

CSC302: Database Management Systems

Aircraft Maintenance

Database Management Systems

Project Report

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Abstract

This report is about an aircraft maintenance management system that is intended to solve issues that aircrafts may encounter with their engines or parts. The report discusses the aircraft's problems and how they can be resolved by an assigned engineer. The system is written in SQL, and all the class codes are listed in this report. It is essential to solve these problems. This system can be used in the future in different airports to help prevent serious issues in aircrafts that might endanger the lives of many people.

Summary

As many know, an aircraft is a vehicle or machine with the ability to fly by means of obtaining support from the air in which it flies in. And over the years, the evolution of aircraft has been considerably noticeable. However, the absence of an efficacious examination and maintenance program created a challenge for many aviation companies. Therefore, the maintenance's primary purpose is to ensure the safety of people as well as the airworthiness of the aircraft according to the "International Aircraft Advisory Circular".

The evolution came with many challenges and keeping a record of each maintenance activity and all its necessary information was one of the major obstacles. Hence came the proposed system, which records all the information that an aviation company considers crucial to retrieve in any circumstances.

At first, the essential entities, along with their essential attributes were identified. Next, an Entity Relationship Diagram (ERD) was proposed to use in the database design. Then, each and every entity proposed was explained in detail in order to clarify what each table in the database holds. After that came the relationship diagram, which refers to an implementation of our model after we clarified the formats of our attributes, the foreign keys we used, and the linking tables we might require to link entities together. In addition, we proposed First, Second, and Third Normalization Forms solutions to the issue in our database. And only then we proceeded with the implementation of our design and started creating the database, provided segments of the SQL code used, and supported it with some results. Finally, we have supported the documentation with a powerful conclusion that re-addressed the issue and the proposed solution and provided suggestions and recommendations for future enhancements to the maintenance database system proposed.

Introduction

As life evolves, many fields have evolved with it; and the Aircraft field was not an exception to the rule. As a matter of fact, the evolution of aircraft has been considerably noticeable since it started a hundred years ago in 1903. Ever since, the recent changes noticed the excellence and perfection of flight methods, along with some techniques, and worked to enhance and improve the designs to keep up with the demands and the constantly changing trends while considering profitability and efficiency (wikipedia, n.d.).

As many know, an aircraft is a vehicle or machine with the ability to fly by means of obtaining support from the air in which it flies in. Some examples of aircraft machines encompass airplanes, airships, helicopters, gliders, hot air balloons, and paramotors (Aircraft Maintenance, n.d.).

Despite the history and evolution, in the absence of an efficacious examination and maintenance program, no aircraft is so permissive with neglect that it is safe in terms of that absence. Therefore, the maintenance's primary purpose is to ensure that the safety of the crew, passengers, and anyone in its service area is preserved by ensuring the airworthiness state of the aircraft is preserved. And according to the "International Aircraft Advisory Circular," maintenance programs must be aligned with particular safety goals for the aircraft and its passengers (Line Maintenance, n.d.).

Aircraft maintenance is the procedure of technical activities carried out on aircraft while it stays in light maintenance or base maintenance environment. Therefore, the maintenance is meant for maintaining the aircraft's state so that it will enable issuing a certificate of Release to Service via a Licensed Aircraft Engineer (LAE), and as it is often not necessary, however, a hanger environment might be available. Hence, [Lam 2002] summarized the reasons behind carrying out maintenance in the following: First, the safety of the aircraft, which is in terms of its airworthiness. Second, keeping the aircraft in service. And third and last, asset value maximization (What is aircraft maintenance?, n.d.).

The purpose of this documentation is to document our process in which we demonstrated and expressed the need for an aircraft maintenance database by identifying the problems and providing solutions in aircraft maintenance. Hence, we aim to provide the best database that keeps a company up to date on how its engineers perform and assesses them based on their performance which will be recorded on the developed database.

Like many other projects, the development of this documentation faced several limitations before it was complete. The absence of a baseline, which is a well-designed and implemented database in order to design the proposed database, was an obstacle that we were proud to overcome. Despite the fact that there was no sufficient real-world data to assist in developing the database and the report, we had to generate our own data for the sake of testing and demonstrating how the proposed database would look and operate on real data and real-world scenarios.

The proposed database was created using SQL LIVE, where we created the tables and filled them with our data to show how the engineers are expected to be monitored by the Aviation companies. Our database is created to hold the tables of the engineers, pilots, aircraft, tasks conducted on the aircraft, and more, in order to record the problems and where have they occurred and keep the data of the engineer who was assigned to work on it. Our aim in this project is to make data recording, saving, and retrieving an easy process for the intended employees so that the engineers can begin their work immediately.

Business Requirements

This database system is used to understand and fulfill the requirements of an aircraft to avoid any risks that might happen for any reason, either naturally or by human errors.

An Engineer will be assigned on a task for the maintenance process of an aircraft in a particular airport, to check or fix any issues on an aircraft.

Solution

- A manager will assign the maintenance of an aircraft/task to an engineer.
- An engineer will fix any problems that occurs on an aircraft.
- If an engineer was not able to complete a task, the task will be assigned to another engineer who is supposed to complete it successfully.
- Engineers can work on teams with other workers to fix any issues.

Methodology

The Aircraft Maintenance Database is part of the aviation company's system in which the three main entities are addressed. Those entities in question are the "Engineer", which is the prime stakeholder who would interact with the system. Moreover, the "aircraft", which includes SerialNumber, Name, Model, and Problem (the issue in the aircraft to be checked or taken care of), is displayed in order to be assigned to specific engineers. The engineers work on their "Tasks" given to them by the "Manager", who is responsible for assigning the engineers to each task and monitoring their work, in which each task has a unique task number.

All the entities in the database have separate tables in the "Aircraft Maintenance Database System". All the attributes are identified by the unique ID of the table. The ERD diagram is the database implemented logically, which gathers all the entities and the relationship between them, and the attributes.

Current system problems and Proposed solutions

1. Absence or lack of technical background and experience.

Some people, especially the older ones, find it challenging to deal with technology due to the absence of experience or simply because they have a limited background when it comes to laptops, computers, and interacting with a system or any other electronic appliance. However, having a system that could record each and every activity conducted on an aircraft is much easier, more convenient, requires less effort, and safer than documenting it on paper that could get lost or manipulated easily. Hence, the issue here that those specific people are facing revolves around the lack or absence of experience, or they do not have enough background that could support them in using a system that records their activities. Because, for example, they probably do not know how to deal with databases.

The issue mentioned above is solvable, simple, and its solution is easy to implement. Therefore, the solution would be customized training for whom this system concerns. The training should include labs, tasks, and quizzes on how to use the system, document the activities, and save them. The training should also include a user manual in order to use it as a reference after the training period is over. By that time, the user would have enough knowledge, experience, and confidence

to be able to run the system and use it on their own with minimal errors or mistakes (GE Digital, n.d.).

2. Absence of Graphical User interface (GUI)

To some people, it is hard and confusing to use the database in its technical form. Where if they needed to record their activities or retrieve them, they would have to resort to writing an SQL code, which would require them to learn the language first, which would be an inconvenience and might take a long time. Furthermore, aviation companies do not want to give anyone full access to the database where they can make direct changes to it or manipulate it or view some confidential information. Hence, the database in its basic form makes the task of monitoring pieces of data and making sure that people only see what the company wants them to see, change what they want them to change, and record what they want them to record much difficult.

Therefore, the best solution to this problem is to develop a Graphical User Interface (GUI). In this case, users with limited experience or no experience at all can use the system and interact with it so easily and smoothly, where all they have to do is insert the information they want to record in the appropriate fields, and it could be registered in the database. As for the aviation companies, they could now have their own restricted system where only authorized users have the accessibility to be able to make significant modifications, which could be achieved by enforcing some rules in the system (Liu, 2019).

3. False information might be registered in the system

As humans, we are all error-prone; the users of the system could accidentally register wrong information or fail to provide a necessary piece of it. For instance, the aircraft's ID or the engineer's ID could be registered wrongly due to a typographical error. That could make the task of retrieving the information or tracing the engineer who worked on the aircraft if any issue had occurred extremely difficult and troublesome. Therefore, despite the fact that no system is error-free, it is not so difficult to create a system that would make sure that a user would enter accurate information if it is critical.

The mentioned issue can be resolved by creating a system that would check each piece of information before it gets registered in the database. For example, if the engineer enters

their ID when they want to do any kind of activity on an aircraft, the system would try to match it with the engineers' IDs registered in the database. And if the system could not find any matches, it would display a message that would prompt the user to reenter their ID correctly. This example could also work with the aircraft ID, where this time, the message would either prompt them to reenter the ID or register the aircraft as a new one. Moreover, the system should enforce a second user to validate the information entered before it gets registered in the database for crucial information. The system would require them to provide their ID and any other necessary information that would identify them and which role did they take in the activity. The provided solution would help the company quickly identify which employee to be held accountable for any mistakes or accidents without any delays that could be caused by false information entry (Guilin Zhou, 2012).

Identifying Entities

- Aircraft
- Aircraft Engineer
- Airport
- Manager
- Task
- Aircraft Route
- Pilot
- Supplier

Identifying Attributes

- Aircraft Engineer

1. Engineer ID
2. Name
3. Phone number
4. Address
5. Email

	Aircraft Engineer
PK	Engineer ID Name Phone Number (Alternate Key) Address Email

- Airport

1. Airport Code
2. Airport Name
3. Address
4. Phone number
5. Email

	Airport
PK	Airport Code Airport Name Address Phone Number (Alternate Key) Email

- Manager

1. Manager ID
2. Name
3. Department Name
4. Phone number
5. Address
6. Email

	Manager
PK	Manager ID Name Department Name Phone Number (Alternate Key) Address Email

- Aircraft

1. Aircraft Serial Number
2. Name
3. Model
4. Problem

	Aircraft
PK	Aircraft Serial Number Name Model Problem

- Task

1. Task Number
2. Date Executed On
3. Fixing Duration
4. Engineer Name
5. Aircraft Serial Number
6. Task Successfulness

	Task
PK	Task Number Date Executed On Fixing Duration Engineer Name Aircraft Serial Number (Foreign Key) Task Successfulness

- Aircraft Route

1. Route Number
2. Number Of Stops
3. Starts From
4. Ends At

	Aircraft Route
PK	Route Number Number Of Stops Starts From Ends At

- Pilot

1. Pilot ID
2. License Number
3. Name
4. Phone number
5. Address
6. Email

	Pilot
PK	Pilot ID License Number (Alternate Key) Name Phone Number (Alternate Key) Address Email

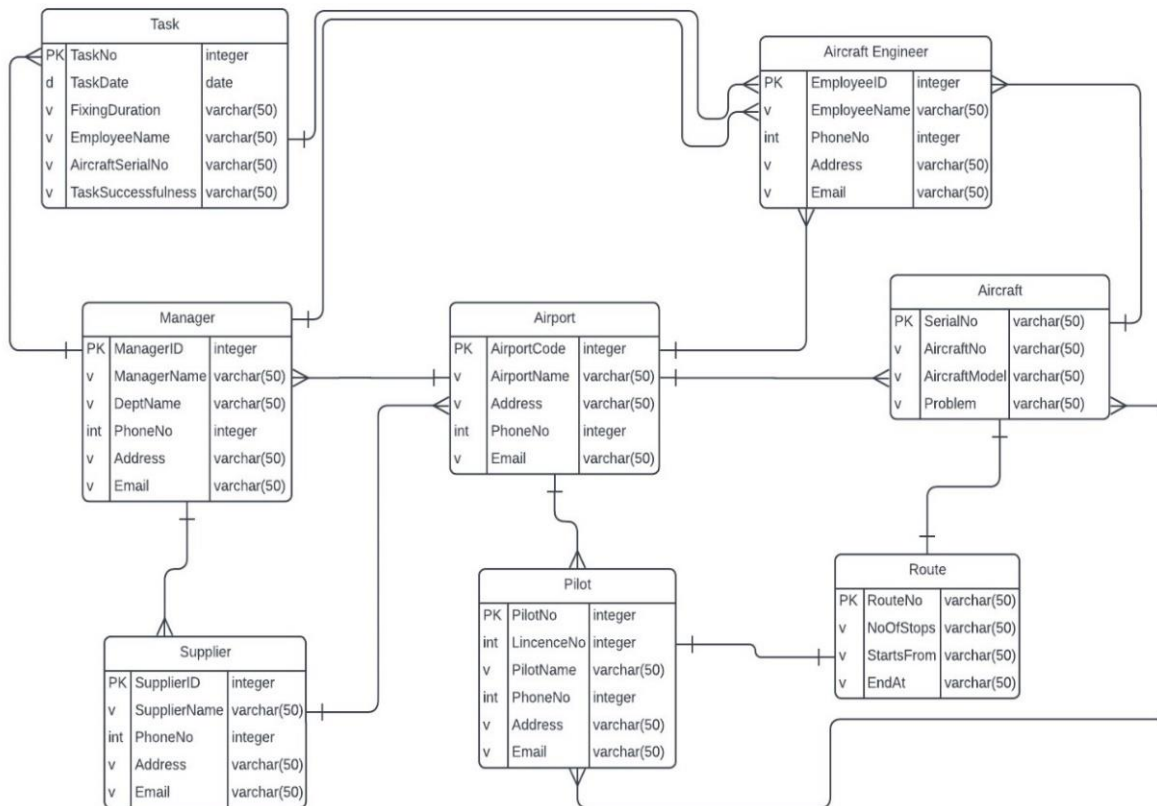
- Supplier

1. Supplier ID
2. Name
3. Phone number
4. Address
5. Email

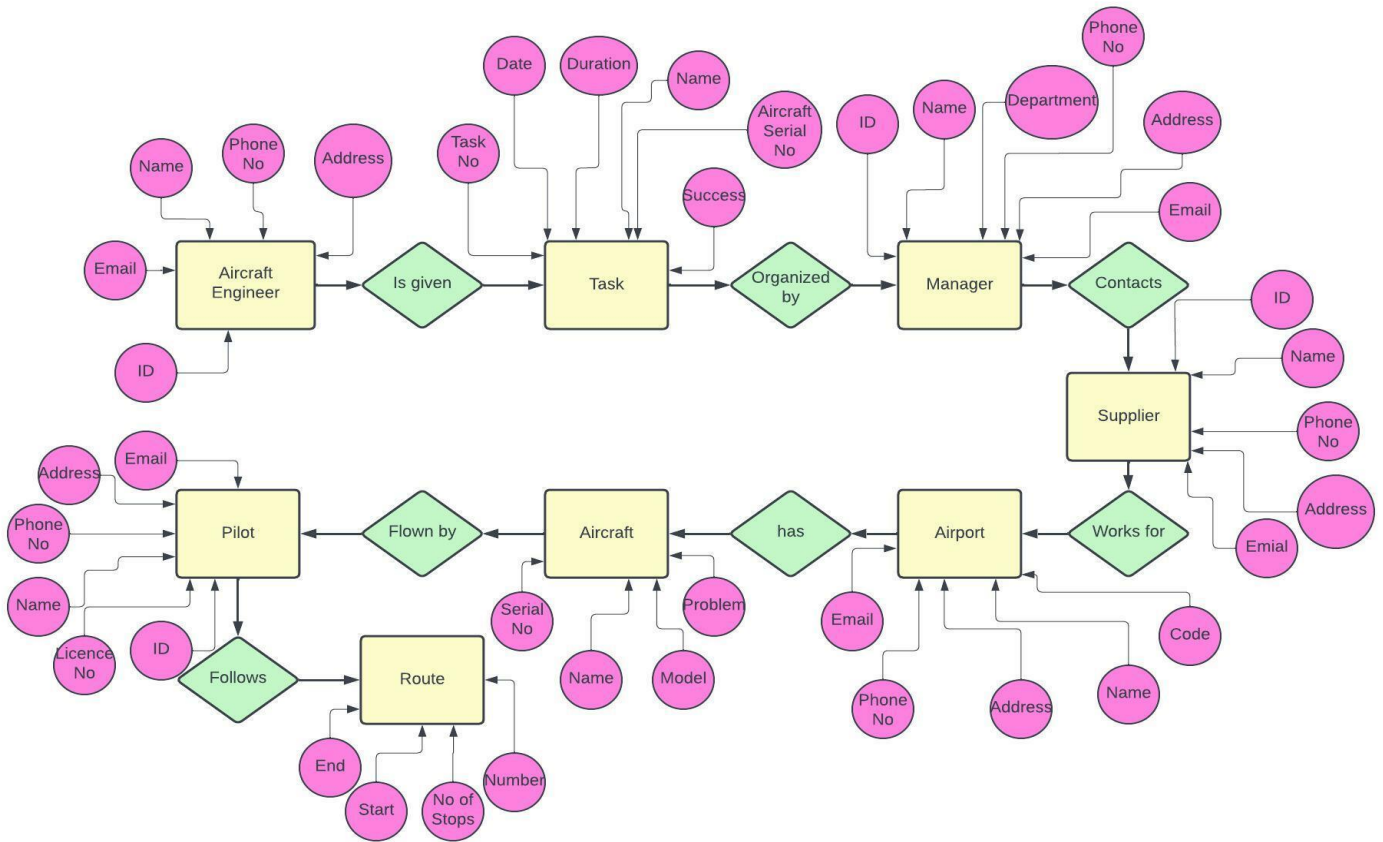
	Supplier
PK	Supplier ID Name Phone Number (Alternate Key) Address Email

Entity Relationship Diagram (ERD)

ERD DIAGRAM



Relationship Diagram



Aircraft Engineer

Field	Description	Type	Default	Other
E_id		int		PK
E_name		varchar (50)		
Ph_no		Int		
Address		varchar (50)		
Email		varchar (50)		

Airport

Field	Description	Type	Default	Other
A_code		int		PK
A_name		varchar (50)		
Address		varchar (50)		
Ph_no		int		
Email		varchar (50)		

Manager

Field	Description	Type	Default	Other
M_id		int		PK
M_name		varchar (50)		
Dept_name		varchar (50)		
Ph_no		int		
Address		varchar (50)		
Email		varchar (50)		

Aircraft

Field	Description	Type	Default	Other
SerialNumber		varchar (50)		PK
Aircraft_Name		varchar (50)		
Aircraft_Model		varchar (50)		
Problem		varchar (50)		

Task

Field	Description	Type	Default	Other
T_no		int		PK
T_date		date		
Fixing_duration		varchar (50)		
E_name		varchar (50)		
Aircraft_Serial_no		varchar (50)		FK
T_successfulness		varchar (50)		

Route

Field	Description	Type	Default	Other
Route_no		varchar (50)		PK
No_of_stops		varchar (50)		
Starts_from		varchar (50)		
Ends_at		varchar (50)		

Pilot

Field	Description	Type	Default	Other
P_id		int		PK
License_no		int		
P_name		varchar (50)		
Ph_no		int		
Address		varchar (50)		
Email		varchar (50)		

Supplier

Field	Description	Type	Default	Other
S_id		int		PK
S_name		varchar (50)		
Ph_no		int		
Address		varchar (50)		
Email		varchar (50)		

Solution

	Engineer	Task	Manager	Supplier	Airport	Aircraft	Pilot	Route
Engineer		given						
Task	given to		organized by					
Manager	organizes			contacts				
Supplier	contacted by				works for			
Airport	utilizes					has		
Aircraft	mandates						flown by	
Pilot	flies							follows
Route	followed by							

Entities Explanation

Aircraft Engineer

The aircraft engineer table contains information about the engineer like employee id, employee name, phone number, address, and email. The engineer is assigned to a task by the manager, they work in the airport and are assigned to an aircraft to fix, and more than one engineer can work on an aircraft at a time. For this table the employee id is the primary key and the phone number is the alternate key.

Airport

The airport table contains information about the airport like airport code, airport name, address, phone number, and email. The airport has the most relationships in the diagram. Many engineers work in an airport, there are many aircrafts in an airport, many pilots work in an airport, there is also more than one manager in an airport depending on which department they work in but a supplier can supply parts to many airports. The primary key in this table is the airport code and the alternate key is the phone number.

Manager

The manager table consists of the following: manager id, manager name, department name, phone number, address, and email. The manager works in an airport, they also contact a supplier in order to get parts for the aircraft. Then they can assign a task to the engineer. The primary key is the manager id, and the alternate is the phone number.

Aircraft

The aircraft table has information about the aircraft like the serial number, aircraft number, aircraft model, and problem. There are many aircrafts in an airport, an aircraft follows one route, many engineers can fix an aircraft at once and different pilots can fly different aircrafts. The primary key is the aircraft serial number.

Task

In the task table, there is task number, task date, fixing duration, employee name, aircraft serial number, and task successfulness. A manager is in charge of giving out tasks and the task could be given to many engineers. The primary key is the task number, and the foreign key is the aircraft serial number.

Route

In the route table there is information about the route number, number of stops, starts from and ends at. An aircraft can follow only one route at a time, the pilot can follow only one route. The primary key is the route number.

Pilot

The pilot table has information about the pilot number, license number, pilot name, phone number, address, and email. A pilot can follow one route at a time, different pilots can fly different aircrafts and a pilot works in airport. The primary key is the pilot id, and the alternate keys are the license number and phone number.

Supplier

The supplier table contains information about the supplier id, supplier name, phone number, address, and email. The manager can contact different suppliers for aircraft parts and a supplier can supply parts to different airports. The primary key is the supplier id, and the phone number is the alternate key.

First, Second and Third Normalization Form

In this part of our report, the tables are put in a well-structured relational form with no data redundancy. By default, all our tables are in first normal form because all the information is stored only once. The second and third normal form is also by default because all the attributes depend entirely on the primary key on the table and there is no data redundancy.

Aircraft

Aircraft_SerialNumber	Aircraft_Name	Aircraft_Model	Problem
msn 30020B	Akutan Zero	Mitsubishi A6M Zero	Broken Right Wing
msn 42230A	Aluminum Overcast	Boeing B-17 Flying Fortress	Misfuelling
msn 35040C	America	Fokker C-2	Broken Connecting Rod
msn 55020B	Bird of Paradise	Fokker C-2	Oil leak
msn 60070A	City of Canberra	Boeing 747-400	Unattached Valve
msn 75090E	Glamorous Glennis	Bell X-11	Fuel Contamination

In this table, the primary key is the Aircraft_SerialNumber. The aircraft_name, aircraft_model and the problem are all fully dependent on the primary key. This means that our table is already in first, second and third normalization.

Aircraft Engineer

E_ID	E_Name	Ph_No	Address	Email
2301	Mark	508346748	Shakbout City	m22@hotmail.com
1092	Jack	568263738	Shamkha	jack101@hotmail.com
3387	Sam	542738906	Khaldiya	s.37609@hotmail.com
9283	Mohammed	552873654	Almuroor	m.00091@hotmail.com
1001	Sara	508260010	Almushrif	sara8764@hotmail.com
6725	Elizabeth	587642651	Alzaffranah	e.9009@hotmail.com

In this table, the primary key is the E_ID. The other attributes which are the e_name, phone_no, address and email are all dependent on the primary key which is the identity of the employee. This means that our table is already in its simplest form with no redundancy.

Airport

A_Code	Dept_ID	A_Name	Address
1001	1111	Albateen Executive Airport	Albateen
2201	1001	AbuDhabi International Airport	AbuDhabi Island
8739	2020	Alain International Airport	Alain
9800	7654	Delma Island Airport	Delma
6355	7635	Sir Bani Yas Airport	Sir Bani Yas
7256	0987	Aldhafra Air Base Airport	Aldhafra

Airport Information

Dept_ID	Ph_No	Email
1111	1029837465	albateen_airport@hotmail.com
2001	020346278	albateen_airport_customerservice@hotmail.com
1001	027894563	abudhabi_airport@hotmail.com
2222	027924356	abudhabi_airport_customerservice@hotmail.com
2020	026345555	alain_airport_customerservice@hotmail.com

3090	026354789	delma_airport@hotmail.com
7654	027638790	delma_airport_customerservice@hotmail.com
7034	027635478	sirbaniyas_airport@hotmail.com
7635	026373866	sirbaniyas_airport_customerservice@hotmail.com
9876	025374896	aldhafra_air_base@hotmail.com
0987	026378960	aldhafra_air_base_customerservice@hotmail.com

Initially, the two tables above were one table, but an airport can have more than one phone number and email address. So, the table was split into two so that the airport information can be in first normal form. By doing so, the table is in second and third normalization because all the attributes depend on the primary key which is the airport code.

Manager

M_ID	M_Name	Dept_Name	Ph_No	Address	Email
7648	Hamad	MNGR	0507635725	Albateen	h.7648@hotmail.com
8345	Saqar	TGR	0557638724	AbuDhabi Island	saqar.8888@hotmail.com
9990	Asma	FMG	0567834526	Alain	a.asma@hotmail.com
1000	Mohamed	CGG	0546789345	Delma	mohammed999@hotmail.com
2200	Hamda	HGR	0527638479	Sir Bani Yas	hamda.7634@hotmail.com
6654	Rahaf	HRM	0586352675	Aldhafra	r.2201@hotmail.com

The manager table is already in first, second and third normal form. This is because the m_name, dept_name, ph_no, address, and email depend on the m_id which is the primary key. All the non-prime attributes depend on the candidate key (primary key).

Task

T_No	T_Date	Fixing_Duration	E_Name	Aircraft_Serial	T_Successfulness
1	12/12/20	10 hrs	Mark	msn 30020B	Successful
2	22/01/21	1 week	Jack	msn 4223	Unsuccessful
3	30/12/21	2 days	Sam	msn 35040C	Successful
4	09/10/22	22 hrs,	Mohammed	msn 55020B	Successful
5	05/09/23	8 hrs	Sara	msn 60070A	Successful
6	16/06/23	4 days	Elizabeth	msn 75090E	Unsuccessful

The t_no is the primary key on this table and all the attributes are non-prime attributes. This means that they all rely on the t_no. This table is already in the normalization forms and cannot be broken down anymore.

Route

Route_No	No_Of_Stops	Starts_From	Ends_At
1	2 Stops	Albateen Airport	AbuDhabi International Airport
2	3 Stops	AbuDhabi International Airport	Aldhafra Airport
3	1 Stop	Delma Island Airport	Alain International Airport
4	5 Stops	Alain International Airport	Delma Island Airport
5	4 Stops	Sir Bani Yas Airport	Aldhafra Airport
6	3 Stops	Albateen Airport	Alain International Airport

On the route table the primary key is the route_no because it's the only unique attribute on the table. All the other attributes such as the no_of_stops, starts_from, and ends_at depend on the number of the route. This means that there is no redundancy of data, and the table is already in the simplest normal form.

Pilot

P_ID	License_No	P_Name	Ph_No	Address	Email
1001	22087	Max	0507836376	Alain	max.22@hotmail.com
2002	24156	Jasim	0558739387	AbuDhabi	j.241@hotmail.com
6378	87555	Adam	0564847903	Albateen	adam.a20@hotmail.com
9800	66660	Jumaa	0543678900	Aldhafra	jumaa.632@hotmail.com
1827	73648	Saeed	0506483111	Sir Bani Yas	s.d60@hotmail.com
5455	45678	Salim	0523467835	Delma	salim.7645@hotmail.com

The p_id is the primary key on the pilot table. The other attributes are non-prime attributes and they all rely on the identification of the pilot. The table is by default in first, second and third normalization.

Supplier

S_ID	S_Name	Ph_No	Address	Email
7701	Boeing	027658493	Chicago	boeing@hotmail.com
7654	Airbus	026542345	Toulouse	airbus@hotmail.com
3324	Lockheed Martin	027634567	AbuDhabi	lockheed_martin@hotmail.com
6654	United Technologies	021347654	Banias	united_technologies@hotmail.com
1235	General Electric	020096543	AbuDhabi	general_electrics@hotmail.com
9087	Safran	023487634	Dubai	safran@hotmail.com

Lastly, the s_id is the primary key on the supplier table. The other attributes such as the s_name, ph_no, address, and email are the non-prime attributes on the table and dependent only on the primary key. This means that our table is already in first, second and third normalization.

SQL code: Create Tables with Screenshots

```
CREATE TABLE Aircraft (
```

```
SerialNumber VARCHAR(50) PRIMARY KEY,
```

```
Aircraft_Name VARCHAR(50),
```

```
Aircraft_Model VARCHAR(50),
```

```
Problem VARCHAR(50));
```

```
INSERT INTO Aircraft VALUES ('msn 30020B', 'Akutan Zero', 'Mitsubishi A6M Zero',  
'Broken Right Wing');
```

```
INSERT INTO Aircraft VALUES ('msn 42230A', 'Aluminum Overcast', 'Boeing B-17 Flying  
Fortress', 'Misfueling');
```

```
INSERT INTO Aircraft VALUES ('msn 35040C', 'America', 'Fokker C-2', 'Broken  
Connecting Rod');
```

```
INSERT INTO Aircraft VALUES ('msn 55020B', 'Bird of Paradise', 'Fokker C-2', 'Oil  
Leak');
```

```
INSERT INTO Aircraft VALUES ('msn 60070A', 'City of Canberra', 'Boeing 747-400',  
'Unattached Valve');
```

```
INSERT INTO Aircraft VALUES ('msn 75090E', 'Glamorous Glennis', 'Bell X-1', 'Fuel  
Contamination');
```

```
SELECT * FROM Aircraft;
```

AIRCRAFT_SERIALNUMBER	AIRCRAFT_NAME	AIRCRAFT_MODEL	PROBLEM
msn 30020B	Akutan Zero	Mitsubishi A6M Zero	Broken Right Wing
msn 42230A	Aluminum Overcast	Boeing B-17 Flying Fortress	Misfueling
msn 35040C	America	Fokker C-2	Broken Connecting Rod
msn 55020B	Bird of Paradise	Fokker C-2	Oil Leak
msn 60070A	City of Canberra	Boeing 747-400	Unattached Valve
msn 75090E	Glamorous Glennis	Bell X-1	Fuel Contamination

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6 rows selected.

```
CREATE TABLE AircraftEngineer (  
E_id INT PRIMARY KEY,  
E_name VARCHAR(50),  
ph_no INT,  
Address VARCHAR(50),  
Email VARCHAR(50));
```

```
INSERT INTO AircraftEngineer VALUES (2301, 'Mark', 0508346748, 'Shakbout City',  
'm22@hotmail.com');
```

```
INSERT INTO AircraftEngineer VALUES (1092, 'Jack', 0568263738, 'Shamkha',  
'jack101@hotmail.com');
```

```
INSERT INTO AircraftEngineer VALUES (3387, 'Sam', 0542738906, 'Khaldiya',  
's.37609@hotmail.com');
```

```
INSERT INTO AircraftEngineer VALUES (9283, 'Mohammed', 0552873654, 'Almuroor',  
'm.00091@hotmail.com');
```

```
INSERT INTO AircraftEngineer VALUES (1001, 'Sara', 0508260010, 'Almushrif',  
'sara8764@hotmail.com');
```

```
INSERT INTO AircraftEngineer VALUES (6725, 'Elizabeth', 0587642651, 'Alzaffranah',  
'e.9009@hotmail.com');
```

```
SELECT * FROM AircraftEngineer;
```

E_ID	E_NAME	PH_NO	ADDRESS	EMAIL
2301	Mark	508346748	Shakbout City	m22@hotmail.com
1092	Jack	568263738	Shamkha	jack101@hotmail.com
3387	Sam	542738906	Khaldiya	s.37609@hotmail.com
9283	Mohammed	552873654	Almuroor	m.00091@hotmail.com
1001	Sara	508260010	Almushrif	sara8764@hotmail.com
6725	Elizabeth	587642651	Alzaffranah	e.9009@hotmail.com

[Download CSV](#)

6 rows selected.

The below two tables (Airport and Airport_Information) are considered as a 2NF since we split the table into two to prevent the redundancy of data.

```
CREATE TABLE Airport (  
  
A_code INT PRIMARY KEY,  
Dept_ID INT,  
A_name VARCHAR(50),  
Address VARCHAR(50));  
  
INSERT INTO Airport VALUES (1001, 1111, 'Albateen Executive Airport', 'Albateen');  
INSERT INTO Airport VALUES (2201, 1001, 'AbuDhabi International Airport',  
'AbuDhabi Island');  
INSERT INTO Airport VALUES (8739, 2020, 'Alain International Airport', 'Alain');  
INSERT INTO Airport VALUES (9800, 7654, 'Delma Island Airport', 'Delma');  
INSERT INTO Airport VALUES (6355, 7635, 'Sir Bani Yas Airport', 'Sir Bani Yas');  
INSERT INTO Airport VALUES (7256, 0987, 'Aldhafra Air Base Airport', 'Aldhafra');  
  
SELECT * FROM Airport;
```

A_CODE	DEPT_ID	A_NAME	ADDRESS
1001	1111	Albateen Executive Airport	Albateen
2201	1001	AbuDhabi International Airport	AbuDhabi Island
8739	2020	Alain International Airport	Alain
9800	7654	Delma Island Airport	Delma
6355	7635	Sir Bani Yas Airport	Sir Bani Yas
7256	987	Aldhafra Air Base Airport	Aldhafra

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6 rows selected.

```
CREATE TABLE Airport_Information (
```

```
Dept_ID INT PRIMARY KEY,
```

```
Ph_no INT,
```

```
Email VARCHAR(50));
```

```
INSERT INTO Airport_Information VALUES (1111, 1029837465, 'albateen_airport@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (2001, 020346278, 'albateen_airport_customerservice@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (1001, 027894563, 'abudhabi_airport@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (2222, 027924356, 'abudhabi_airport_customerservice@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (1010, 027368498, 'alain_airport@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (2020, 026345555, 'alain_airport_customerservice@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (3090, 026354789, 'delma_airport@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (7654, 027638790, 'delma_airport_customerservice@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (7034, 027635478, 'sirbaniyas_airport@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (7635, 026373866, 'sirbaniyas_airport_customerservice@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (9876, 025374896, 'aldhafra_air_base@hotmail.com');
```

```
INSERT INTO Airport_Information VALUES (0987, 026378960, 'aldhafra_air_base_customerservice@hotmail.com');
```

```
SELECT * FROM Airport_Information;
```

DEPT_ID	PH_NO	EMAIL
1111	1029837465	albateen_airport@hotmail.com
2001	20346278	albateen_airport_customerservice@hotmail.com
1001	27894563	abudhabi_airport@hotmail.com
2222	27924356	abudhabi_airport_customerservice@hotmail.com
1010	27368498	alain_airport@hotmail.com
2020	26345555	alain_airport_customerservice@hotmail.com
3090	26354789	delma_airport@hotmail.com
7654	27638790	delma_airport_customerservice@hotmail.com
7034	27635478	sirbaniyas_airport@hotmail.com
7635	26373866	sirbaniyas_airport_customerservice@hotmail.com
9876	25374896	aldhafra_air_base@hotmail.com
987	26378960	aldhafra_air_base_customerservice@hotmail.com

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12 rows selected.

```
CREATE TABLE Manager (
```

```
M_id INT PRIMARY KEY,
```

```
M_name VARCHAR(50),
```

```
Dept_name VARCHAR(50),
```

```
Ph_no INT,
```

```
Address VARCHAR(50),
```

```
Email VARCHAR(50))
```

```
INSERT INTO Manager VALUES (7648, 'Hamad', 'MNGR', 0507635725, 'Albateen',  
'h.7648@hotmail.com');
```

```
INSERT INTO Manager VALUES (8345, 'Saqr', 'TGR', 0557638724, 'AbuDhabi Island',  
'saqr.8888@hotmail.com');
```

```
INSERT INTO Manager VALUES (9990, 'Asma', 'FMG', 0567834526, 'Alain', 'a.asma@hotmail.com');
```

```
INSERT INTO Manager VALUES (1000, 'Mohamed', 'CGG', 0546789345, 'Delma',  
'mohammed999@hotmail.com');
```

```
INSERT INTO Manager VALUES (2200, 'Hamda', 'HGR', 0527638479, 'Sir Bani Yas',  
'hamda.7634@hotmail.com');
```

```
INSERT INTO Manager VALUES (6654, 'Rahaf', 'HRM', 0586352675, 'Aldhafra',  
'r.2201@hotmail.com');
```

```
SELECT * FROM Manager;
```


M_ID	M_NAME	DEPT_NAME	PH_NO	ADDRESS	EMAIL
7648	Hamad	MNGR	507635725	Albateen	h.7648@hotmail.com
8345	Saqar	TGR	557638724	AbuDhabi Island	saqar.8888@hotmail.com
9990	Asma	FMG	567834526	Alain	a.asma@hotmail.com
1000	Mohamed	CGG	546789345	Delma	mohammed999@hotmail.com
2200	Hamda	HGR	527638479	Sir Bani Yas	hamda.7634@hotmail.com
6654	Rahaf	HRM	586352675	Aldhafra	r.2201@hotmail.com

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6 rows selected.

CREATE TABLE Task (

T_no INT PRIMARY KEY,

T_date DATE,

Fixing_duration VARCHAR(50),

E_name VARCHAR(50),

Aircraft_SerialNumber VARCHAR(50),

T_successfulness VARCHAR(50));

INSERT INTO Task VALUES (1, to_date('12-DEC-2020','DD-MON-YYYY'), '10 hrs', 'Mark', 'msn 30020B', 'Successful');

INSERT INTO Task VALUES (2, to_date('22-JAN-2021','DD-MON-YYYY'), '1 week', 'Jack', 'msn 42230A', 'Unsuccessful: Task handed to Eng. Mark');

INSERT INTO Task VALUES (3, to_date('30-DEC-2021','DD-MON-YYYY'), '2 days', 'Sam', 'msn 35040C', 'Successful');

INSERT INTO Task VALUES (4, to_date('09-OCT-2022','DD-MON-YYYY'), '22 hrs', 'Mohammed', 'msn 55020B', 'Successful');

INSERT INTO Task VALUES (5, to_date('05-SEP-2023','DD-MON-YYYY'), '8 hrs', 'Sara', 'msn 60070A', 'Successful');

INSERT INTO Task VALUES (6, to_date('16-JUN-2023','DD-MON-YYYY'), '4 days', 'Elizabeth', 'msn 75090E', 'Unsuccessful: Task handed to Eng. Sara');

SELECT * FROM Task;

T_NO	T_DATE	FIXING_DURATION	E_NAME	AIRCRAFT_SERIALNUMBER	T_SUCCESSFULNESS
1	12-DEC-20	10 hrs	Mark	msn 30020B	Successful
2	22-JAN-21	1 week	Jack	msn 42230A	Unsuccessful: Task handed to Eng. Mark
3	30-DEC-21	2 days	Sam	msn 35040C	Successful
4	09-OCT-22	22 hrs	Mohammed	msn 55020B	Successful
5	05-SEP-23	8 hrs	Sara	msn 60070A	Successful
6	16-JUN-23	4 days	Elizabeth	msn 75090E	Unsuccessful: Task handed to Eng. Sara

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6 rows selected.

CREATE TABLE AircraftRoute (

Route_no VARCHAR(50) PRIMARY KEY,

no_of_stops VARCHAR(50),

Starts_from VARCHAR(50),

Ends_at VARCHAR(50));

INSERT INTO AircraftRoute VALUES (1, '2 Stops', 'Albateen Airport', 'AbuDhabi International Airport');

INSERT INTO AircraftRoute VALUES (2, '3 Stops', 'AbuDhabi International Airport', 'Aldhafra Airport');

INSERT INTO AircraftRoute VALUES (3, '1 Stop', 'Delma Island Airport', 'Alain International Airport');

INSERT INTO AircraftRoute VALUES (4, '5 Stops', 'Alian International Airport', 'Delma Island Airport');

INSERT INTO AircraftRoute VALUES (5, '4 Stops', 'Sir Bani Yas Airport', 'Aldhafra Airport');

INSERT INTO AircraftRoute VALUES (6, '3 Stops', 'Albateen Airport', 'Alain International Airport');

SELECT * FROM AircraftRoute;

ROUTE_NO	NO_OF_STOPS	STARTS_FROM	ENDS_AT
1	2 Stops	Albateen Airport	AbuDhabi International Airport
2	3 Stops	AbuDhabi International Airport	Aldhafra Airport
3	1 Stop	Delma Island Airport	Alain International Airport
4	5 Stops	Alian International Airport	Delma Island Airport
5	4 Stops	Sir Bani Yas Airport	Aldhafra Airport
6	3 Stops	Albateen Airport	Alain International Airport

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6 rows selected.

CREATE TABLE Pilot (

P_id INT PRIMARY KEY,

License_no INT,

P_name VARCHAR(50),

ph_no INT,

Address VARCHAR(50),

Email VARCHAR(50));

INSERT INTO Pilot VALUES (1001, 22087, 'Max', 0507836376, 'Alain', 'max.22@hotmail.com');

INSERT INTO Pilot VALUES (2002, 24156, 'Jasim', 0558739387, 'AbuDhabi', 'j.241@hotmail.com');

INSERT INTO Pilot VALUES (6378, 87555, 'Adam', 0564847903, 'Albateen', 'adam.a20@hotmail.com');

INSERT INTO Pilot VALUES (9800, 66660, 'Jumaa', 0543678900, 'Aldhafra', 'jumaa.632@hotmail.com');

INSERT INTO Pilot VALUES (1827, 73648, 'Saeed', 0506483111, 'Sir Bani Yas', 's.d60@hotmail.com');

INSERT INTO Pilot VALUES (5455, 45678, 'Salim', 0523467835, 'Delma', 'salim.7645@hotmail.com');

SELECT * FROM Pilot;

P_ID	LICENSE_NO	P_NAME	PH_NO	ADDRESS	EMAIL
1001	22087	Max	507836376	Alain	max.22@hotmail.com
2002	24156	Jasim	558739387	AbuDhabi	j.241@hotmail.com
6378	87555	Adam	564847903	Albateen	adam.a20@hotmail.com
9800	66660	Jumaa	543678900	Aldhafra	jumaa.632@hotmail.com
1827	73648	Saeed	506483111	Sir Bani Yas	s.d60@hotmail.com
5455	45678	Salim	523467835	Delma	salim.7645@hotmail.com

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6 rows selected.

CREATE TABLE Supplier (

S_id INT PRIMARY KEY,

S_name VARCHAR(50),

ph_no INT,

Address VARCHAR(50),

Email VARCHAR(50));

INSERT INTO Supplier VALUES (7701, 'Boeing', 027658493, 'CHICAGO', 'boeing@hotmail.com');

INSERT INTO Supplier VALUES (7654, 'Airbus', 026542345, 'TOULOUSE', 'airbus@hotmail.com');

INSERT INTO Supplier VALUES (3324, 'Lockheed Martin', 027634567, 'ABUDHABI', 'lockheed_martin@hotmail.com');

INSERT INTO Supplier VALUES (6654, 'United Technologies', 021347654, 'BANIYAS', 'united_technologies@hotmail.com');

INSERT INTO Supplier VALUES (1235, 'General Electric', 020096543, 'ABUDHABI', 'general_electrics@hotmail.com');

INSERT INTO Supplier VALUES (9087, 'Safran', 023487634, 'DUBAI', 'safran@hotmail.com');

SELECT * FROM Supplier;

S_ID	S_NAME	PH_NO	ADDRESS	EMAIL
7701	Boeing	27658493	CHICAGO	boeing@hotmail.com
7654	Airbus	26542345	TOULOUSE	airbus@hotmail.com
3324	Lockheed Martin	27634567	ABUDHABI	lockheed_martin@hotmail.com
6654	United Technologies	21347654	BANIYAS	united_technologies@hotmail.com
1235	General Electric	20096543	ABUDHABI	general_electrics@hotmail.com
9087	Safran	23487634	DUBAI	safran@hotmail.com

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6 rows selected.

Results

- To improve aircraft maintenance.
- To stop future serious issues.
- To save aircraft maintenance records.
- Found out new methods to maintain good aircraft maintenance.
- Understood what issues can be faced in the process of aircraft maintenance to overcome them.
- We used different tools for building charts.
- We learnt how to make a database management system correctly.
- The aircraft maintenance system must be updated from time to time to fix all the issues that might occur inside it.
- Managers need to follow up with engineers on tasks assigned to them continuously until the task is done successfully.
- The aircraft maintenance system needs to make sure that the engineers work is done successfully to prevent any problem in the aircraft.

Conclusion

Over the years, the aircraft field has evolved in a considerably noticeable way, and with that evolution came with a wide range of challenges. And keeping a record of each maintenance activity and all its necessary information was one of the most significant challenges. These tasks are really hard to follow and require a physical activity from whoever is working on a maintenance duty at the time. Moreover, it is even more challenging for the aviation company to easily trace and link the activities to its assigned engineers and employees.

Therefore, we took Feris Karachak's advice and did not just come up with a problem, but we did come up with a solution to it. Hence, we developed this system, implemented it, and tested it in order to overcome some of the major challenges.

We have developed a database that would record the information of each significant entity based on the attributes that we agreed are the most crucial ones. And by doing so, we made the task of recording and retrieving data on maintenance activities more efficient for the aviation company as well as its employees.

Due to the efficiency of our database system, we highly recommend that aviation companies consider implementing it according to the Entity Relationship Diagram (ERD). And that is for the reason that it has a Primary Key (PK) and Foreign key (FK) that would assist in ensuring that the database is consistent and free of any redundancy.

For future enhancements and modifications to the proposed database, we suggest that the aviation company to add more entities according to what they see as essential and crucial to their system and serve their business best. Furthermore, we would suggest adding a Graphical User Interface (GUI) to make the tasks much easier for the employees with little technical background or experience. In addition, we would highly recommend enforcing some rules on the database in which it would restrict the access to it in order to preserve its credibility, confidentiality, availability, and integrity by adding some layers of security to the system. Finally, we find it preferable and convenient for the aviation companies to consider and prepare proper training for their intended employees, to make sure they know how to use the system so easily and in the best way that would serve the companies' needs.

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