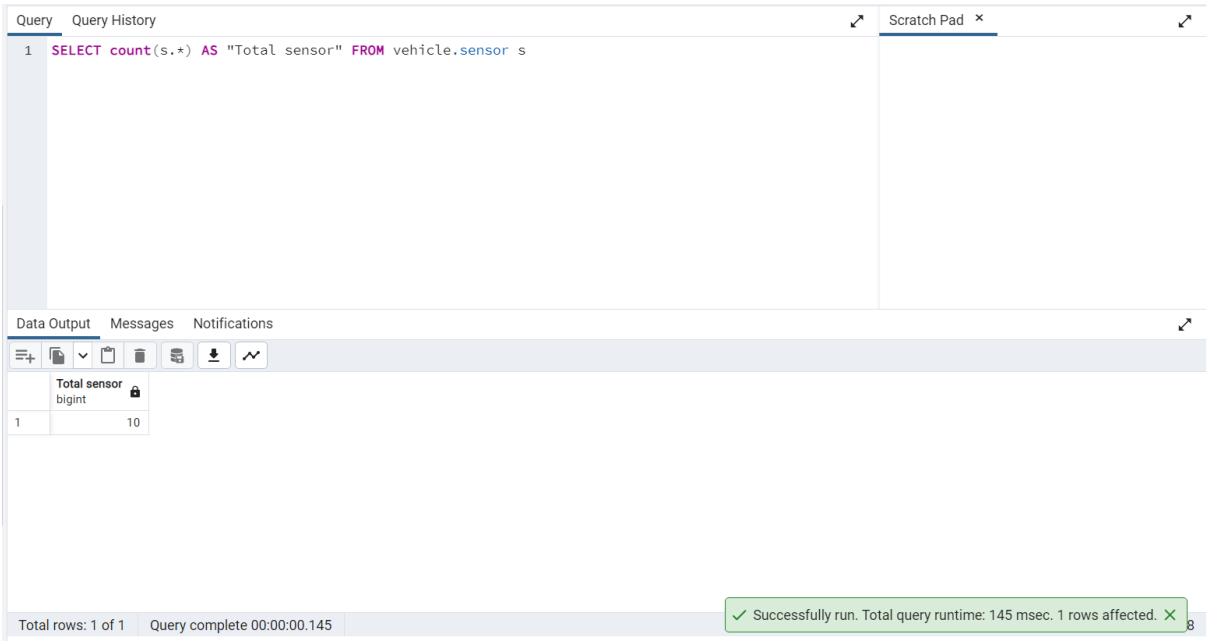
8. Find average of age and show as “Avg Age” where user age is greater than 56

SELECT AVG(u_age) AS "Avg Age" FROM vehicle.user WHERE u_age > 56



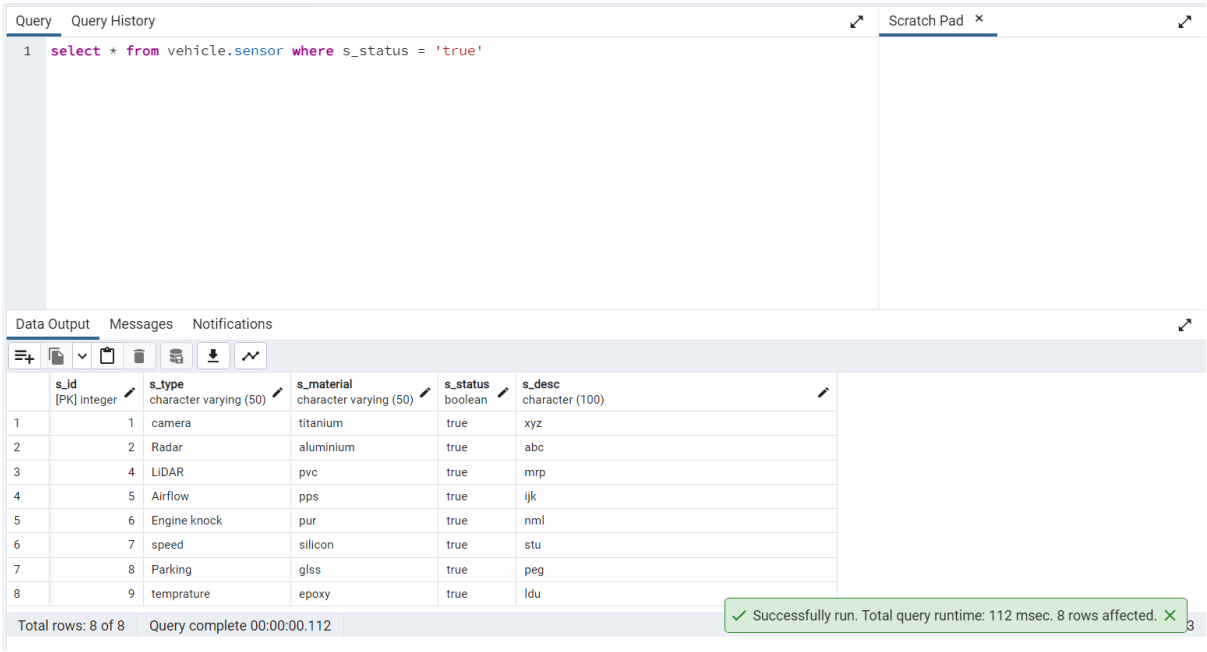
9. Count the total number of sensors by counting from sensor table

SELECT count(s.*) AS "Total sensor" FROM vehicle.sensor s



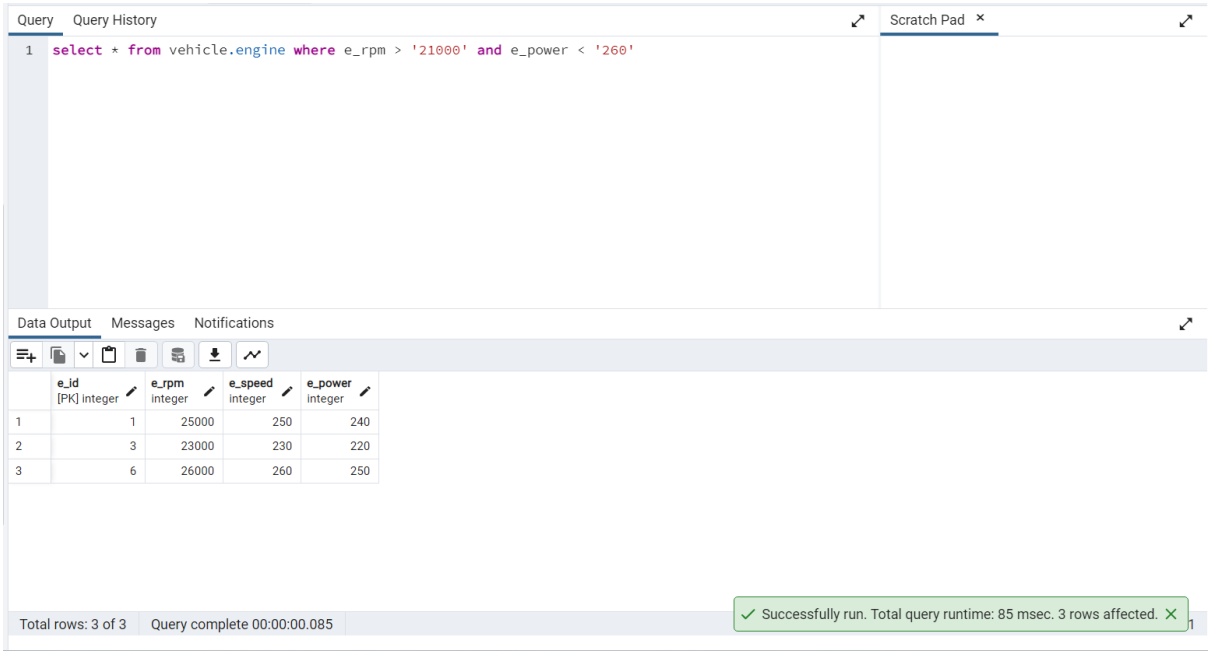
10. Show all the sensor details having “working” status (where working = true)

select * from vehicle.sensor where s_status = 'true'



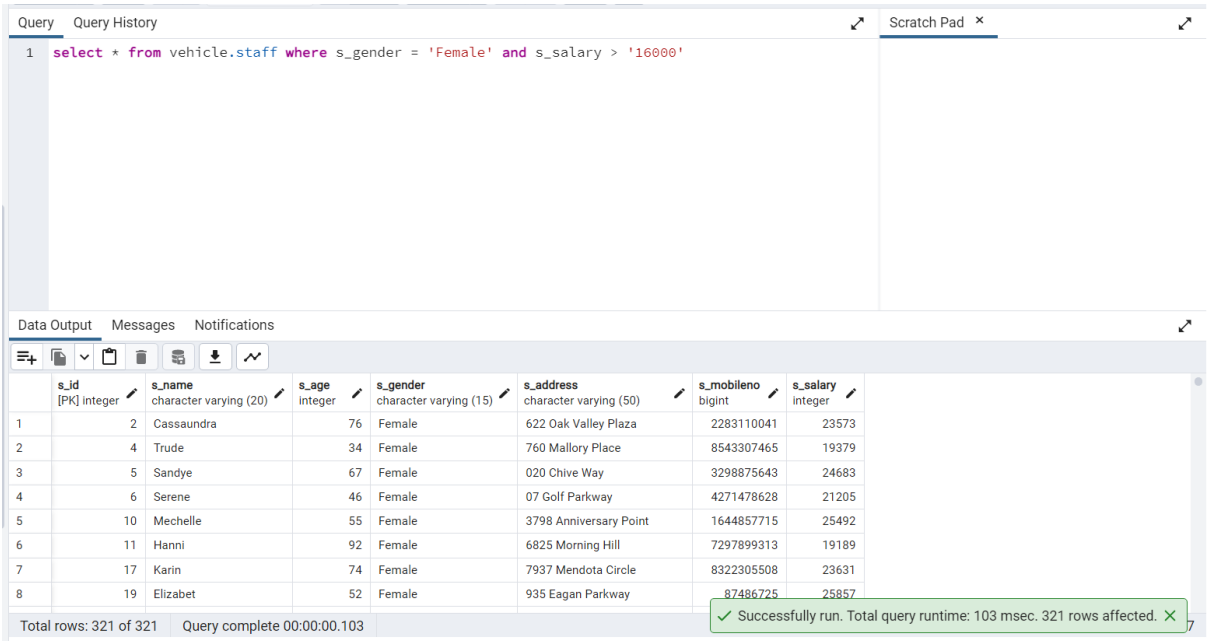
11. **Show all detail of engine where engine power is less than 260 and engine rpm is less than 21000**

select * from vehicle.engine where e_rpm > '21000' and e_power < '260'



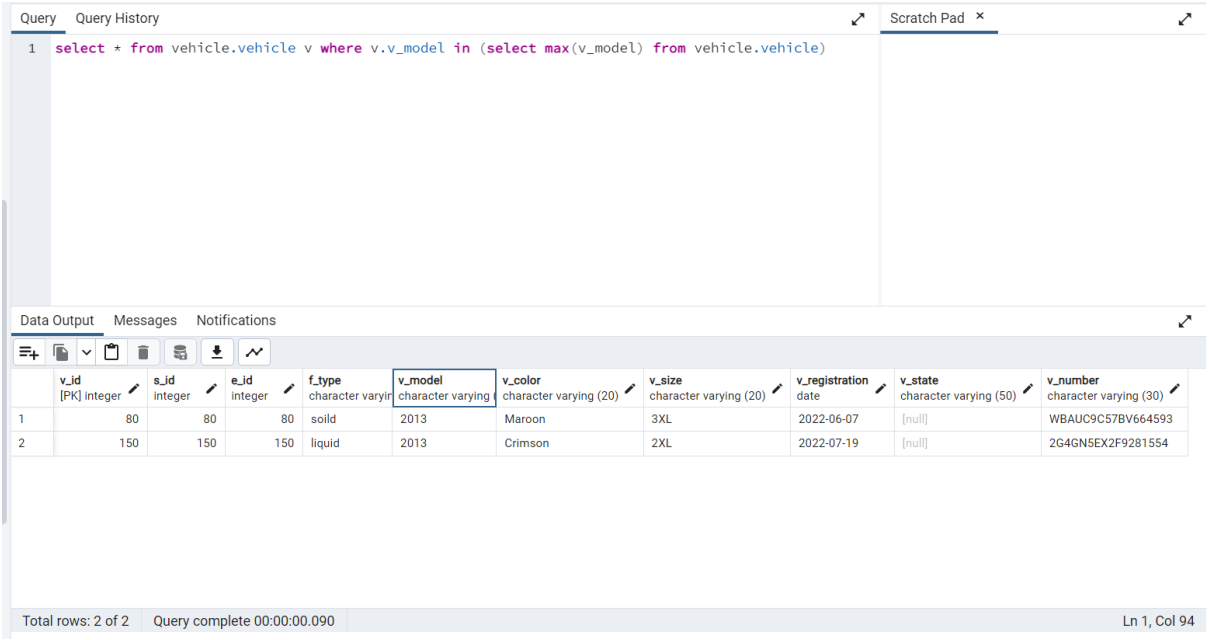
12. **Find all the details of staff member where staff gender is female and salary is greater than 16000**

select * from vehicle.staff where s_gender = 'Female' and s_salary > '16000'



13. **Show all vehicle information where vehicle model number is latest from all vehicle**

select * from vehicle.vehicle v where v.v_model in (select max(v_model) from vehicle.vehicle)



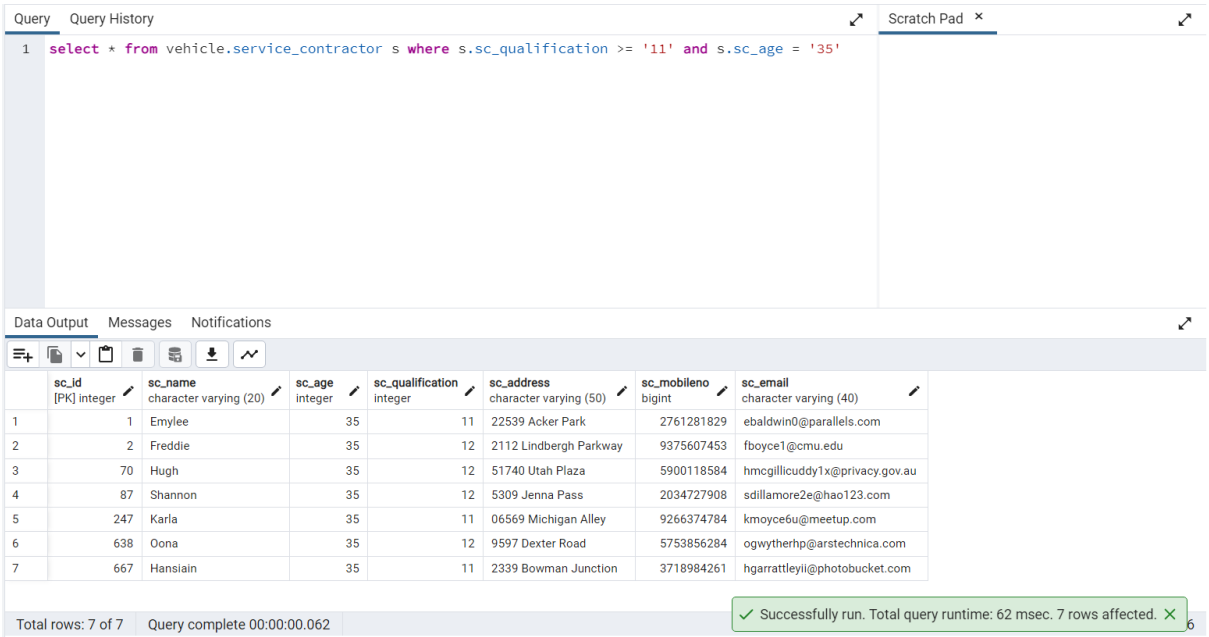
```
select * from vehicle.vehicle v where v.v_model in (select max(v_model) from vehicle.vehicle)
```

	v_id [PK] integer	s_id integer	e_id integer	f_type character varyir	v_model character varying	v_color character varying (20)	v_size character varying (20)	v_registration date	v_state character varying (50)	v_number character varying (30)
1	80	80	80	soild	2013	Maroon	3XL	2022-06-07	[null]	WBAUC9C57BV664593
2	150	150	150	liquid	2013	Crimson	2XL	2022-07-19	[null]	2G4GN5EX2F9281554

Total rows: 2 of 2 | Query complete 00:00:00.090 | Ln 1, Col 94

14. **Show detail of all service contractor where service contractor qualification is greater than equal to 11 and service contractor age is 35**

select * from vehicle.service_contractor s where s.sc_qualification >= '11' and s.sc_age = '35'



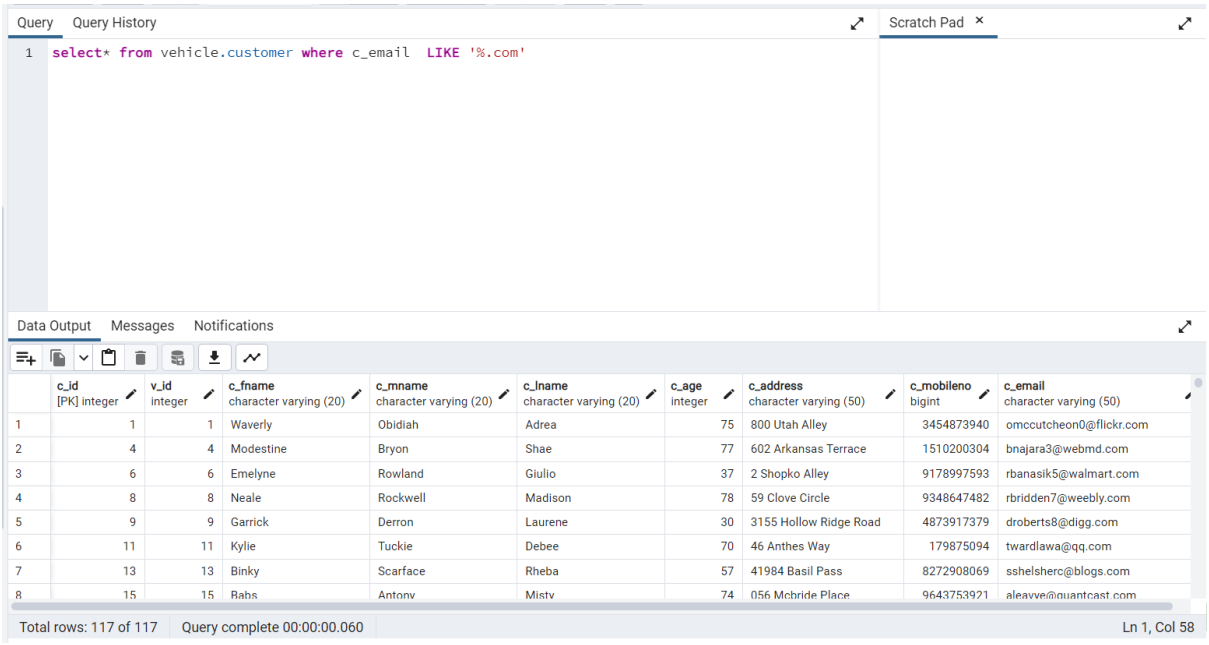
```
select * from vehicle.service_contractor s where s.sc_qualification >= '11' and s.sc_age = '35'
```

	sc_id [PK] integer	sc_name character varying (20)	sc_age integer	sc_qualification integer	sc_address character varying (50)	sc_mobileno bigint	sc_email character varying (40)
1	1	Emylee	35	11	22539 Acker Park	2761281829	ebaldwin0@parallels.com
2	2	Freddie	35	12	2112 Lindbergh Parkway	9375607453	fboyce1@cmu.edu
3	70	Hugh	35	12	51740 Utah Plaza	5900118584	hmcgillicuddy1x@privacy.gov.au
4	87	Shannon	35	12	5309 Jenna Pass	2034727908	sdillamore2e@hao123.com
5	247	Karla	35	11	06569 Michigan Alley	9266374784	kmoyce6u@meetup.com
6	638	Oona	35	12	9597 Dexter Road	5753856284	ogwytherhp@arstechnica.com
7	667	Hansiain	35	11	2339 Bowman Junction	3718984261	hgarrattleyii@photobucket.com

Total rows: 7 of 7 | Query complete 00:00:00.062 | Successfully run. Total query runtime: 62 msec. 7 rows affected.

15. List out all customer details whose email id end with “.com”

select* from vehicle.customer where c_email LIKE '%.com'



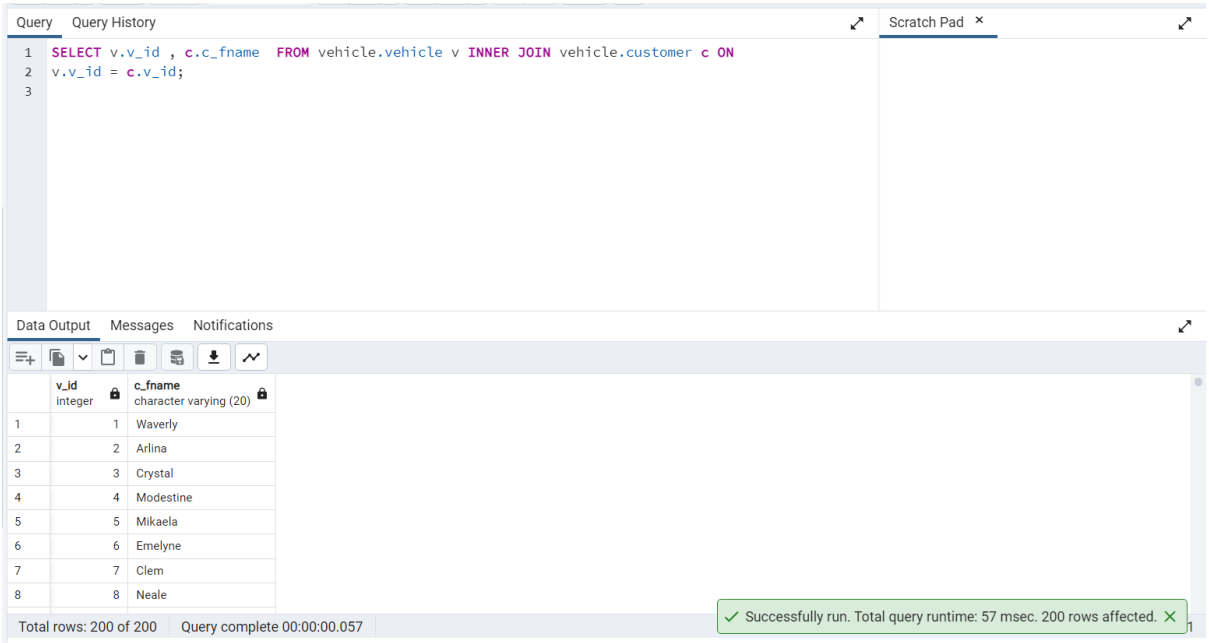
```
select* from vehicle.customer where c_email  LIKE '%.com'
```

	c_id [PK] integer	v_id integer	c_fname character varying (20)	c_mname character varying (20)	c_lname character varying (20)	c_age integer	c_address character varying (50)	c_mobileno bigint	c_email character varying (50)
1	1	1	Waverly	Obidiah	Adrea	75	800 Utah Alley	3454873940	omccutcheon0@flickr.com
2	4	4	Modestine	Bryon	Shae	77	602 Arkansas Terrace	1510200304	bnajara3@webmd.com
3	6	6	Emelyne	Rowland	Giulio	37	2 Shopko Alley	9178997593	rbanasik5@walmart.com
4	8	8	Neale	Rockwell	Madison	78	59 Clove Circle	9348647482	rbridden7@weebly.com
5	9	9	Garrick	Derron	Laurene	30	3155 Hollow Ridge Road	4873917379	droberts8@digg.com
6	11	11	Kylie	Tuckie	Debee	70	46 Anthes Way	179875094	twardlawa@qq.com
7	13	13	Binky	Scarface	Rheba	57	41984 Basil Pass	8272908069	sshelsherc@blogs.com
8	15	15	Babs	Antony	Misty	74	056 Mcbride Place	9643753921	aleavve@quantcast.com

Total rows: 117 of 117 Query complete 00:00:00.060 Ln 1, Col 58

16. Find customer first name for all v_id from `vehicle` & `customer` table.

SELECT v.v_id , c.c_fname FROM vehicle.vehicle v INNER JOIN vehicle.customer c ON v.v_id = c.v_id;



```
SELECT v.v_id , c.c_fname  FROM vehicle.vehicle v INNER JOIN vehicle.customer c ON
v.v_id = c.v_id;
```

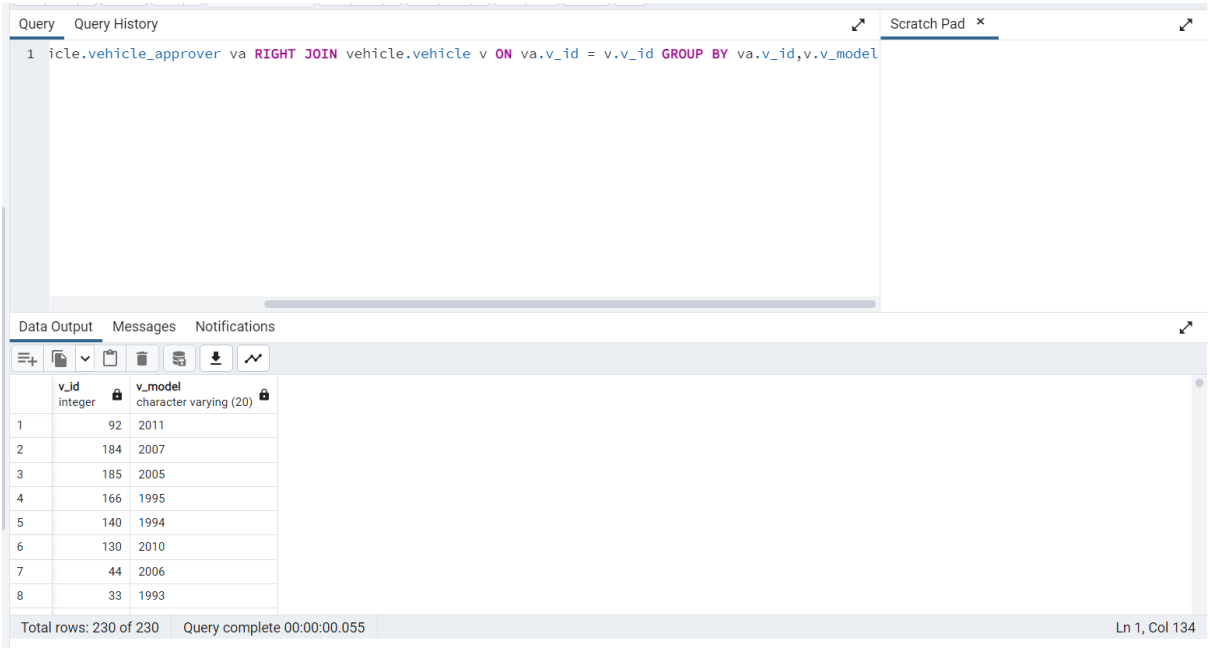
	v_id integer	c_fname character varying (20)
1	1	Waverly
2	2	Arlina
3	3	Crystal
4	4	Modestine
5	5	Mikaela
6	6	Emelyne
7	7	Clem
8	8	Neale

Total rows: 200 of 200 Query complete 00:00:00.057

Successfully run. Total query runtime: 57 msec. 200 rows affected.

17. Find Vehicle model for all the vehicle id from vehicle and vehicle approver table.

SELECT va.v_id,v.v_model FROM vehicle.vehicle_approver va RIGHT JOIN vehicle.vehicle v ON va.v_id = v.v_id GROUP BY va.v_id,v.v_model



```
1  icle.vehicle_approver va RIGHT JOIN vehicle.vehicle v ON va.v_id = v.v_id GROUP BY va.v_id,v.v_model
```

Query | Query History | Scratch Pad

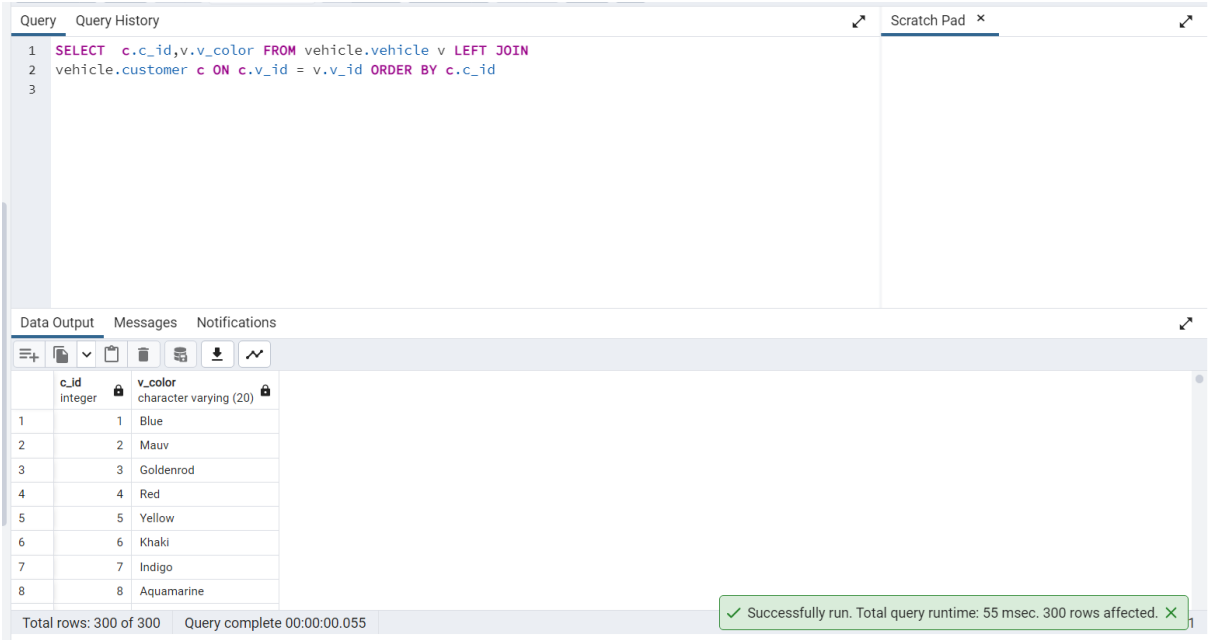
Data Output | Messages | Notifications

	v_id integer	v_model character varying (20)
1	92	2011
2	184	2007
3	185	2005
4	166	1995
5	140	1994
6	130	2010
7	44	2006
8	33	1993

Total rows: 230 of 230 | Query complete 00:00:00.055 | Ln 1, Col 134

18. Find vehicle color for all the Customer id from customer and vehicle table.

SELECT c.c_id,v.v_color FROM vehicle.vehicle v LEFT JOIN vehicle.customer c ON c.v_id = v.v_id ORDER BY c.c_id



```
1  SELECT  c.c_id,v.v_color FROM vehicle.vehicle v LEFT JOIN
2  vehicle.customer c ON c.v_id = v.v_id ORDER BY c.c_id
3
```

Query | Query History | Scratch Pad

Data Output | Messages | Notifications

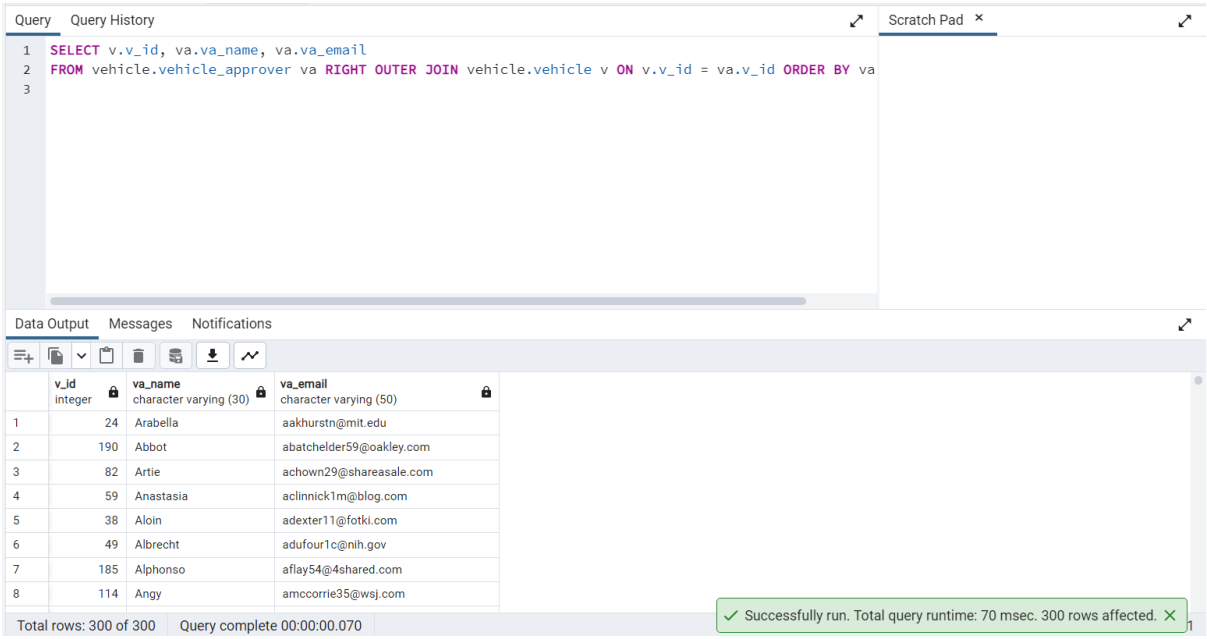
	c_id integer	v_color character varying (20)
1	1	Blue
2	2	Mauv
3	3	Goldenrod
4	4	Red
5	5	Yellow
6	6	Khaki
7	7	Indigo
8	8	Aquamarine

Total rows: 300 of 300 | Query complete 00:00:00.055

Successfully run. Total query runtime: 55 msec. 300 rows affected.

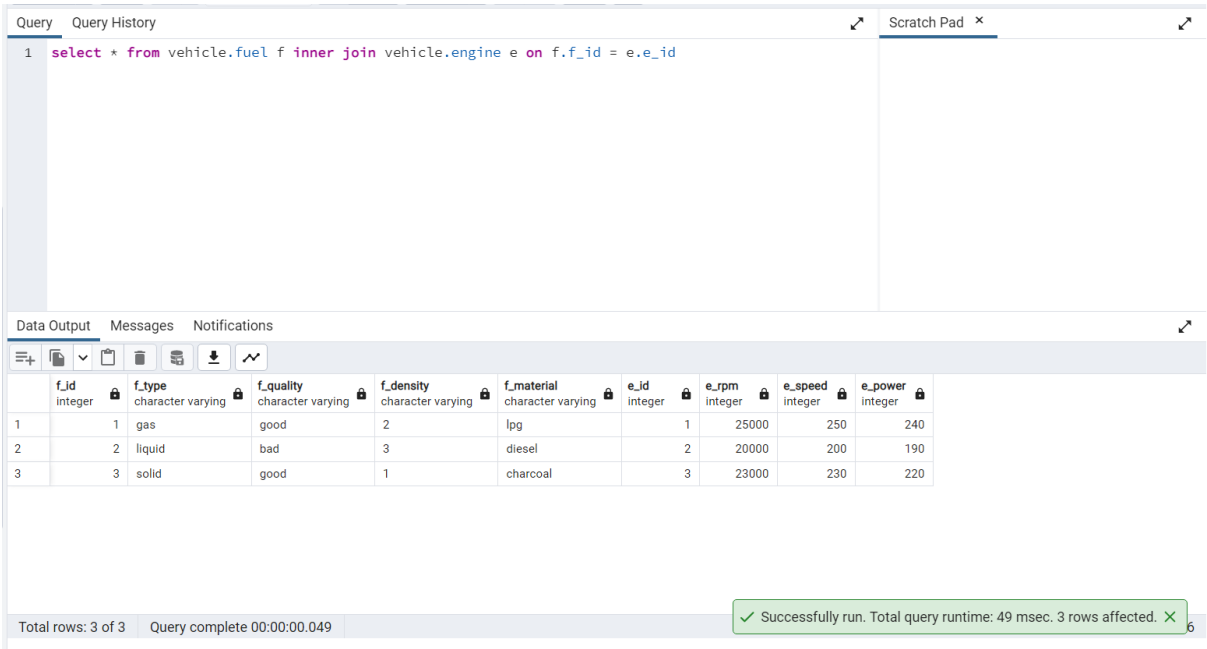
19. **find vehicle approver details i.e id, name and email of all the vehicle approver from vehicle and vehicle approver table.**

SELECT v.v_id, va.va_name, va.va_email
FROM vehicle.vehicle_approver va RIGHT OUTER JOIN vehicle.vehicle v ON v.v_id = va.v_id
ORDER BY va.va_email



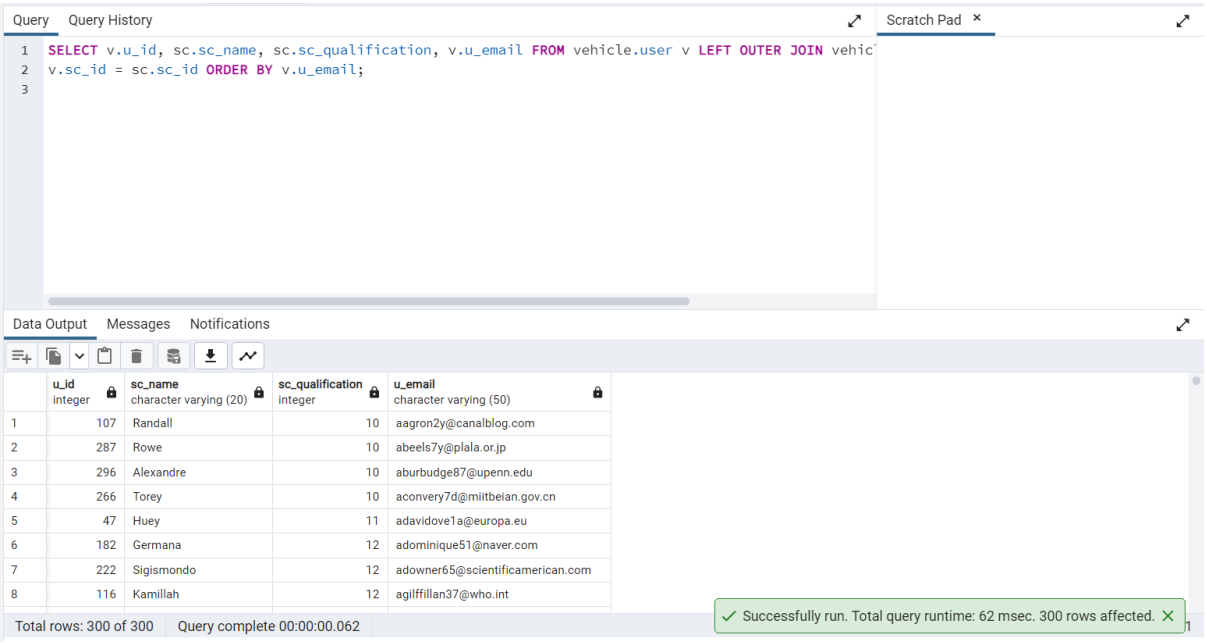
20. **Find out all detail of fuel and engine together.**

select * from vehicle.fuel f inner join vehicle.engine e on f.f_id = e.e_id



21. find service contractor name, qualification and email id for all the user id from service contractor and user table.

SELECT v.u_id, sc.sc_name, sc.sc_qualification, v.u_email FROM vehicle.user v LEFT OUTER JOIN vehicle.service_contractor sc ON
v.sc_id = sc.sc_id ORDER BY v.u_email;



```
SELECT v.u_id, sc.sc_name, sc.sc_qualification, v.u_email FROM vehicle.user v LEFT OUTER JOIN vehic
v.sc_id = sc.sc_id ORDER BY v.u_email;
```

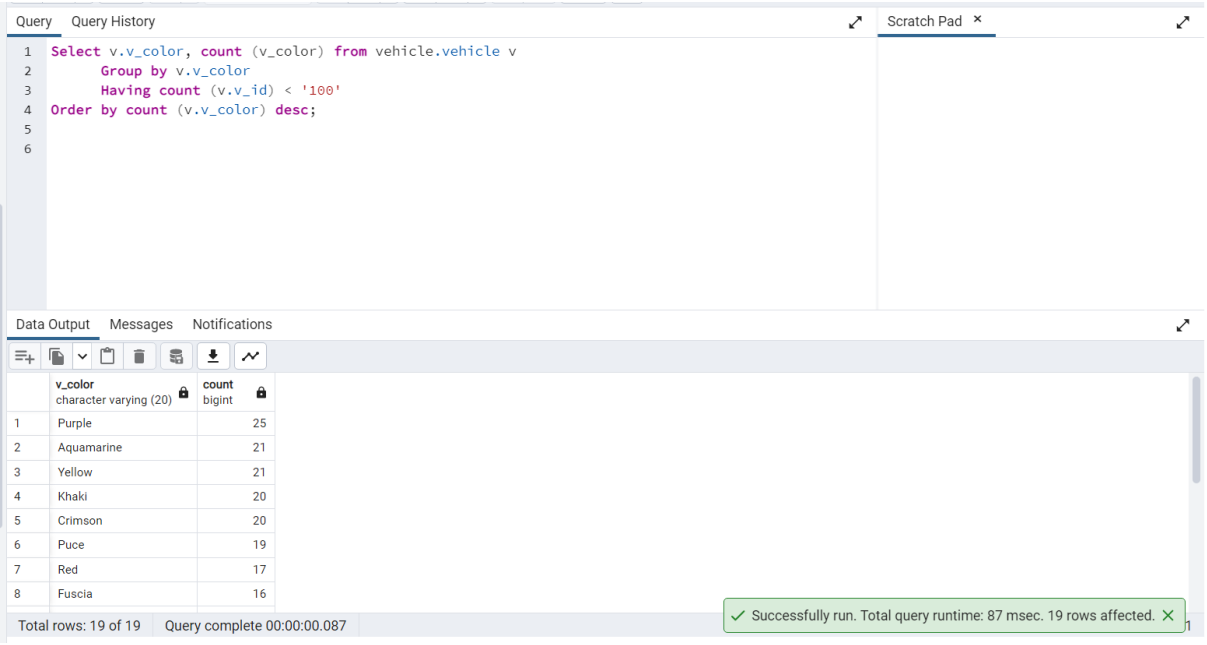
	u_id integer	sc_name character varying (20)	sc_qualification integer	u_email character varying (50)
1	107	Randall	10	aagron2y@canalblog.com
2	287	Rowe	10	abeels7y@plala.or.jp
3	296	Alexandre	10	aburbudge87@upenn.edu
4	266	Torey	10	aconvery7d@miitbeian.gov.cn
5	47	Huey	11	adavidove1a@europa.eu
6	182	Germana	12	adominique51@naver.com
7	222	Sigismondo	12	adowner65@scientificamerican.com
8	116	Kamillah	12	agilffillan37@who.int

Total rows: 300 of 300 Query complete 00:00:00.062

Successfully run. Total query runtime: 62 msec. 300 rows affected.

22. find count of duplicate row in vehicle color from vehicle table

Select v.v_color, count (v_color) from vehicle.vehicle v
Group by v.v_color Having count (v.v_id) < '100'
Order by count (v.v_color) desc;



```
Select v.v_color, count (v_color) from vehicle.vehicle v
      Group by v.v_color
      Having count (v.v_id) < '100'
Order by count (v.v_color) desc;
```

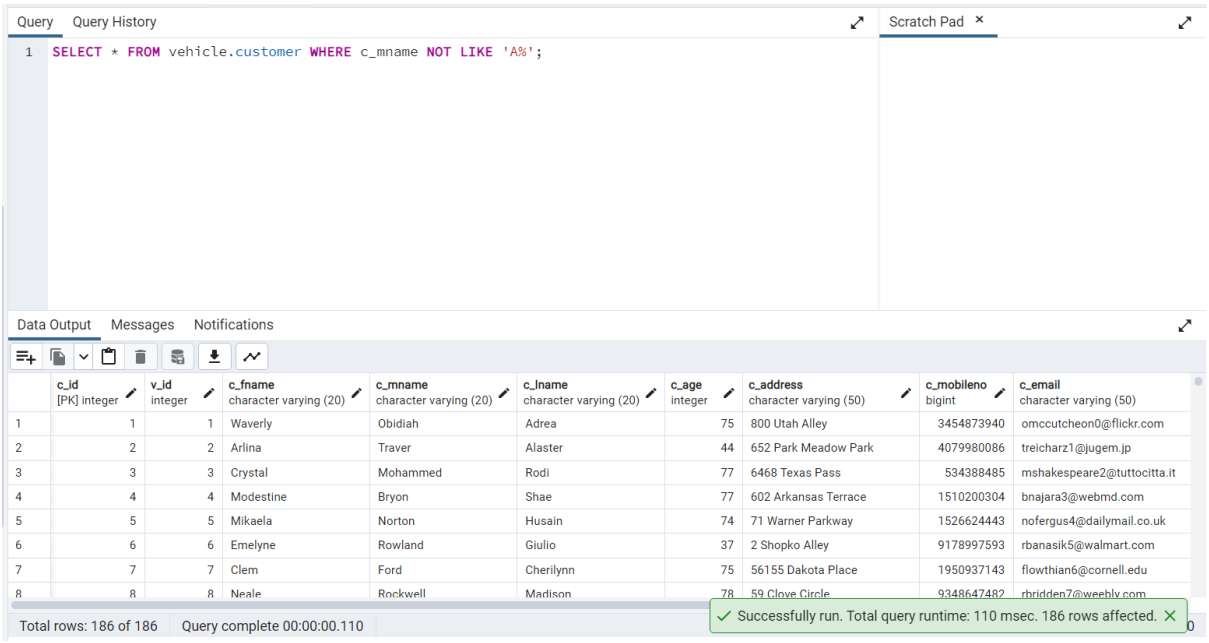
	v_color character varying (20)	count bigint
1	Purple	25
2	Aquamarine	21
3	Yellow	21
4	Khaki	20
5	Crimson	20
6	Puce	19
7	Red	17
8	Fuscia	16

Total rows: 19 of 19 Query complete 00:00:00.087

Successfully run. Total query runtime: 87 msec. 19 rows affected.

23. Show all customer detail whose middle name is not start with ‘a’.

SELECT * FROM vehicle.customer WHERE c_mname NOT LIKE 'A%';



Query | Query History | Scratch Pad

```
SELECT * FROM vehicle.customer WHERE c_mname NOT LIKE 'A%';
```

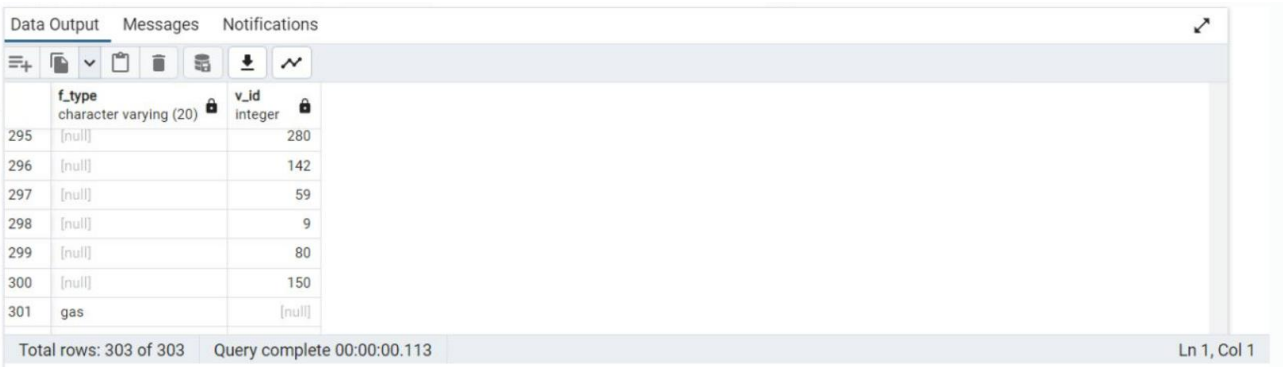
Data Output | Messages | Notifications

	c_id [PK] integer	v_id integer	c_fname character varying (20)	c_mname character varying (20)	c_lname character varying (20)	c_age integer	c_address character varying (50)	c_mobileno bigint	c_email character varying (50)
1	1	1	Waverly	Obidiah	Adrea	75	800 Utah Alley	3454873940	omccutcheon0@flickr.com
2	2	2	Arlina	Traver	Alaster	44	652 Park Meadow Park	4079980086	treicharz1@jugem.jp
3	3	3	Crystal	Mohammed	Rodi	77	6468 Texas Pass	534388485	mshakespeare2@tuttocitta.it
4	4	4	Modestine	Bryon	Shae	77	602 Arkansas Terrace	1510200304	bnajara3@webmd.com
5	5	5	Mikaela	Norton	Husain	74	71 Warner Parkway	1526624443	nofergus4@dailymail.co.uk
6	6	6	Emelyne	Rowland	Giulio	37	2 Shopko Alley	9178997593	rbanasik5@walmart.com
7	7	7	Clem	Ford	Cherilynn	75	56155 Dakota Place	1950937143	flowthian6@cornell.edu
8	8	8	Neale	Rockwell	Madison	78	59 Clove Circle	9348647482	rbridden7@weebly.com

Total rows: 186 of 186 | Query complete 00:00:00.110 | ✓ Successfully run. Total query runtime: 110 msec. 186 rows affected.

24. Show information of fuel type and vehicle id arrange by vehicle model.

```
SELECT f.f_type, v.v_id
FROM vehicle.fuel f
FULL OUTER JOIN vehicle.vehicle v ON v.f_id = f.f_id
ORDER BY v.v_model;
```



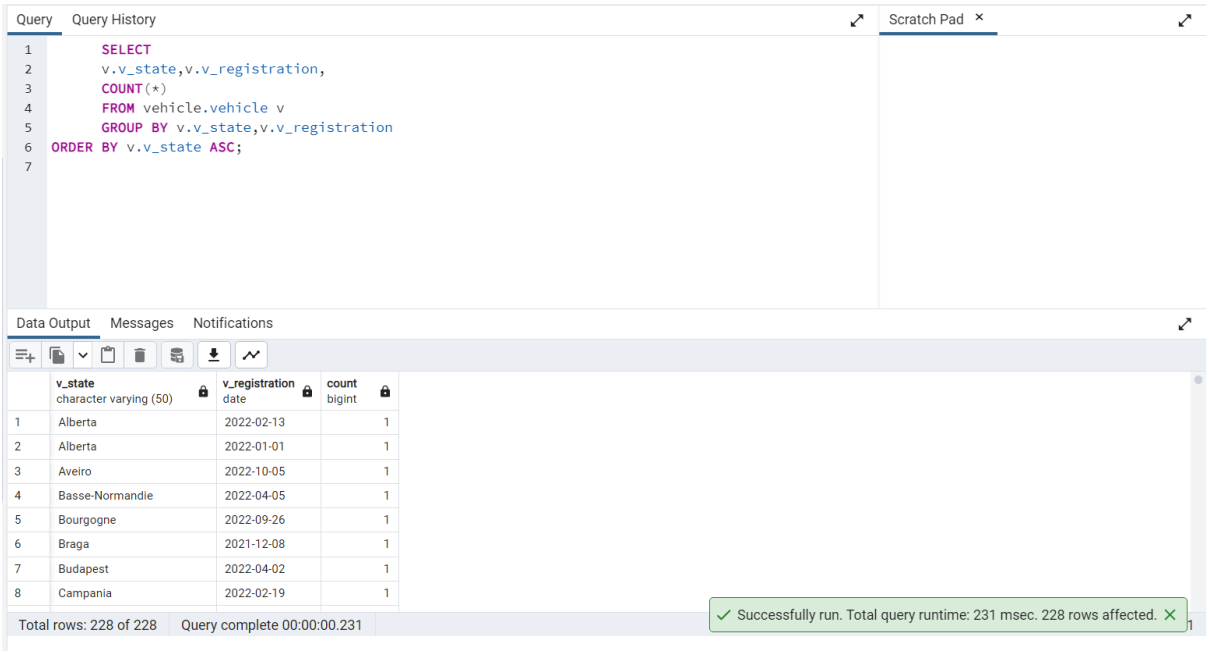
Data Output | Messages | Notifications

	f_type character varying (20)	v_id integer
295	[null]	280
296	[null]	142
297	[null]	59
298	[null]	9
299	[null]	80
300	[null]	150
301	gas	[null]

Total rows: 303 of 303 | Query complete 00:00:00.113 | Ln 1, Col 1

25. Find information of vehicle state, registration and count arrange by vehicle state.

```
SELECT v.v_state,v.v_registration,
COUNT(*) FROM vehicle.vehicle v
GROUP BY v.v_state,v.v_registration ORDER BY v.v_state ASC;
```



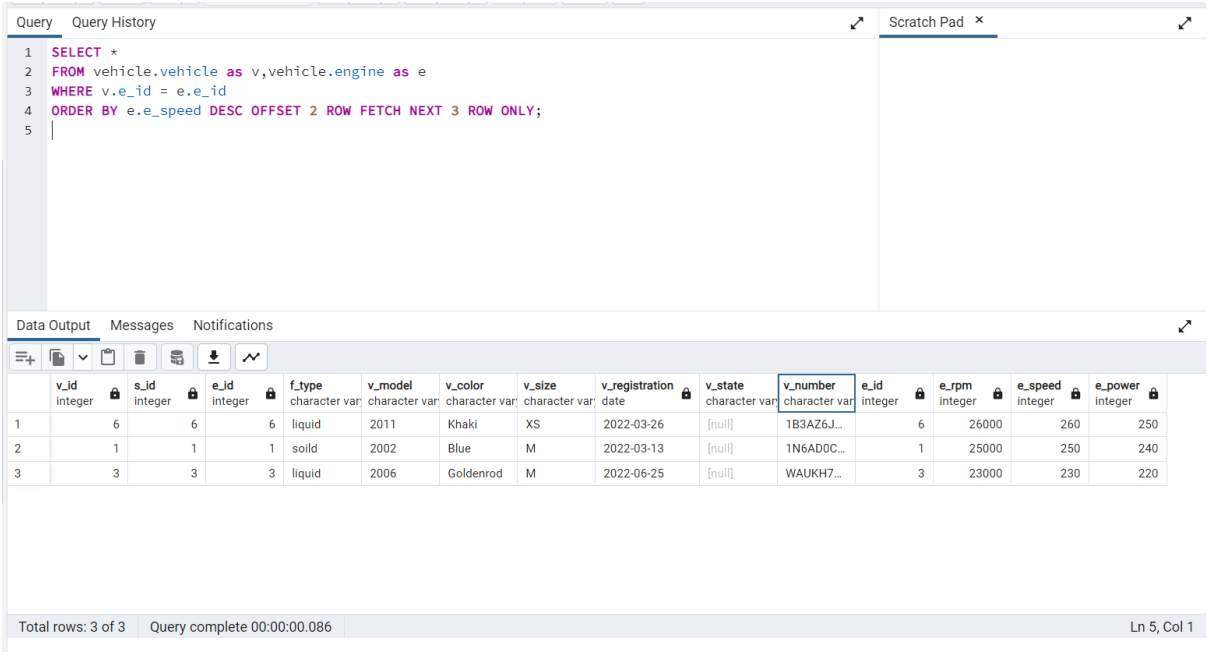
```
SELECT
v.v_state,v.v_registration,
COUNT(*)
FROM vehicle.vehicle v
GROUP BY v.v_state,v.v_registration
ORDER BY v.v_state ASC;
```

	v_state character varying (50)	v_registration date	count bigint
1	Alberta	2022-02-13	1
2	Alberta	2022-01-01	1
3	Aveiro	2022-10-05	1
4	Basse-Normandie	2022-04-05	1
5	Bourgogne	2022-09-26	1
6	Braga	2021-12-08	1
7	Budapest	2022-04-02	1
8	Campania	2022-02-19	1

Total rows: 228 of 228 | Query complete 00:00:00.231 | Successfully run. Total query runtime: 231 msec. 228 rows affected.

26. Find vehicle all detail which has 3rd,4th and 5th highest engine speed.

```
SELECT * FROM vehicle.vehicle as v,vehicle.engine as e
WHERE v.e_id = e.e_id
ORDER BY e.e_speed DESC OFFSET 2 ROW FETCH NEXT 3 ROW ONLY;
```



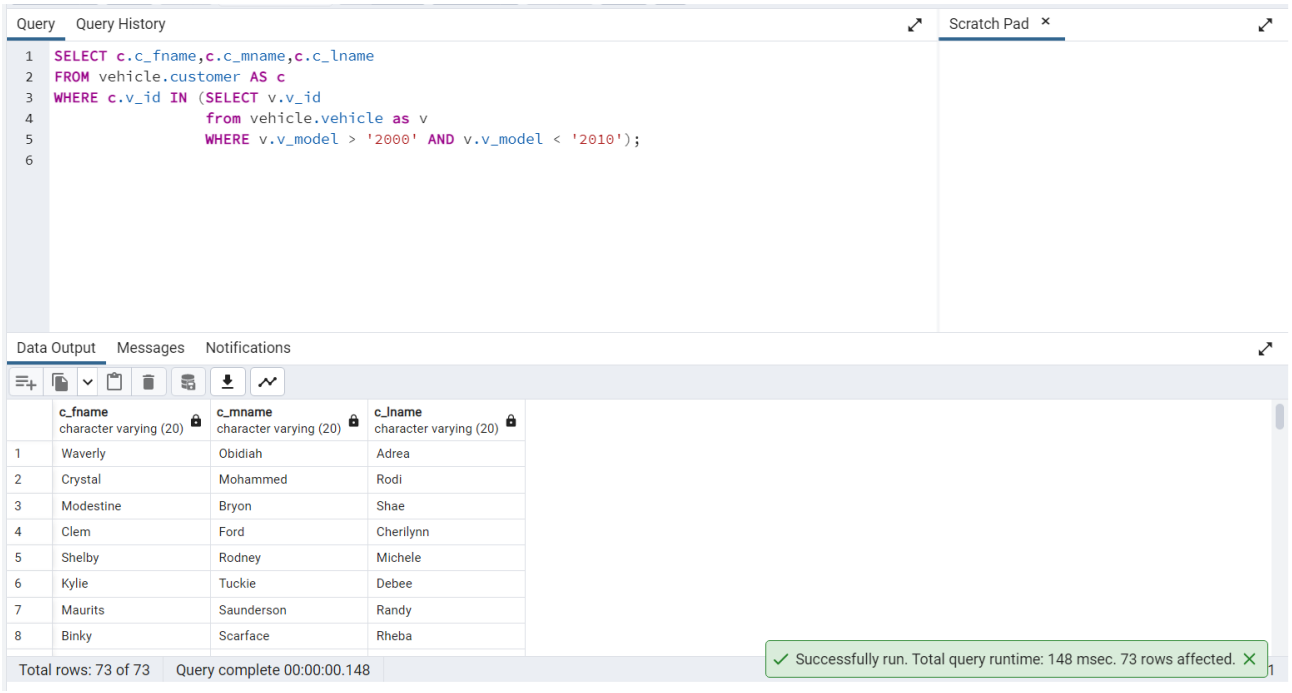
```
SELECT *
FROM vehicle.vehicle as v,vehicle.engine as e
WHERE v.e_id = e.e_id
ORDER BY e.e_speed DESC OFFSET 2 ROW FETCH NEXT 3 ROW ONLY;
```

	v_id integer	s_id integer	e_id integer	f_type character var	v_model character var	v_color character var	v_size character var	v_registration date	v_state character var	v_number character var	e_id integer	e_rpm integer	e_speed integer	e_power integer
1	6	6	6	liquid	2011	Khaki	XS	2022-03-26	[null]	1B3AZ6J...	6	26000	260	250
2	1	1	1	soild	2002	Blue	M	2022-03-13	[null]	1N6AD0C...	1	25000	250	240
3	3	3	3	liquid	2006	Goldenrod	M	2022-06-25	[null]	WAUKH7...	3	23000	230	220

Total rows: 3 of 3 | Query complete 00:00:00.086 | Ln 5, Col 1

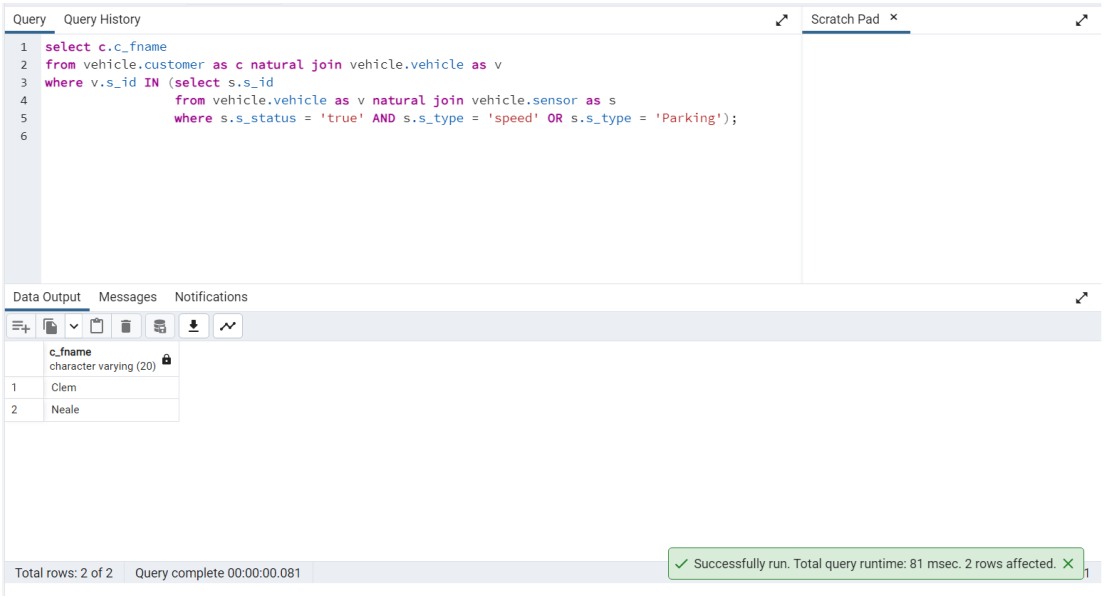
27. **List customer first name , middle name, last name whose vehicle model is between 2000 and 2010.**

```
SELECT c.c_fname,c.c_mname,c.c_lname
FROM vehicle.customer AS c
WHERE c.v_id IN (SELECT v.v_id
                 from vehicle.vehicle as v
                 WHERE v.v_model > '2000' AND v.v_model < '2010');
```



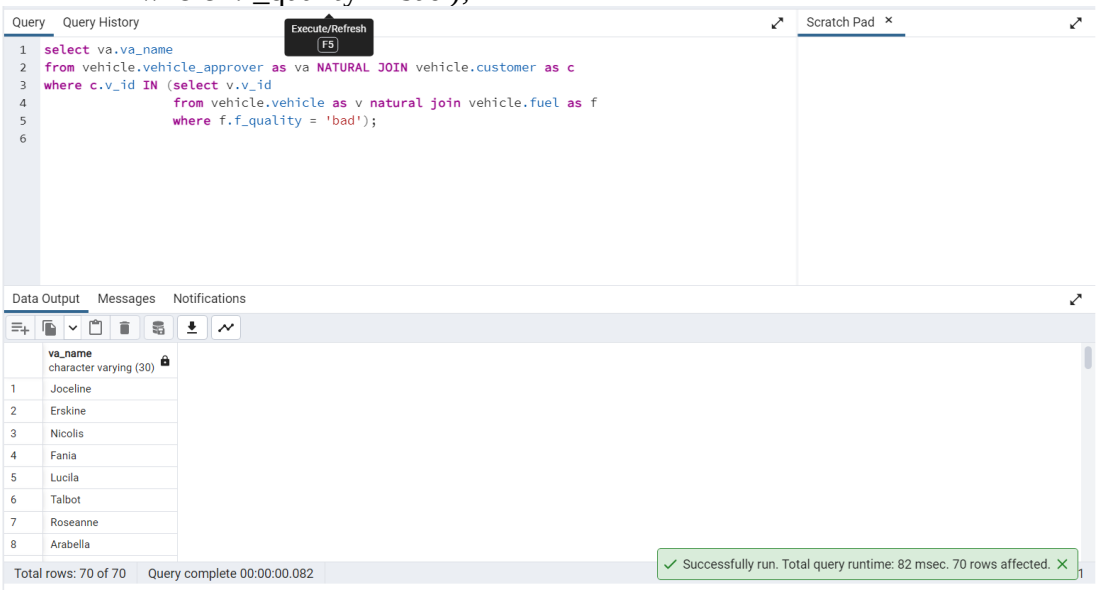
28. Find out the customer details whose vehicle's speed and parking sensor is active.

```
select c.c_fname
from vehicle.customer as c natural join vehicle.vehicle as v
where v.s_id IN (select s.s_id
                 from vehicle.vehicle as v natural join vehicle.sensor as s
                 where s.s_status = 'true' AND s.s_type = 'speed' OR s.s_type = 'Parking');
```



29. Find vehicle approver name who approved vehicle which vehicle's fuel quality is bad.

```
select va.va_name
from vehicle.vehicle_approver as va NATURAL JOIN vehicle.customer as c
where c.v_id IN (select v.v_id
                 from vehicle.vehicle as v natural join vehicle.fuel as f
                 where f.f_quality = 'bad');
```

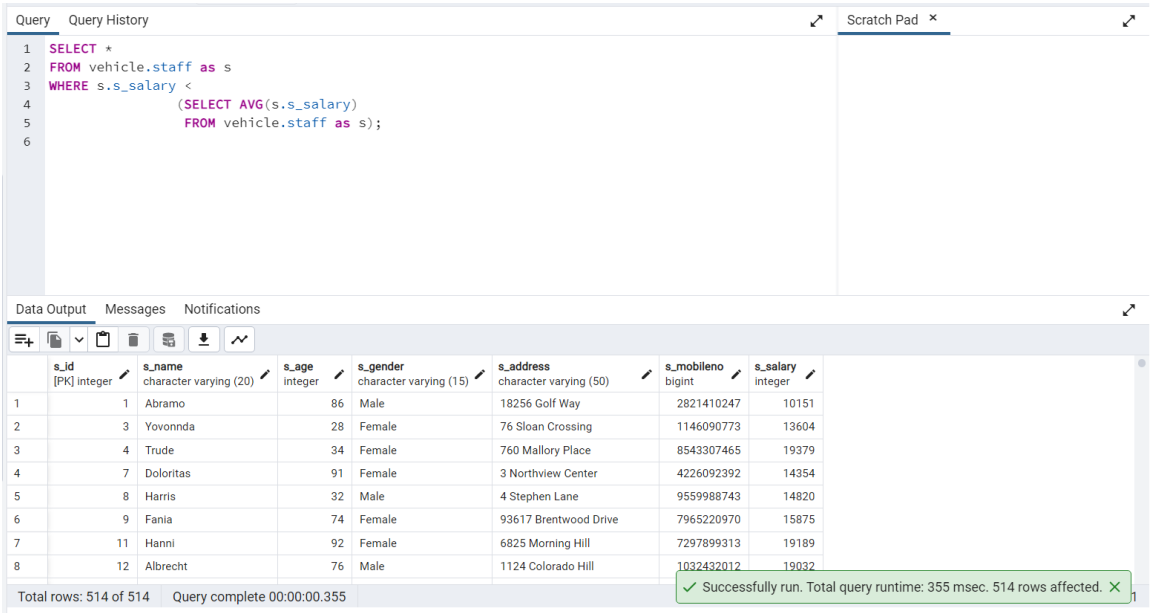


30. Find out total sum of manager and staff salary whose age is greater than 50.

```
select count('m.m_salary')
from vehicle.manager as m natural join vehicle.staff as s where s.s_age > '50' and m.m_age >
'50';
```

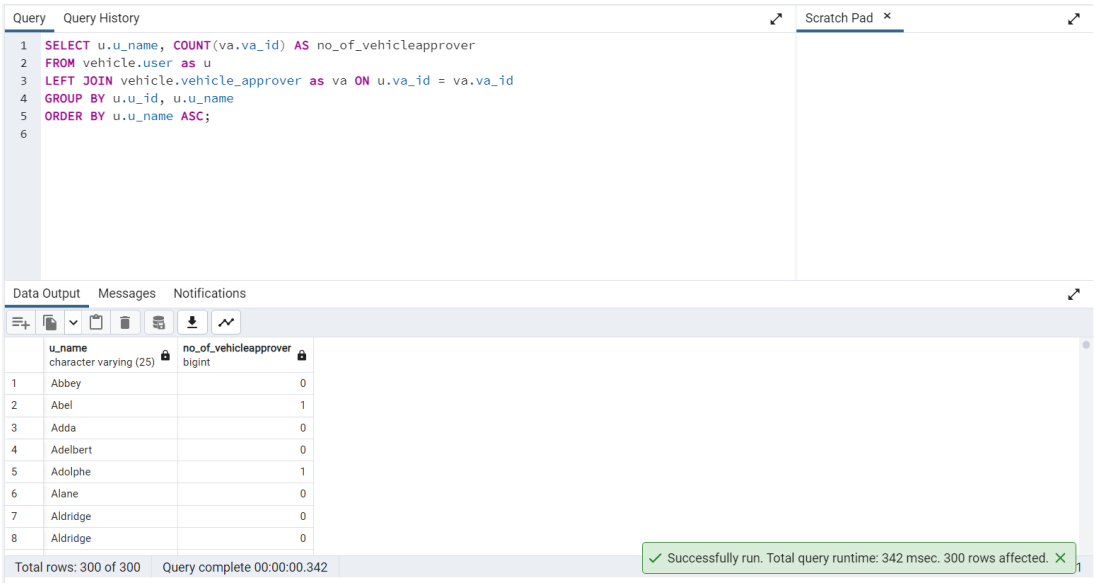
31. Find all detail of the staff who earn more than the average salary in staff department

```
SELECT *
FROM vehicle.staff as s
WHERE s.s_salary <
        (SELECT AVG(s.s_salary)
         FROM vehicle.staff as s);
```



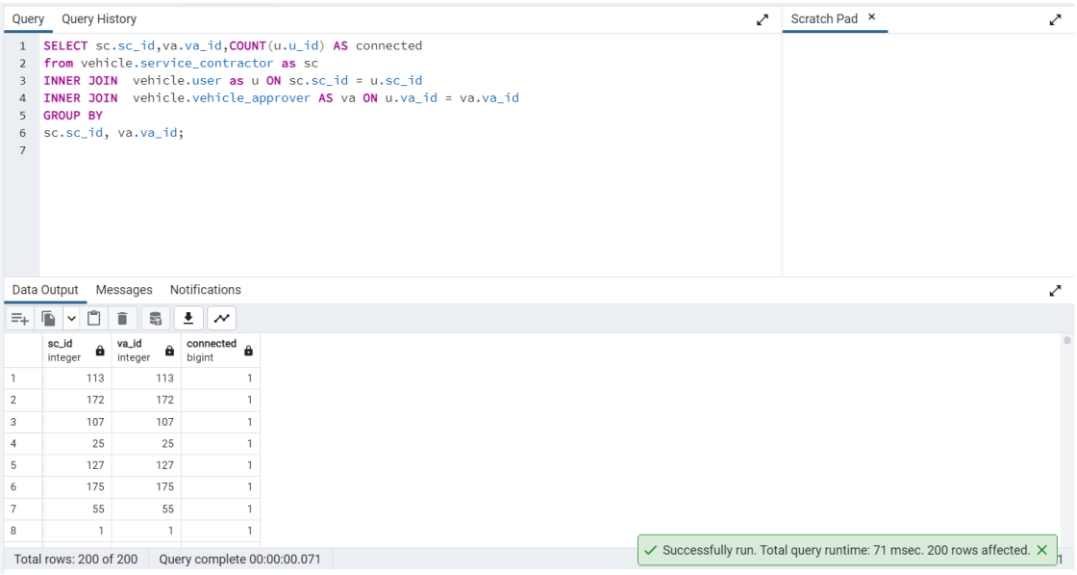
32. List of all user name and count of vehicle approve with the number of related vehicle approver.

```
SELECT u.u_name, COUNT(va.va_id) AS no_of_vehicleapprover
FROM vehicle.user as u
LEFT JOIN vehicle.vehicle_approver as va ON u.va_id = va.va_id
GROUP BY u.u_id, u.u_name
ORDER BY u.u_name ASC;
```



33. Show how many vehicle approver and service provider connected to eachother.

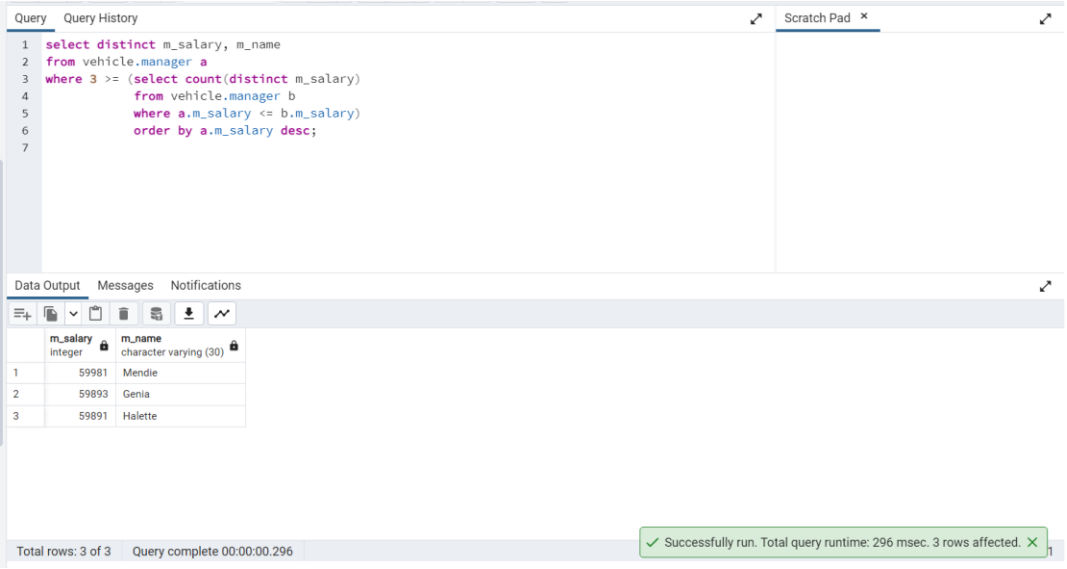
```
SELECT sc.sc_id,va.va_id,COUNT(u.u_id) AS connected
from vehicle.service_contractor as sc
INNER JOIN  vehicle.user as u ON sc.sc_id = u.sc_id
INNER JOIN  vehicle.vehicle_approver AS va ON u.va_id = va.va_id
GROUP BY
sc.sc_id, va.va_id;
```



	sc_id integer	va_id integer	connected bigint
1	113	113	1
2	172	172	1
3	107	107	1
4	25	25	1
5	127	127	1
6	175	175	1
7	55	55	1
8	1	1	1

34. Get 3 Highest salaries and manager name from manager table.

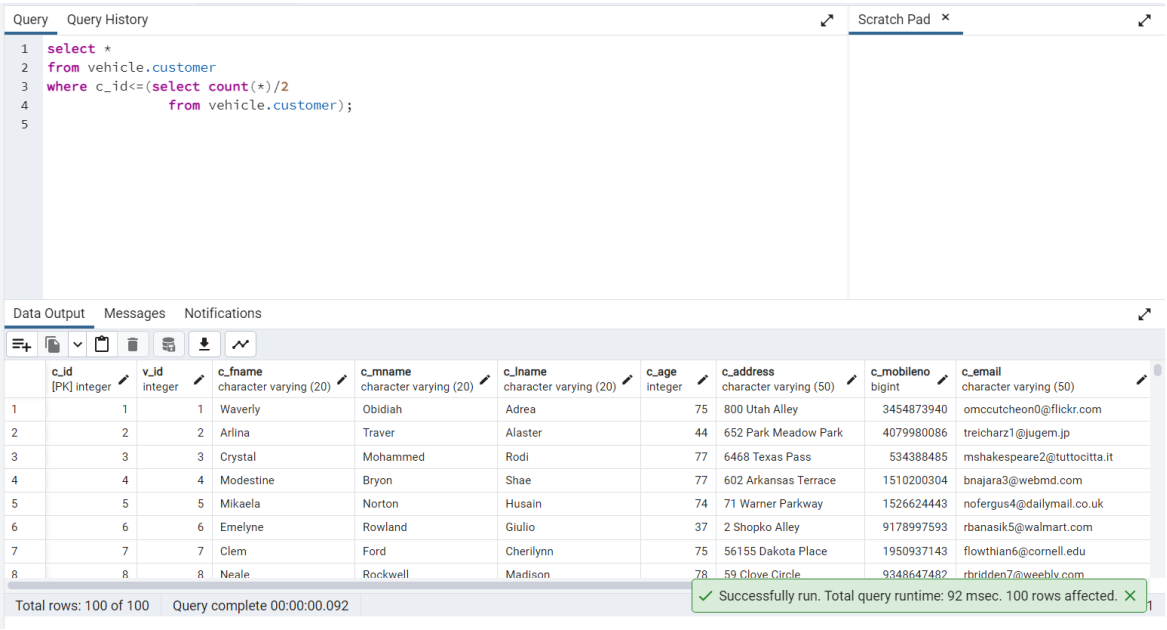
```
select distinct m_salary, m_name
from vehicle.manager a
where 3 >= (select count(distinct m_salary)
                    from vehicle.manager b
                    where a.m_salary <= b.m_salary)
                    order by a.m_salary desc;
```



	m_salary integer	m_name character varying (30)
1	59981	Mendie
2	59893	Genia
3	59891	Halette

35. Display first 50% records from customer table

```
select *
from vehicle.customer
where c_id<=(select count(*)/2
                    from vehicle.customer);
```



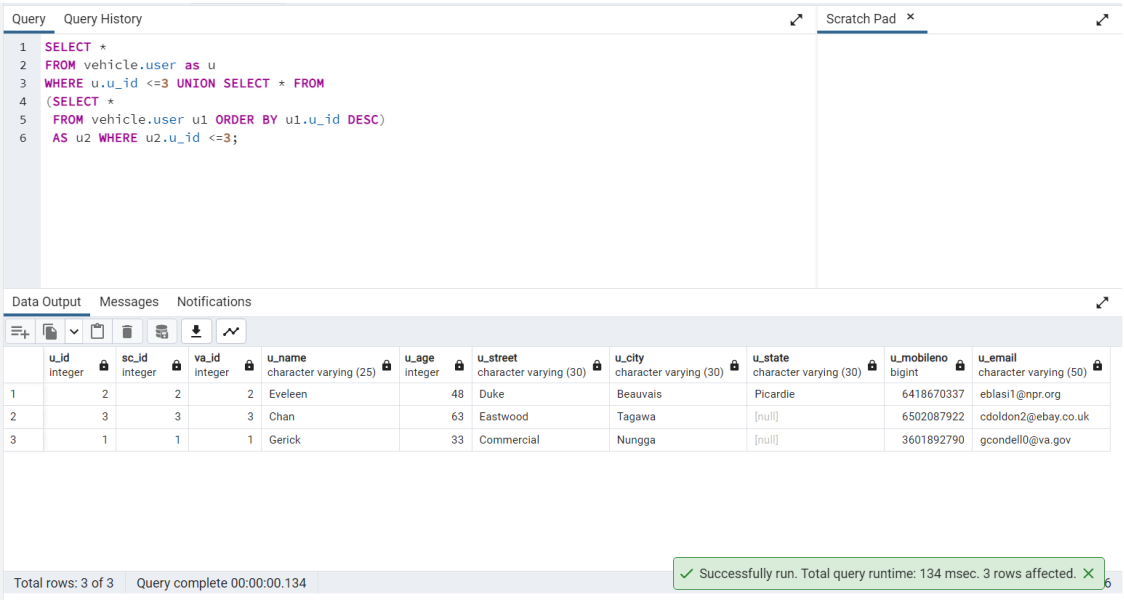
c_id [PK] integer	v_id integer	c_fname character varying (20)	c_mname character varying (20)	c_lname character varying (20)	c_age integer	c_address character varying (50)	c_mobileno bigint	c_email character varying (50)
1	1	Waverly	Obidiah	Adrea	75	800 Utah Alley	3454873940	omccutcheon0@flickr.com
2	2	Arlina	Traver	Alaster	44	652 Park Meadow Park	4079980086	treicharz1@jugem.jp
3	3	Crystal	Mohammed	Rodi	77	6468 Texas Pass	534388485	mshakespeare2@tuttocitta.it
4	4	Modestine	Bryon	Shae	77	602 Arkansas Terrace	1510200304	bnajara3@webmd.com
5	5	Mikaela	Norton	Husain	74	71 Warner Parkway	1526624443	nofergus4@dailymail.co.uk
6	6	Emelyne	Rowland	Giulio	37	2 Shopko Alley	9178997593	rbanasik5@walmart.com
7	7	Clem	Ford	Cherilynn	75	56155 Dakota Place	1950937143	flowthian6@cornell.edu
8	8	Neale	Rockwell	Madison	78	59 Clove Circle	9348647482	rbridden7@weebly.com

Total rows: 100 of 100 Query complete 00:00:00.092

Successfully run. Total query runtime: 92 msec. 100 rows affected.

36. Write a query to retrieve the last 3 records from the user table.

```
SELECT *
FROM vehicle.user as u
WHERE u.u_id <=3 UNION SELECT * FROM
(SELECT *
 FROM vehicle.user u1 ORDER BY u1.u_id DESC)
 AS u2 WHERE u2.u_id <=3;
```



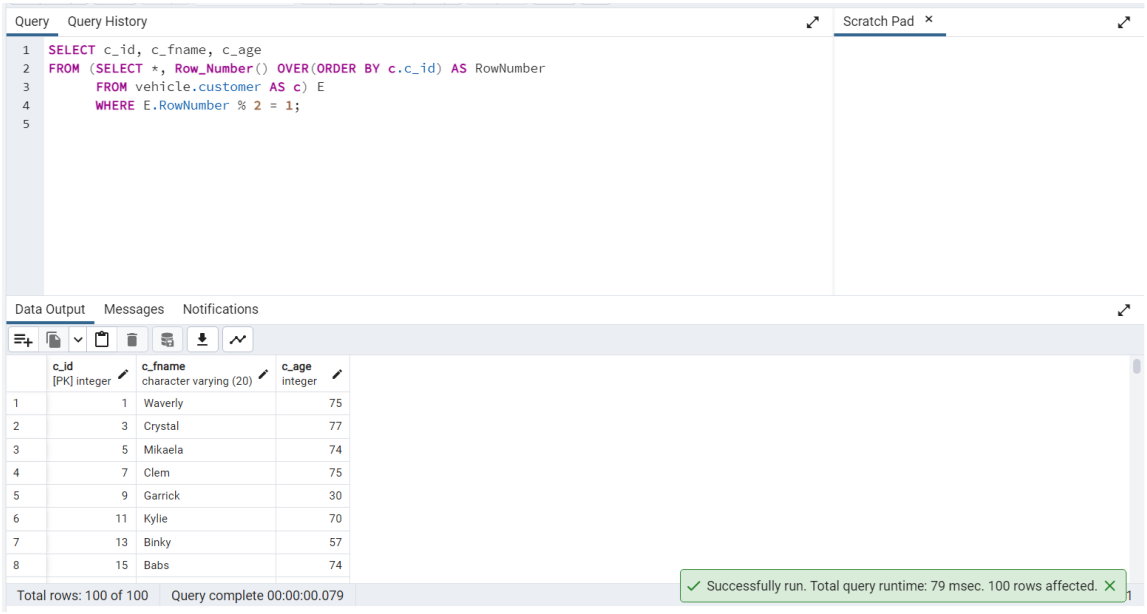
u_id integer	sc_id integer	va_id integer	u_name character varying (25)	u_age integer	u_street character varying (30)	u_city character varying (30)	u_state character varying (30)	u_mobileno bigint	u_email character varying (50)
2	2	2	Eveleen	48	Duke	Beauvais	Picardie	6418670337	eblasi1@npr.org
3	3	3	Chan	63	Eastwood	Tagawa	[null]	6502087922	cdoldon2@ebay.co.uk
1	1	1	Gerick	33	Commercial	Nungga	[null]	3601892790	gcondell0@va.gov

Total rows: 3 of 3 Query complete 00:00:00.134

Successfully run. Total query runtime: 134 msec. 3 rows affected.

37. Fetch only odd tuple from customer table.

```
SELECT c_id, c_fname, c_age
FROM (SELECT *, Row_Number() OVER(ORDER BY c.c_id) AS RowNumber
        FROM vehicle.customer AS c) E
        WHERE E.RowNumber % 2 = 1;
```



Query | Query History | Scratch Pad

```
SELECT c_id, c_fname, c_age
FROM (SELECT *, Row_Number() OVER(ORDER BY c.c_id) AS RowNumber
      FROM vehicle.customer AS c) E
      WHERE E.RowNumber % 2 = 1;
```

Data Output | Messages | Notifications

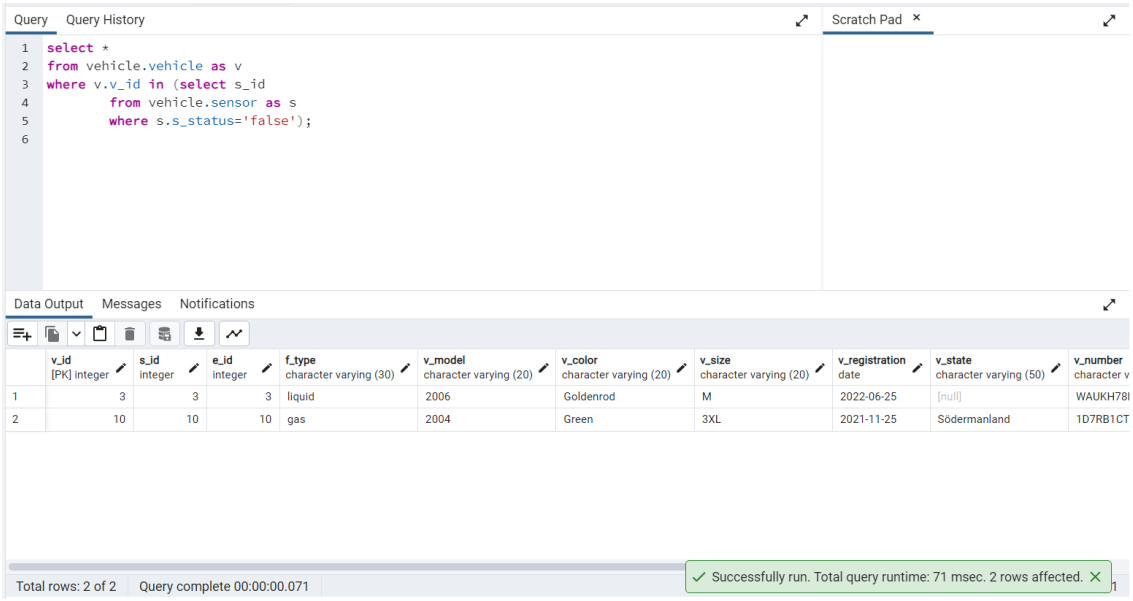
	c_id [PK] integer	c_fname character varying (20)	c_age integer
1	1	Waverly	75
2	3	Crystal	77
3	5	Mikaela	74
4	7	Clem	75
5	9	Garrick	30
6	11	Kylie	70
7	13	Binky	57
8	15	Babs	74

Total rows: 100 of 100 | Query complete 00:00:00.079

✓ Successfully run. Total query runtime: 79 msec. 100 rows affected.

38. Show vehicle detail which vehicle's sensor is not working.

```
select *
from vehicle.vehicle as v
where v.v_id in (select s_id
                 from vehicle.sensor as s
                 where s.s_status='false');
```



Query | Query History | Scratch Pad

```
select *
from vehicle.vehicle as v
where v.v_id in (select s_id
        from vehicle.sensor as s
        where s.s_status='false');
```

Data Output | Messages | Notifications

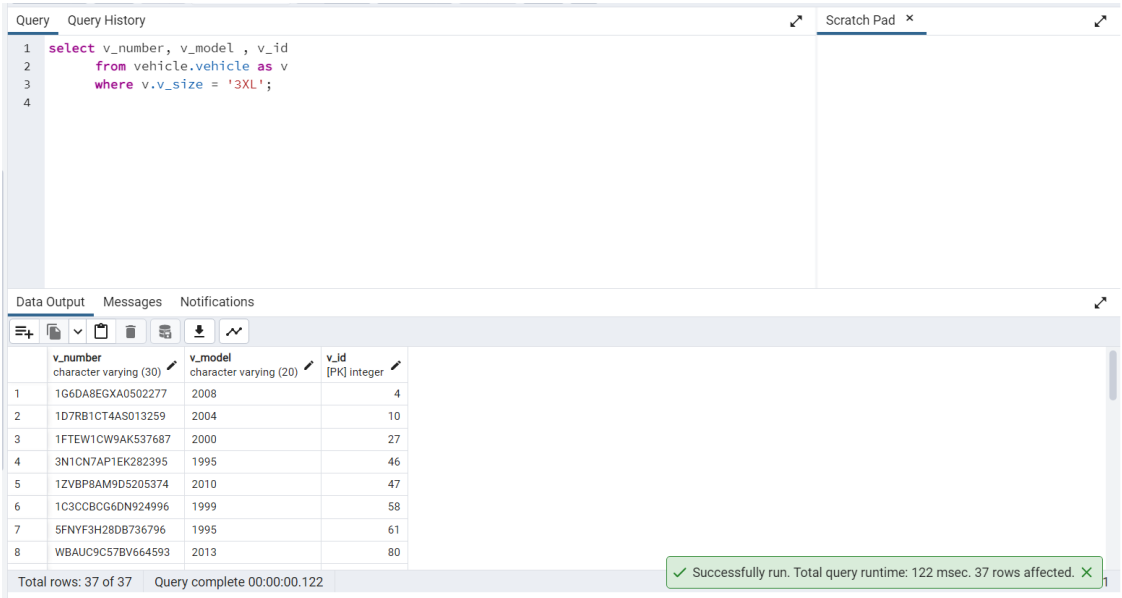
	v_id [PK] integer	s_id integer	e_id integer	f_type character varying (30)	v_model character varying (20)	v_color character varying (20)	v_size character varying (20)	v_registration date	v_state character varying (50)	v_number character v
1	3	3	3	liquid	2006	Goldenrod	M	2022-06-25	[null]	WAUKH78I
2	10	10	10	gas	2004	Green	3XL	2021-11-25	Södermanland	1D7RB1CT

Total rows: 2 of 2 | Query complete 00:00:00.071

✓ Successfully run. Total query runtime: 71 msec. 2 rows affected.

39. Select vehicle number , model and vehicle id of all large size vehicle.

```
select v_number, v_model , v_id
from vehicle.vehicle as v
where v.v_size = '3XL';
```



40. Find the second highest salary of a staff member(without using a limit).

```
select max(s_salary)
from vehicle.staff as s
where s.s_salary <>(select max(s_salary)
                    from vehicle.staff);
```