



University of Brighton

SCHOOL OF COMPUTING, ENGINEERING AND MATHEMATICS

“Ellie’s Electric Cars”

Submitted By

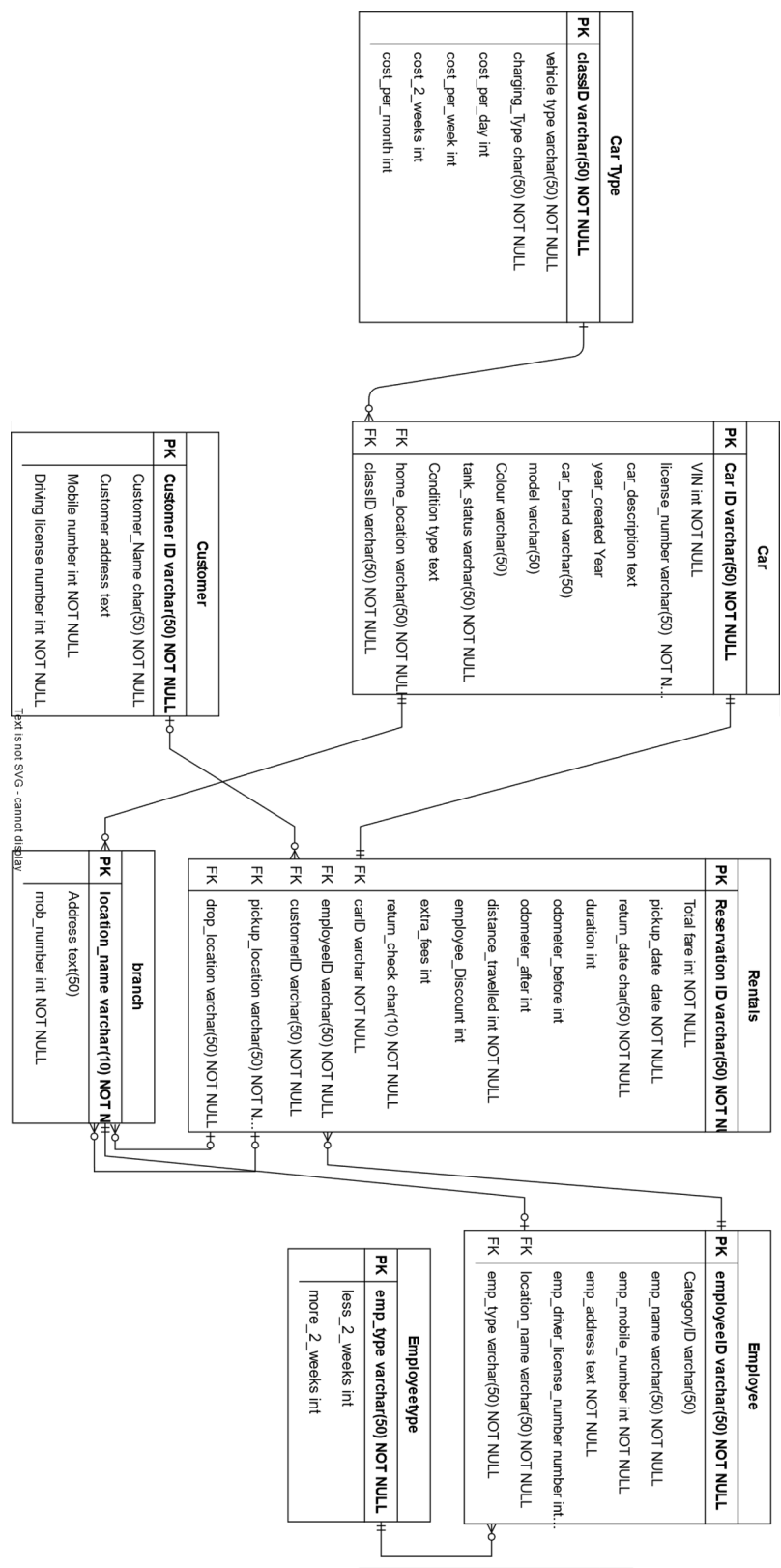
ROSHAN D K

CONTENTS

1. Entity Relationship Diagram (ERD)	2
2. Prototype Database	3
3. Star Schema (Data Warehouse)	4
4. Privacy and Security Implications	7
5. References	7

Entity Relationship Diagram (ERD)

Draw.io table



Summary

Prototype Database

1. Record information for cars, customers, and staff

Cartype Table

```
CREATE TABLE Cartype (  
    classID varchar(50) NOT NULL,  
    vehicle_type varchar(50) NOT NULL,  
    charging_Type char(50) NOT NULL,  
    cost_per_day int,  
    cost_per_week int,  
    cost_2_weeks int,  
    cost_per_month int,  
    PRIMARY KEY (classID),  
);  
INSERT INTO Cartype (classID, vehicle_type, charging_Type, cost_per_day, cost_per_week, cost_2_weeks, cost_per_month) VALUES  
('COM1', 'COMPACT', 'Electric', '38', '396', '715', '1123'),  
('COM2', 'COMPACT', 'Hybrid', '31', '350', '676', '1116'),  
('VA1', 'VAN', 'Electric', '67', '321', '745', '1118'),  
('VA2', 'VAN', 'Hybrid', '39', '373', '707', '1142'),  
('LUX1', 'LUXARY', 'Electric', '52', '364', '705', '1215'),  
('LUX2', 'LUXARY', 'Hybrid', '30', '302', '688', '1155');  
SELECT * FROM Cartype;
```

	classID	vehicle_type	charging_Type	cost_per_day	cost_per_week	cost_2_weeks	cost_per_month
1	COM1	COMPACT	Electric	38	396	715	1123
2	COM2	COMPACT	Hybrid	31	350	676	1116
3	LUX1	LUXARY	Electric	52	364	705	1215
4	LUX2	LUXARY	Hybrid	30	302	688	1155
5	VA1	VAN	Electric	67	321	745	1118
6	VA2	VAN	Hybrid	39	373	707	1142

Branch table

```
CREATE TABLE branch (  
    location_name varchar(50) NOT NULL,  
    Address text,  
    mob_number varchar(50),  
    PRIMARY KEY (location_name)  
);  
INSERT INTO branch (location_name, Address, mob_number) VALUES  
('Brighton', '20 St James\s St, Kemptown, Brighton BN2 1RF', '7935545454'),  
('Dove', '62 Biggin St, Dover CT16 1DD', '7843524363'),  
('Hastings', '21-22 George St, Hastings TN34 3EG', '7933535532'),  
('Lewes', '85 Stanley Road INVERNESS IV93 8KQ', '7809732397');  
SELECT * FROM branch;
```

	location_name	Address	mob_number
1	Brighton	20 St James\s St, Kemptown, Brighton BN2 1RF	7935545454
2	Dove	62 Biggin St, Dover CT16 1DD	7843524363
3	Hastings	21-22 George St, Hastings TN34 3EG	7933535532
4	Lewes	85 Stanley Road INVERNESS IV93 8KQ	7809732397

Car Table

```
CREATE TABLE Car (
  carID varchar(50) NOT NULL,
  classID varchar(50) NOT NULL,
  vin varchar(50) NOT NULL,
  license_number varchar(50) NOT NULL,
  car_description text,
  year_created Date,
  car_brand varchar(50),
  model varchar(50),
  colour varchar(50),
  tank_status varchar(50) NOT NULL,
  condition_type text,
  home_location varchar(50) NOT NULL,
  PRIMARY KEY (carID),
  FOREIGN KEY (home_location) REFERENCES branch(location_name),
  FOREIGN KEY (classID) REFERENCES Cartype(classID)
);
```

Inserting data in Car Table

```
INSERT INTO Car (carID, classID, vin, license_number, car_description, year_created, car_brand, model, colour, tank_status, condition_type, home_location)
VALUES
('10', 'COM1', '5GZCZ53486S935759', 'QQ20ZHX', 'FORDFocusGrey', '2020', 'FORD', 'Focus', 'Grey', 'empty', 'Good', 'Dove'),
('14', 'COM2', '2G1WS551869347781', 'FG22VXB', 'ToyotaPriuswhite', '2021', 'Toyota', 'Prius', 'white', 'quarter full', 'Shield broken', 'Lewes'),
('18', 'COM1', '1FTEW1EF7FFA55042', 'AG21SKS', 'HyundaiioniqlsSilver', '2021', 'Hyundai', 'ioniq', 'Silver', 'half', 'Scratch on bumper', 'Dove'),
('22', 'COM2', '2G1WS551869347781', 'YH22SJS', 'VWgolfWhite', '2022', 'VW', 'Golf', 'White', 'full', 'Shield broken', 'Brighton'),
('26', 'VA1', '1FTEW1EF7FFA55043', 'DT21VDB', 'FordTransitWhite', '2020', 'Ford', 'Transit', 'White', 'quarter full', 'Scratch on bumper', 'Brighton'),
('30', 'VA2', '2G1WS551869347781', 'UU20DVD', 'MercedesSprinterBlack', '2020', 'Mercedes', 'Sprinter', 'Black', 'half', 'Good', 'Hastings'),
('34', 'VA1', '1FTEW1EF7FFA55044', 'PP21BDHB', 'RenaultPRO+Grey', '2021', 'Renault', 'PRO+', 'Grey', 'full', 'Dent on the window', 'Hastings'),
('38', 'VA2', '2G1WS551869347781', 'YY22BDH', 'FordTransitWhite', '2022', 'Ford', 'Transit', 'White', 'empty', 'Good', 'Lewes'),
('42', 'LUX1', '2G1WS551869347781', 'TT19GDG', 'MercedesE332Sliver', '2019', 'Mercedes', 'E332', 'Sliver', 'half', 'Dent on the window', 'Brighton'),
('46', 'LUX1', '1FTEW1EF7FFA55043', 'BB22GDG', 'BMWwi8Sliver', '2022', 'BMW', 'i8', 'Sliver', 'full', 'Scratch on bumper', 'Brighton'),
('50', 'LUX2', '2G1WS551869347781', 'OQ21BDN', 'JaguarXFWhite', '2021', 'Jaguar', 'XF', 'White', 'empty', 'Good', 'Dove'),
('54', 'LUX1', '2G1WS551869347781', 'PL22UEH', 'TeslaModel XWhite', '2022', 'Tesla', 'Model X', 'White', 'half', 'Dent on the window', 'Brighton'),
('58', 'LUX2', '1FTEW1EF7FFA55043', 'OL22BDB', 'TeslaModel XWhite', '2022', 'Tesla', 'Model X', 'White', 'quarter full', 'Scratch on bumper', 'Lewes');
```

Output

	carID	classID	vin	license_number	car_description	year_created	car_brand	model	colour	tank_status	condition_type	home_location
1	10	COM1	5GZCZ53486S935759	QQ20ZHX	FORDFocusGrey	2020-01-01	FORD	Focus	Grey	empty	Good	Dove
2	14	COM2	2G1WS551869347781	FG22VXB	ToyotaPriuswhite	2021-01-01	Toyota	Prius	white	quarter full	Shield broken	Lewes
3	18	COM1	1FTEW1EF7FFA55042	AG21SKS	HyundaiioniqlsSilver	2021-01-01	Hyundai	ioniq	Silver	half	Scratch on bumper	Dove
4	22	COM2	2G1WS551869347781	YH22SJS	VWgolfWhite	2022-01-01	VW	Golf	White	full	Shield broken	Brighton
5	26	VA1	1FTEW1EF7FFA55043	DT21VDB	FordTransitWhite	2020-01-01	Ford	Transit	White	quarter full	Scratch on bumper	Brighton
6	30	VA2	2G1WS551869347781	UU20DVD	MercedesSprinterBlack	2020-01-01	Mercedes	Sprinter	Black	half	Good	Hastings
7	34	VA1	1FTEW1EF7FFA55044	PP21BDHB	RenaultPRO+Grey	2021-01-01	Renault	PRO+	Grey	full	Dent on the window	Hastings
8	38	VA2	2G1WS551869347781	YY22BDH	FordTransitWhite	2022-01-01	Ford	Transit	White	empty	Good	Lewes
9	42	LUX1	2G1WS551869347781	TT19GDG	MercedesE332Sliver	2019-01-01	Mercedes	E332	Sliver	half	Dent on the window	Brighton
10	46	LUX1	1FTEW1EF7FFA55043	BB22GDG	BMWwi8Sliver	2022-01-01	BMW	i8	Sliver	full	Scratch on bumper	Brighton
11	50	LUX2	2G1WS551869347781	OQ21BDN	JaguarXFWhite	2021-01-01	Jaguar	XF	White	empty	Good	Dove
12	54	LUX1	2G1WS551869347781	PL22UEH	TeslaModel XWhite	2022-01-01	Tesla	Model X	White	half	Dent on the window	Brighton
13	58	LUX2	1FTEW1EF7FFA55043	OL22BDB	TeslaModel XWhite	2022-01-01	Tesla	Model X	White	quarter full	Scratch on bumper	Lewes

Employee type Table

```
CREATE TABLE Employeetype (  
    emp_type varchar(50),  
    less_2_weeks int,  
    more_2_weeks int,  
    PRIMARY KEY(emp_type)  
);  
  
INSERT INTO Employeetype (emp_type, less_2_weeks, more_2_weeks) VALUES  
    ('managers', '50', '10'),  
    ('workers', '50', '10'),  
    ('cleaners', '50', '10'),  
    ('clerks', '50', '10');
```

SELECT * From Employeetype

100 %

Results Messages

	emp_type	less_2_weeks	more_2_weeks
1	cleaners	50	10
2	clerks	50	10
3	managers	50	10
4	workers	50	10

Employee Table

```
CREATE TABLE Employee (  
    employeeID varchar(50),  
    location_name varchar(50),  
    CategoryID varchar(50),  
    emp_type varchar(50) NOT NULL,  
    emp_name varchar(50) NOT NULL,  
    emp_mobile_number varchar(50),  
    emp_address text,  
    emp_driver_license_number varchar(50) NOT NULL,  
    PRIMARY KEY (employeeID),  
    FOREIGN KEY (emp_type) REFERENCES Employeetype(emp_type)  
);  
  
Alter table Employee  
ADD FOREIGN KEY (location_name) REFERENCES branch(location_name);  
SELECT * FROM Employee;
```

Output

	employeeID	location_name	CategoryID	emp_type	emp_name	emp_mobile_number	emp_address	emp_driver_license_number
1	101	Brighton	MN1	managers	Isai Hernandez	7001543038	11 Main Road FALKIRK FK22 0ER	TATE9805263BE9AT
2	104	Dove	ST11	workers	Kimberly Good	7054303092	811 Alexander Road TUNBRIDGE WELLS TN72 4AY	DORIA861117LI90D
3	107	Hastings	CL1	cleaners	Aydin Knox	7026760197	5 Green Lane CAMBRIDGE CB69 3VD	MESSE904134DE9EM
4	110	Lewes	CR1	clerks	Miguel Bond	7043191792	80 Church Street CARLISLE CA92 9YG	LAVEY808163YA9AL
5	113	Hastings	MN1	managers	Alisha Bishop	7001459407	849 Station Road PRESTON PR29 8NJ	FISH9803252CA9IF
6	116	Lewes	CL1	cleaners	Isha McKay	7013533955	33 Albert Road LONDON SW53 6SR	POTTE606230WI9OP
7	119	Brighton	CR1	clerks	Samson McGowan	7037707474	"298 The Crescent KILMARNOCK KA17 7ZK"	CROFT955227CL9RC
8	122	Dove	CR1	clerks	Autumn Burns	7002507883	"1 High Street IPSWICH IP38 6QQ"	FISH9002182MA9IF
9	125	Hastings	MN1	managers	Cleo Pearce	7025424244	"43 Highfield Road LEICESTER LE18 0VE"	POTTE660190KA9OP
10	128	Lewes	ST11	workers	Kacper Pineda	7063126999	"26 Stanley Road GLASGOW G18 2OT"	JONES403077DE9OJ
11	131	Lewes	CR1	clerks	Mercedes Durham	7092983630	"1 Highfield Road BELFAST BT59 7GM"	ORWEL661231SA9RO
12	134	Hastings	MN1	managers	Safa Leon	7007239053	"773 Mill Road WORCESTER WR75 7AY"	OWEN9862062SA9WO
13	137	Brighton	ST11	workers	Lila Mata	7060338182	"80 Mill Lane SHEFFIELD S40 2AZ"	KING9504056ZA9IK

Customer Table

```

CREATE TABLE Customer (
  customerID varchar(50),
  customer_name varchar(50),
  mobile_number varchar(50),
  cust_address text,
  driver_license_number varchar(50) NOT NULL,
  comments text
  PRIMARY KEY (customerID)
);

INSERT INTO Customer (customerID, customer_name, mobile_number, cust_address, driver_license_number, comments) VALUES
('502', 'Kenzie Sheppard', '7785131289', '61 London Road NEWPORT NP80 3JI', 'TAYLO655247UR9AT', 'Damage to frontlight'),
('505', 'Erica Cochran', '7797997792', '33 Albert Road LONDON SW53 6SR', 'JACKS856037KA9AJ', ''),
('508', 'Omar Maddox', '7709156719', '840 Manor Road LANCASTER LA49 0NC', 'ORWEL612274NI9RO', 'dent on left side'),
('511', 'Adison Vang', '7784873535', '85 Stanley Road INVERNESS IV93 8KQ', 'PALIN908243FR9AP', ''),
('514', 'Brooklyn Green', '7779612301', '819 Church Road STOCKPORT SK37 4RX', 'EMBUR812132HE9ME', 'car crashed'),
('517', 'Kaden Yoder', '7717905654', '"26 Stanley Road G18 2OT"', 'POTTE606230WI9OP', ''),
('520', 'Shelby Mooney', '7781907369', '"1 Highfield Road BT59 7GM"', 'CROFT955227CL9RC', 'Bonnet missing'),
('523', 'Robbie Pruitt', '7783727523', '"773 Mill Road WR75 7AY"', 'FISH9002182MA9IF', ''),
('526', 'Mae Bowman', '7706438239', '"80 Mill Lane SHEFFIELD S40 2AZ"', 'POTTE660190KA9OP', ''),
('529', 'Melissa Wright', '7768106492', '"9429 King Street BRISTOL BS64 5BX"', 'MESSE904134DE9EM', '');

```

Output

	customerID	customer_name	mobile_number	cust_address	driver_license_number	comments
1	502	Kenzie Sheppard	7785131289	61 London Road NEWPORT NP80 3JI	TAYLO655247UR9AT	Damage to frontlight + 25 pounds
2	505	Erica Cochran	7797997792	33 Albert Road LONDON SW53 6SR	JACKS856037KA9AJ	
3	508	Omar Maddox	7709156719	840 Manor Road LANCASTER LA49 0NC	ORWEL612274NI9RO	dent on left side + 10 pounds
4	511	Adison Vang	7784873535	85 Stanley Road INVERNESS IV93 8KQ	PALIN908243FR9AP	
5	514	Brooklyn Green	7779612301	819 Church Road STOCKPORT SK37 4RX	EMBUR812132HE9ME	car crashed + 700 pounds
6	517	Kaden Yoder	7717905654	"26 Stanley Road G18 2OT"	POTTE606230WI9OP	
7	520	Shelby Mooney	7781907369	"1 Highfield Road BT59 7GM"	CROFT955227CL9RC	Bonnet missing + 250 pounds
8	523	Robbie Pruitt	7783727523	"773 Mill Road WR75 7AY"	FISH9002182MA9IF	
9	526	Mae Bowman	7706438239	"80 Mill Lane SHEFFIELD S40 2AZ"	POTTE660190KA9OP	
10	529	Melissa Wright	7768106492	"9429 King Street BRISTOL BS64 5BX"	MESSE904134DE9EM	
11	532	Micheal Connolly	7736681435	"298 The Crescent KILMARNOCK KA17 7ZK"	ORWEL661231SA9RO	side mirror broken + 100 pounds

Rentals Table


```

CREATE TABLE Rentals (
    Reservation_ID varchar(50) NOT NULL,
    customerID varchar(50) ,
    pickup_date date ,
    return_date date ,
    duration int,
    pickup_location char(20) ,
    drop_location char(20) ,
    odometer_before int,
    odometer_after int,
    distance_travelled int ,
    employee_Discount int,
    extra_fees int ,
    return_check char(20) ,
    carID varchar(50) ,
    PRIMARY KEY (Reservation_ID),
    FOREIGN KEY (carID) REFERENCES Car(carID)
);

Alter table Rentals
ADD FOREIGN KEY (customerID) REFERENCES Employee(employeeID);

Alter table Rentals
ADD FOREIGN KEY (customerID) REFERENCES Customer(customerID);

```

Output

Results		Messages											
	Reservation_ID	customerID	pickup_date	return_date	duration	pickup_location	drop_location	odometer_before	odometer_after	distance_travelled	employee_Discount	extra_fees	return_chec
1	1040	532	2021-10-01	2021-10-17	16	Hastings	Dove	23456	23481	25	0	10	Yes
2	1041	535	2021-10-02	2021-10-16	14	Lewes	Lewes	23458	23471	13	0	20	Yes
3	1042	538	2021-10-03	2021-10-18	15	Dove	Lewes	34768	34811	43	0	50	Yes
4	1043	511	2021-10-04	2021-10-08	4	Brighton	Hastings	34770	34815	45	0	70	Yes
5	1044	514	2021-10-05	2021-10-08	3	Dove	Brighton	34572	34604	32	0	30	Yes
6	1045	517	2021-10-06	2021-10-30	24	Hastings	Dove	34580	34625	45	0	40	Yes
7	1046	520	2021-10-09	2021-11-05	27	Lewes	Hastings	34576	34599	23	0	60	Yes
8	1047	523	2021-10-10	2021-11-12	33	Hastings	Lewes	34584	34605	21	0	10	Yes
9	1048	526	2021-11-03	2021-12-03	30	Brighton	Hastings	34772	34806	34	0	50	Yes
10	1049	128	2021-11-05	2021-11-25	20	Dove	Brighton	34774	34786	12	50	70	Yes
11	1050	131	2021-11-08	2021-11-15	7	Lewes	Dove	23460	23482	22	10	30	Yes
12	1051	134	2021-11-09	2021-11-10	1	Hastings	Brighton	23462	23505	43	10	10	Yes
13	1052	137	2021-11-10	2021-11-20	10	Lewes	Hastings	23464	23486	22	10	70	Yes

Show all bookings, with full customer and vehicle information, including rental rate

```

SELECT * FROM Car
INNER JOIN Rentals ON Rentals.carID = Car.carID
INNER JOIN Customer ON Customer.customerID = Rentals.customerID
INNER JOIN Cartype ON Cartype.classID = Car.classID;

```

Output- (1st part)

Results Messages													
	carID	classID	vin	license_plate	car_description	year_created	car_brand	model	colour	tank_status	condition_type	home_location	Reservation_ID
1	18	COM1	1FTEW1EF7FFA55042	AG215KS	HyundaiIoniqSilver	2021-01-01	Hyundai	ioniq	Silver	half	Scratch on bumper	Dove	1040
2	22	COM2	2G1WS551869347781	YH225JS	VW Golf White	2022-01-01	VW	Golf	White	full	Shield broken	Brighton	1041
3	26	VA1	1FTEW1EF7FFA55043	DT21VDB	Ford Transit White	2020-01-01	Ford	Transit	White	quarter full	Scratch on bumper	Brighton	1042
4	30	VA2	2G1WS551869347781	UU20DVD	Mercedes Sprinter Black	2020-01-01	Mercedes	Sprinter	Black	half	Good	Hastings	1043
5	34	VA1	1FTEW1EF7FFA55044	PP21BDHB	Renault PRO+ Grey	2021-01-01	Renault	PRO+	Grey	full	Dent on the window	Hastings	1044
6	42	LUX1	2G1WS551869347781	TT19GDG	Mercedes E332 Silver	2019-01-01	Mercedes	E332	Silver	half	Dent on the window	Brighton	1046
7	46	LUX1	1FTEW1EF7FFA55043	BB22GDG	BMW i8 Silver	2022-01-01	BMW	i8	Silver	full	Scratch on bumper	Brighton	1047
8	50	LUX2	2G1WS551869347781	OQ21BDN	Jaguar XF White	2021-01-01	Jaguar	XF	White	empty	Good	Dove	1048
9	14	COM2	2G1WS551869347781	FG22VXB	Toyota Prius white	2021-01-01	Toyota	Prius	white	quarter full	Shield broken	Lewes	1052

(2nd Part)

Results Messages													
	customerID	pickup_date	return_date	total_amount	duration	pickup_location	drop_location	odometer_before	odometer_after	distance_travelled	employee_Discount	extra_fees	return_check
1	532	2021-10-01	2021-10-17	470	16	Hastings	Dove	23456	23481	25	0	10	Yes
2	535	2021-10-02	2021-10-16	450	14	Lewes	Lewes	23458	23471	13	0	20	Yes
3	538	2021-10-03	2021-10-18	460	15	Dove	Lewes	34768	34811	43	0	50	Yes
4	511	2021-10-04	2021-10-08	115	4	Brighton	Hastings	34770	34815	45	0	70	Yes
5	514	2021-10-05	2021-10-08	96	3	Dove	Brighton	34572	34604	32	0	30	Yes
6	520	2021-10-09	2021-11-05	990	27	Lewes	Hastings	34576	34599	23	0	60	Yes
7	523	2021-11-00	2021-11-12	1020	33	Hastings	Lewes	34584	34605	21	0	10	Yes
8	526	2021-11-03	2021-12-03	1010	30	Brighton	Hastings	34772	34806	34	0	50	Yes
9	535	2021-11-10	2021-11-20	320	10	Lewes	Hastings	23464	23486	22	10	70	Yes

(3rd part)

Results		Messages									
	carID	customerID	customer_name	mobile_number	cust_address	driver_license_number	comments	classID	vehicle_type	charging_Type	cost_per_day
1	18	532	Michael Connolly	7736681435	"298 The Crescent KILMARNOCK KA17 7ZK"	ORWEL661231SA9RO	side mirror broken	COM1	COMPACT	Electric	38
2	22	535	Ned Molina	7752445878	"1 High Street IPSWICH IP38 6QO"	OWEN9862062SA9WO		COM2	COMPACT	Hybrid	31
3	26	538	Austin Harper	7797485518	"43 Highfield Road LEICESTER LE18 0VE"	PALIN908243FR9AP		VA1	VAN	Electric	67
4	30	511	Adison Vang	7784873535	85 Stanley Road INVERNESS IV93 8KQ	PALIN908243FR9AP		VA2	VAN	Hybrid	39
5	34	514	Brooklyn Green	7779612301	819 Church Road STOCKPORT SK37 4RX	EMBUR812132HE9ME	car crashed	VA1	VAN	Electric	67
6	42	520	Shelby Mooney	7781907369	"1 Highfield Road BT59 7GM"	CROFT955227CL9RC	Bonnet missing	LUX1	LUXARY	Electric	52
7	46	523	Robbie Pruitt	7783727523	"773 Mill Road WR75 7AY"	FISH9002182MA9IF		LUX1	LUXARY	Electric	52
8	50	526	Mae Bowman	7706438239	"80 Mill Lane SHEFFIELD S40 2AZ"	POTTE660190KA9OP		LUX2	LUXARY	Hybrid	30
9	14	535	Ned Molina	7752445878	"1 High Street IPSWICH IP38 6QO"	OWEN9862062SA9WO		COM2	COMPACT	Hybrid	31

(4th part)

Results Messages											
	per	cust_address	driver_license_number	comments	classID	vehicle_type	charging_Type	cost_per_day	cost_per_week	cost_2_weeks	cost_per_month
1	5	"298 The Crescent KILMARNOCK KA17 7ZK"	ORWEL661231SA9RO	side mirror broken	COM1	COMPACT	Electric	38	396	715	1123
2	8	"1 High Street IPSWICH IP38 6QO"	OWEN9862062SA9WO		COM2	COMPACT	Hybrid	31	350	676	1116
3	8	"43 Highfield Road LEICESTER LE18 0VE"	PALIN908243FR9AP		VA1	VAN	Electric	67	321	745	1118
4	5	85 Stanley Road INVERNESS IV93 8KQ	PALIN908243FR9AP		VA2	VAN	Hybrid	39	373	707	1142
5	1	819 Church Road STOCKPORT SK37 4RX	EMBUR812132HE9ME	car crashed	VA1	VAN	Electric	67	321	745	1118
6	9	"1 Highfield Road BT59 7GM"	CROFT955227CL9RC	Bonnet missing	LUX1	LUXARY	Electric	52	364	705	1215
7	3	"773 Mill Road WR75 7AY"	FISH9002182MA9IF		LUX1	LUXARY	Electric	52	364	705	1215
8	9	"80 Mill Lane SHEFFIELD S40 2AZ"	POTTE660190KA9OP		LUX2	LUXARY	Hybrid	30	302	688	1155
9	8	"1 High Street IPSWICH IP38 6QO"	OWEN9862062SA9WO		COM2	COMPACT	Hybrid	31	350	676	1116

Identify the 10% of customers who have spent the most in the last year

```

SELECT TOP (10) PERCENT total_amount, Reservation_ID, customer_name, driver_license_number, license_plate AS Car_license_plate, vehicle_type, charging_Type
FROM Rentals
INNER Join Car ON Car.carID = Rentals.carID
INNER Join Customer ON Customer.customerID = Rentals.customerID
INNER Join Cartype ON Cartype.classID = Car.classID
ORDER BY total_amount ASC;

```

Output

Results Messages									
	total_amount	Reservation_ID	customer_name	driver_license_number	Car_license_plate	vehicle_type	charging_Type	Duration	cost_per_day
1	1020	1047	Robbie Pruitt	FISH9002182MA9IF	BB22GDG	LUXARY	Electric	33	52

The percentage of time each vehicle has been rented for last two months

```
SELECT FORMAT(duration*100/60 * 0.01, 'P') AS percentcarused, license_plate, year_created, car_brand, model, colour, vehicle_type, charging_Type,
From Rentals
INNER Join Car ON Car.carID = Rentals.carID
INNER Join Cartype ON Cartype.classID = Car.classID;
```

Output

	percentcarused	license_plate	year_created	car_brand	model	colour	vehicle_type	charging_Type	duration
1	26.00%	AG21SKS	2021-01-01	Hyundai	ioniq	Sliver	COMPACT	Electric	16
2	23.00%	YH22SJS	2022-01-01	VW	Golf	White	COMPACT	Hybrid	14
3	25.00%	DT21VDB	2020-01-01	Ford	Transit	White	VAN	Electric	15
4	6.00%	UU20DVD	2020-01-01	Mercedes	Sprinter	Black	VAN	Hybrid	4
5	5.00%	PP21BDHB	2021-01-01	Renault	PRO+	Grey	VAN	Electric	3
6	40.00%	YY22BDH	2022-01-01	Ford	Transit	White	VAN	Hybrid	24
7	45.00%	TT19GDG	2019-01-01	Mercedes	E332	Sliver	LUXARY	Electric	27
8	55.00%	BB22GDG	2022-01-01	BMW	i8	Sliver	LUXARY	Electric	33
9	50.00%	OQ21BDN	2021-01-01	Jaguar	XF	White	LUXARY	Hybrid	30
10	33.00%	PL22UEH	2022-01-01	Tesla	Model X	White	LUXARY	Electric	20
11	11.00%	OL22BDB	2022-01-01	Tesla	Model X	White	LUXARY	Hybrid	7

For a given date, identify any vehicles that need to be moved back to home location

```
SELECT customer_name, return_date, vehicle_type, charging_Type, license_plate, car_description, year_created, car_brand, model
from Rentals
INNER Join Car ON Car.carID = Rentals.carID
INNER Join Customer ON Customer.customerID = Rentals.customerID
INNER Join Cartype ON Cartype.classID = Car.classID
Where home_location <> drop_location;
```

Output –

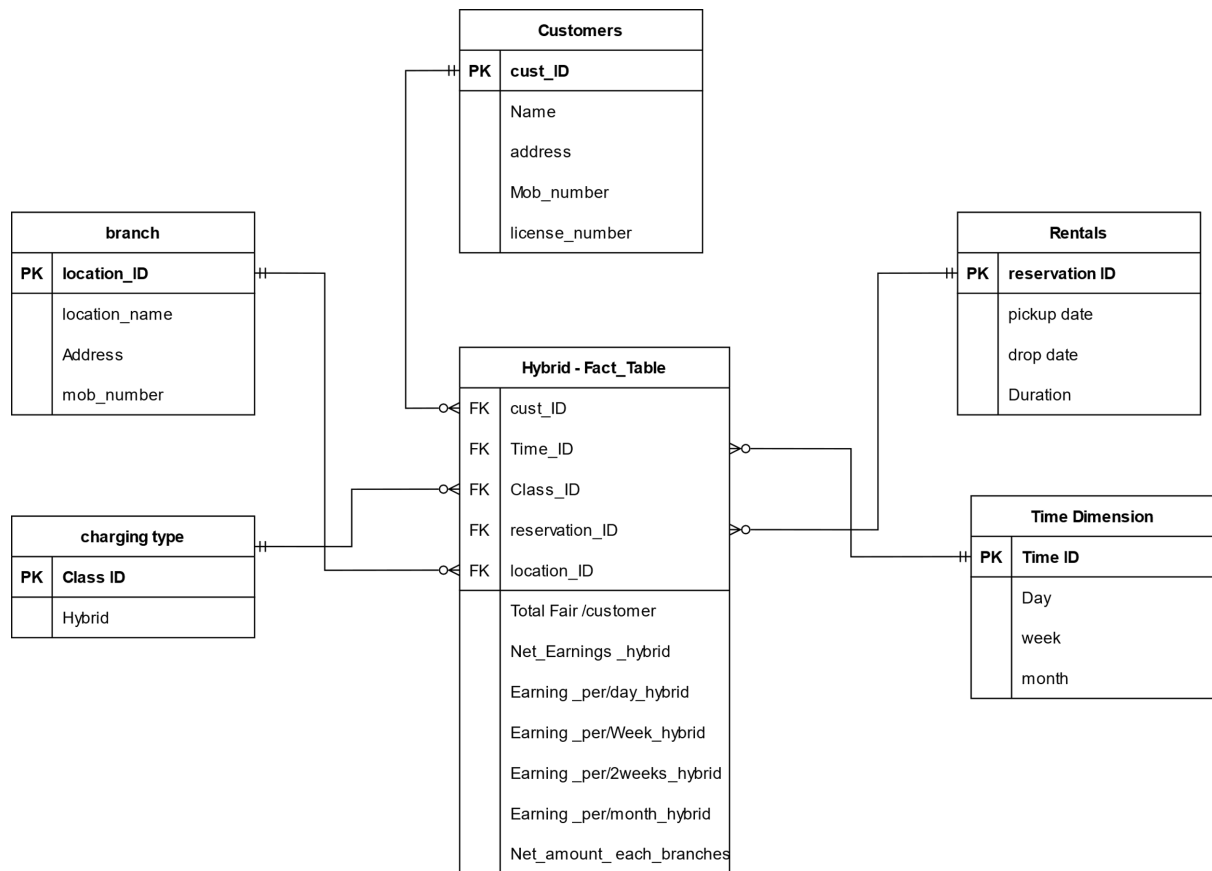
	customer_name	return_date	vehicle_type	charging_Type	license_plate	car_description	year_created	car_brand	model
1	Ned Molina	2021-10-16	COMPACT	Hybrid	YH22SJS	VW Golf White	2022-01-01	VW	Golf
2	Austin Harper	2021-10-18	VAN	Electric	DT21VDB	Ford Transit White	2020-01-01	Ford	Transit
3	Brooklyn Green	2021-10-08	VAN	Electric	PP21BDHB	Renault PRO+ Grey	2021-01-01	Renault	PRO+
4	Shelby Mooney	2021-11-05	LUXARY	Electric	TT19GDG	Mercedes E332 Sliver	2019-01-01	Mercedes	E332
5	Robbie Pruitt	2021-11-12	LUXARY	Electric	BB22GDG	BMW i8 Sliver	2022-01-01	BMW	i8
6	Mae Bowman	2021-12-03	LUXARY	Hybrid	OQ21BDN	Jaguar XF White	2021-01-01	Jaguar	XF
7	Ned Molina	2021-11-20	COMPACT	Hybrid	FG22VXB	Toyota Prius white	2021-01-01	Toyota	Prius

Assumptions

- Extra cost is charged based on condition of car and fuel check.
- Cost of the vehicles vary depending on the Vehicle type and Charging type.
-

Star Schema (Data Warehouse)

Schema



Transformation of Data for (Example: - Cartable)

carID	Internal	Joined to Rentals, joined to Car	
classID	Internal	Joined to Car, Joined to Class Type	Internal source ... If COM1 -> COMPACT Electric If COM2 -> COMPACT Hybrid If VA1 -> VAN Electric If VA2 -> VAN Hybrid If LUX1 -> LUXARY Electric If LUX2 -> LUXARY Hybrid If STD1 -> Standard Electric If STD2 -> Standard Hybrid
vin	Internal	Joined to Car	
license_plate	Internal	Joined to Car	

car_description	Internal	Joined to Car	
year_created	Internal	Joined to Car	
car_brand	Internal	Joined to Car	
model	Internal	Joined to Car	
colour	Internal	Joined to Car	
tank_status	Internal	Joined to Car	Internal source If Full tank -> 0 pound If empty -> 100 pound If quarter full -> 25 pound If half full -> 50 pound If three quarters full -> 75 pound
condition_type	Internal	Joined to Car	Assumption - Extra charge will be added to the customer based on the return vehicle condition
home_location	Internal	Joined to Car, Joined to branch	Locations -> Brighton Dove Hastings Lewes

How to improve Ellies car rental service using data warehousing?

Telematics Solutions are a critical part of data warehouse. Telematics systems may be incorporated into any warehouse environment to fulfil targeted KPIs and carry out digital transformation. Several advantages of this technology for the Ellies car rental service are such as

Dynamic pricing — In order to maximize income, Ellies car rental service must constantly spend a significant amount of time planning and managing the fleet. In this situation, telematics data can help with dynamic pricing while delivering a distinctive consumer experience. Customers renting a car for a fixed distance often complain about excessive charges, but by utilizing telematics data, car rentals can now warn the client when they exceed the mileage restriction and instantly tell them of the extra charges they would pay as a result, without waiting for it to show in the final bill or invoice. To boost client retention, it can produce a highly clear and reliable experience.

Fleet tracking and live updates — While most devices will provide this feature, the key is to utilize information more efficiently for fleet management and Logistics operations. For instance, employing vehicle monitoring data to facilitate automatic scheduling of vehicles and booking management, while leveraging live updating abilities to produce notifications that consumers and staff members find the most valuable. It is projected that automobile

rental firms would be able to use their fleets more efficiently by at least 10% to 15% thanks to the automated scheduling capability.

Fuel management — This is a serious concern for many automobiles rental businesses since fuel waste corresponds to greater operational costs. Data that may be used to improve fleet management and fuel efficiency can be accessed using telematics. For instance, one of the telematics businesses, Masternaut, created a guide to help consumers choose the right kind of car to buy to save money on gas. A car rental business may then pass on the savings to clients, who will save money on fuel while also helping to keep the environment cleaner.

Predictive maintenance and vehicle health monitoring — The rental industry is one of the best at utilising telematics devices that provide vehicle health and diagnostics data in real time, allowing for the prediction of when a vehicle may require routine maintenance to avoid unexpected complications.

Driving performance monitoring — In the automobile rental sector, there is a continuing discussion about limiting Emissions of co2 in vehicles and managing driving behaviour is a significant aspect of this challenge. Telematics can assist in addressing bad and reckless driving by providing real-time and in-cab feedback to drivers to help them improve their driving behaviour and therefore reduce CO2 emissions. for instance, When the driver presses the accelerator harder than normal, a warning light appears on the dashboard.

Privacy and Security Implications for Ellies Electric Car Services

Why is data collection necessary for the rental car industry?

This business develops a platform for customers to register and enter personal information. This enables users to perform a variety of beneficial tasks, like managing reservations or other purchases, taking advantage of exclusive discounts, and managing personal preferences and settings. Renting industry majorly utilise personal data to create and handle bookings, as well as to send details to companies that supply automobile or insurance

services. Additionally, personal data is also used to send reminders, modifications, and booking confirmations. It also makes it simpler for consumers to make future reservations. Personal data is used by businesses for customer insight and for product enhancement. This allows businesses to improve their offerings and improve the consumer experience. The primary purpose to analyse the personal data is to gain insights on how services work and are utilised, with the goal of optimising and customising websites and apps to make them as convenient and meaningful to use as possible. In some situations, companies analyse users' personal data to ease online check-in and collect personal data linked to damaged deposits. (Rentalcars.com)

What information does the Elties car rental company collect from its customers?

Data is extremely important to the rental car industry. The system in the cars generates large volumes of data of many types through a variety of sources, including telematic boxes, cameras, microphones, sensors, and GPS trackers. This can include operational data (e.g., number of passengers, fuel, speed, location), data related to maintenance issues (e.g., technical difficulties, oil levels, mileage due), data about the surroundings (e.g., temperature, weather conditions, road marking), data about user preferences and driver behaviours (e.g., speed patterns, distances driven, seat and steering wheel position). The data that infotainment and navigation systems save may include contacts, call logs, message information from the phone, call history, and financial information that has been sent to the car's operating system. The system in the vehicles also records administrative infractions like speeding or failing to stop at a red light, as well as criminal offences. Using the internal software and hardware of the vehicle, a mobile phone linked by Bluetooth can replicate the records of the previous locations of the vehicle, GPS navigation history, stored locations, and mobile phone data. Data gathered by linked automobiles is massive and incredibly diversified. When vehicle data are combined, it is possible to learn in-depth details about the preferences and driving behaviours. (Rentalcars.com)

What are the privacy and security implications for the Elties car rental company?

Customers' data collected by connected cars may be sensitive, and its misuse might have a negative impact on someone's personal and professional life. After the user's device is connected to the vehicle's system, for instance, calls may be automatically exchanged between the device and the car, and user personal preferences, contact information, calendar entries, and other content from the phone may be downloaded. The system may also be used to collect detailed records of a person's activities and locations. It can also repeatedly access a user's private settings via biometric information.

The "Digital Control Strategy" of the Metropolitan Police in the UK (United Kingdom) claims that infotainment systems in automobiles, which stores all the information, present a high security risk. Users' names and navigation history are important pieces of private information. When supplemented with a little open-source intelligence, such social media profiles, any person may be found using this information. In fact, a Baltimore car driver did exactly that when he used the device names saved in the linked device list on his Jeep's Connect system to track down adolescents who had borrowed his car for a joyride on Instagram (FIA Region I. (n.d.)).

What measures should Elies car service take when gathering data?

1. All rental businesses must offer clients clear and transparent information about what data is stored on infotainment systems and ways to erase it.
2. Manufacturers must give the equivalent of a delete button, allowing consumers to erase their private details easily and swiftly from infotainment systems.
3. The ICO (Information Commissioners Office) needs to issue a warning that rental companies must give rental customers clear instructions. With over 350 different automobile models, data deletion varies across each model. So, how to erase their data and what safeguards are in place to ensure this happens. Also, there must be clarity on the data controller duties on rental services.
4. Personal data must be removed, blocked, or anonymized in line with the applicable laws after a specific amount of time. Once the journey is completed, the database should automatically remove or anonymize the data with respect to information such vehicle speed, driving direction, previous locations of the vehicle, GPS navigation history, and specific location data. (Your Privacy is Important to Us! - Rentalcars.com)
5. To preserve and safeguard the personal information gathered from users, the company must take care to implement the proper business processes and procedures. The business should also be sure to adhere to proper security protocols and impose technological and physical limitations on who can access and use the customers' sensitive data stored on their servers. Access to customers' confidential data should be restricted to authorised employees only (FIA Region I. (n.d.)).

References

- <https://www.rentalcars.com/en/privacy/>
- https://privacyinternational.org/sites/default/files/2017-12/cars_briefing.pdf
- https://www.fiaregion1.com/wp-content/uploads/2022/01/GDPR-application-in-the-context-of-car-connectivity_EY_FIA_Final-Report_211231.pdf
- <https://medium.datadriveninvestor.com/connected-vehicle-technologies-will-shape-the-future-of-car-rentals-63efd10e13dc>
- <https://docs.oracle.com/database/121/DWHSG/transform.htm#DWHSG8327>

- <https://www.upgrad.com/blog/methods-of-data-transformation-in-data-mining/>
- <https://www.geeksforgeeks.org/designing-the-star-schema-in-data-warehousing/>