HOSPITAL MANAGEMENT APPLICATION

USING SQL & MongoDB

By

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HOSPITAL MANAGEMENT

1. INTRODUCTION:

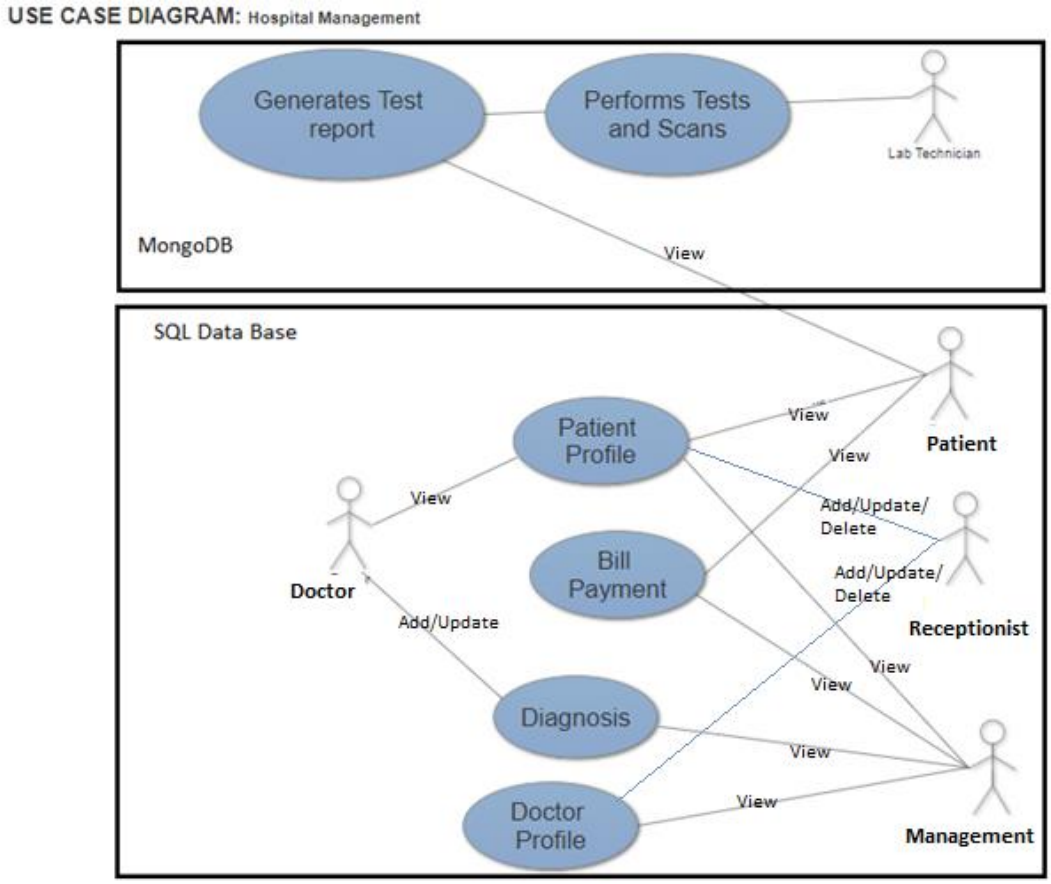
Data Management is one of the major challenges in Healthcare. Hospitals struggle to store and manage the patients records and images from various tests and surgeries carried out. Medical Reports are the most intensive and diverse in Hospital Management Information System. This application works on a hybrid model that combines both SQL Data base and MongoDB to solve the data storage and management challenges

1.1 Scope:

The hospital application provides solution for the following:

a. Patient profile management using SQL
b. Diagnosis management Using SQL
c. Billing Management Using SQL
d. Revenue and other Business Management Reports Using SQL
e. Repository for Lab reports,images and scans, using large files handling features of MongDB

2. USERS:



a. **Doctor:**
   - Updates Diagnoses details about the patients
   - Reads the patients history
   - Reads patient's Lab reports

b. **Patient:**
   - Views his profile, Diagnosis and test report
   - Makes bill payments

c. **Receptionist:**
   - Adds, Updates, deletes Patient's profile
   - Adds, Updates, deletes Doctor's profile

d. **Management:**
   - View profiles of Doctors, patient and payments for business management purpose

e. **Lab Technician:**

- Conducts all lab tests and records the test results and scanned images

3. USE CASE:

a. Patient Details Management

- All the registered patients are recorded in tables.
- The Patients are provided with their profile login
- Doctors view the patient's details
- The hospital Management can also view the information for business purpose

b. Diagnosis Details Management

- The doctor updates every diagnosis of patients visiting for consultation
- The patients can view the updated data
- The hospital Management can also view the information for business purpose

c. Billing Management

i. Payments made by patients are recorded

ii. The hospital Management can also view the information for business purpose

d. Lab Data Management

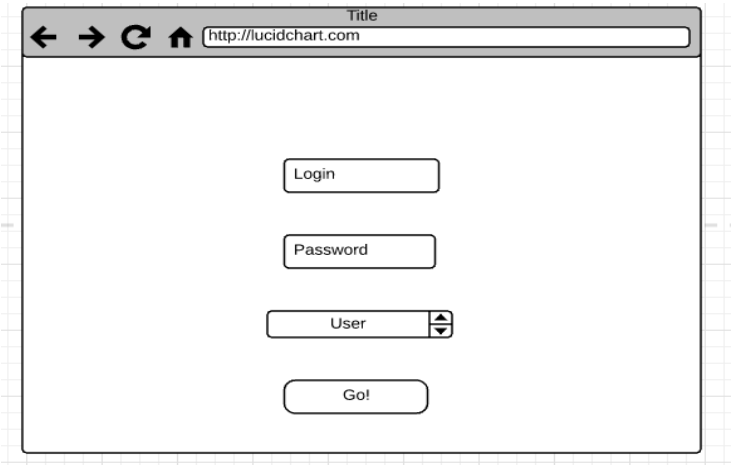
i. Lab Technician updated the scan and other test reports

ii. Doctors can view their patient's reports

iii. Patients can view their reports online

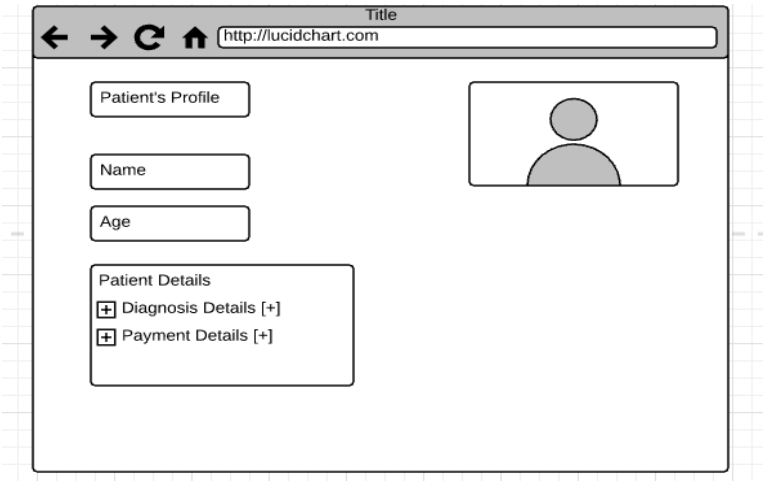
4. USER INTERFACE:

A. Login



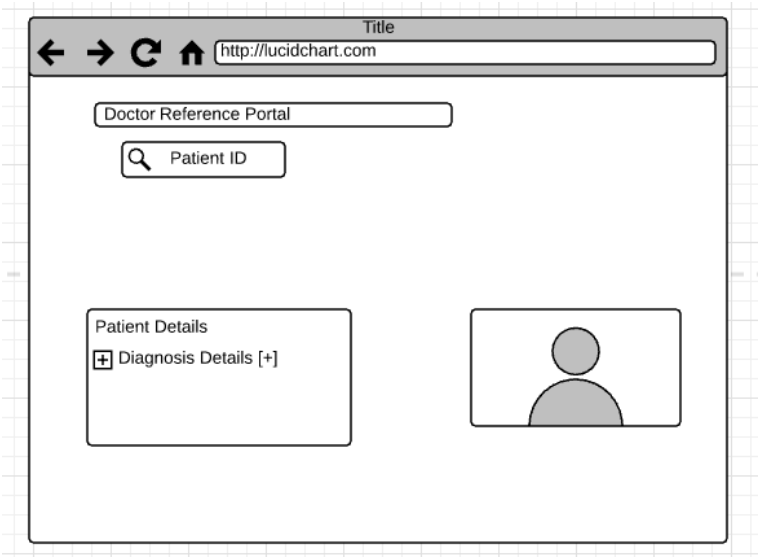
Login: Based on whether the user is a patient, doctor or admin, the login page will lead to corresponding user interface. The User can be chosen from the dropdown box. Once the credentials are validated, it guides to the corresponding user portals mentioned below.

B. Patient's Profile



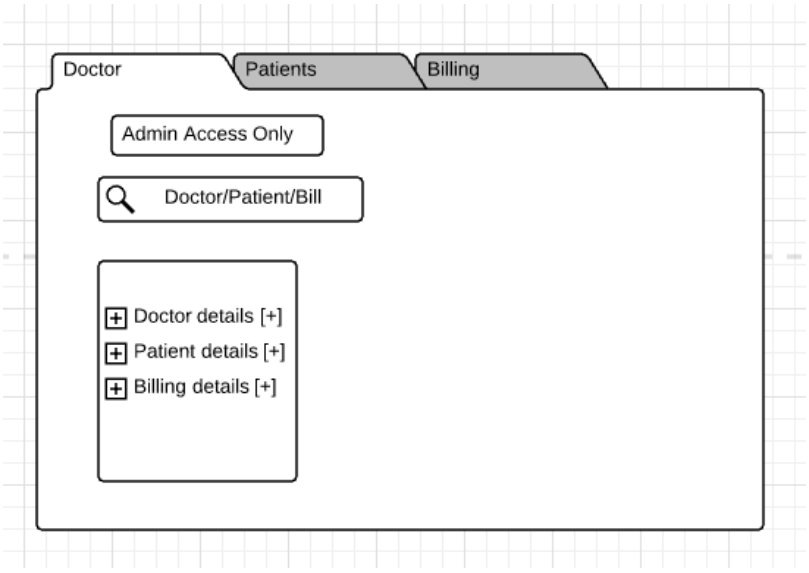
Patient's Profile: The patients can access the above page to view their hospital details

C. Diagnosis Details



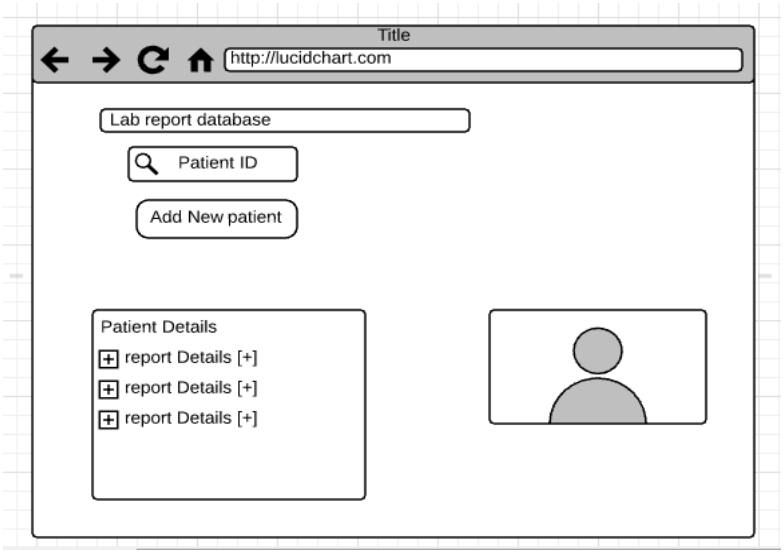
Diagnosis Details: Doctors can view the patient's history from the above portal

D. Management



The management can view all the details about the doctors, patients and financial information from then above portal.

e. Lab Reports



Lab Report: The Lab technicians can update the test results, images and scan in then above portal

5. SQL Vs NoSQL:

a. SQL:

The below use cases are handled in SQL. Due to ACID property of SQL, they are used for transactional processes , where we require structured data handling systems and consistent data retrieval.

i) Patient Record Detail

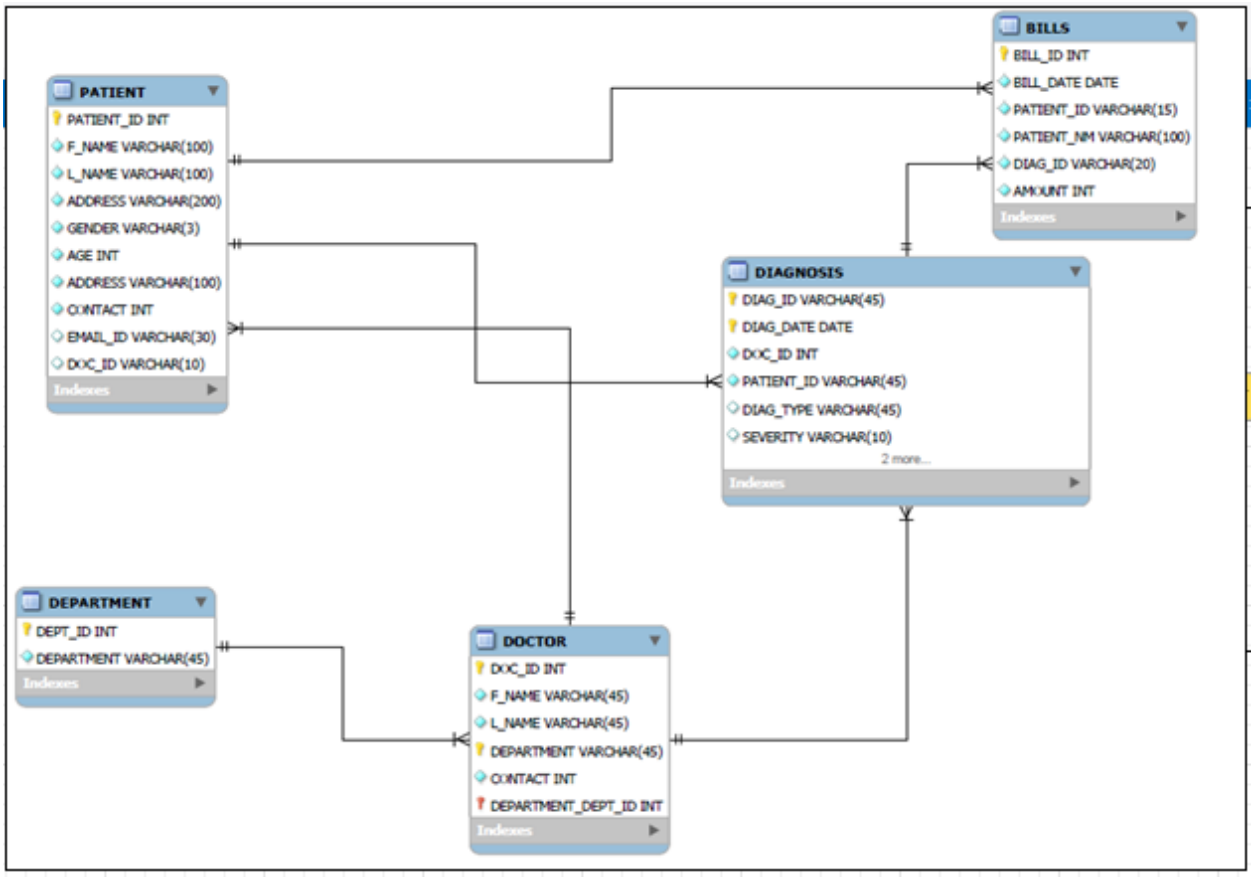
All the patient's profile details have to be stored and retrieved whenever the patient or doctor wishes to view them. The data retrieval has to be consistent and precise. Also, the details of all patients follow structured pattern. In such a case SQL is the appropriate solution

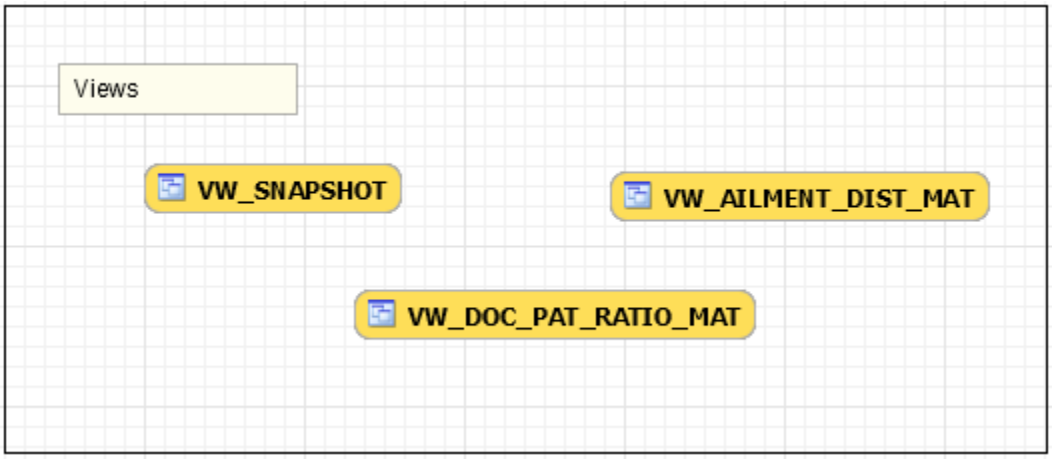
ii) Diagnosis Details Management

When a patient visits a doctor, the doctor has to update patient's diagnosis details. This has to be available to patients when he /she views his/her profile. The data has to be appropriate and instantly updated. SQL is better option as they provide structured and consistent data retrieval.

iii) Billing Management

The payment of bills by the patients has to be secured and involves the same kind of transactions throughout. In such situation where it involves consistent, secured and homogenous transaction SQL is the best choice.





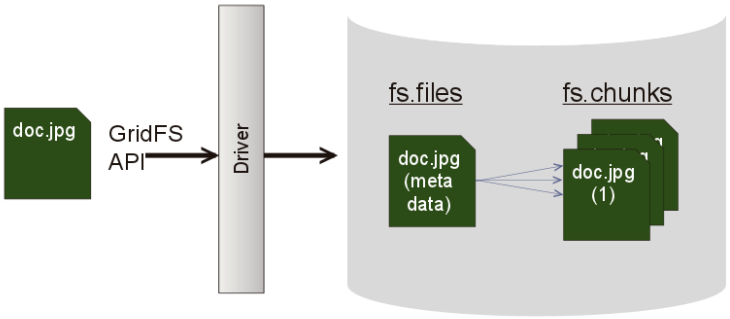
SQL – UML Diagram

b. NoSQL:

Lab Data Management

There are variety of tests that are conducted to patients which ranges from a simple blood tests to MRI scans. Each patient produces voluminous and varied data for every

lab test. In such case, handling lab data in a structured environment will be very difficult. More flexible environment like NoSQL is needed. The BASE property of NoSQL helps in storing and managing different test results in an easy fashion and also data retrieval is faster in case of large data. The file system handling features like mongofiles and GridFS provides solutions for handling very large files greater than 16MB as well. Handling images and videos are also tedious process in SQL



6. QUERY ENUMERATION:

a. Patient Details Management

- **Patient Login:** Patient ID and password must match to access his profile
- **Receptionist:** Needs to add, update and delete the patient profile details if needed
- **Doctor** has to view the patient's details
- **Management** can View patient's details

b. Diagnosis Details Management

- **Doctor** needs to add or update for each consultation
- **Patient** can view the updated data
- **Management** can view for Business analysis reports

c. Billing Management

- **Patient** can view the payments
- **Receptionist** can add or update the billing details
- **Management** can view for Business analysis reports

d. Lab Data Management

- **Lab technician can add or** update the test results and reports
- **Doctors** can view the reports
- **Patients** can view the reports

7. BUSINESS METRICS:

a. Overall Snapshot of the hospital management
b. Revenue Metrics
c. Doctor to Patient Ratio
d. Gender wise Ailment Frequency
e. Department wise revenue report

8. Design Database Schema & MongoDB structure

a. SQL

i) TABLES

- DOCTOR

COLUMN	DATATYPE	NULL/NOT NULL	AUTO INCREMENT	PRIMARY KEY?	FOREIGN KEY?	INDEX
DOC_ID	INT	NOT NULL	Y	Y	Y	Y
F_NAME	CHAR(30)	NOT NULL				
L_NAME	CHAR(30)	NOT NULL				
DEPARTMENT	VARCHAR(30)	NOT NULL				
CONTACT	VARCHAR(20)	NOT NULL				
EXPERIENCE	INTEGER(9)	NOT NULL				

PRIVILIGES

USER	PRIVILIGES
Receptionist	INSERT,UPDATE
Management	SELECT
Patient	SELECT

- PATIENT

COLUMN	DATATYPE	NULL/NOT NULL	AUTO INCREMENT	PRIMARY KEY?	FOREIGN KEY	INDEX
PATIENT_ID	INT	NOT NULL	Y	Y		Y
F_NAME	CHAR(30)	NOT NULL				
L_NAME	CHAR(30)	NOT NULL				
GENDER	CHAR(12)	NOT NULL				
ADDRESS	VARCHAR(256)	NOT NULL				
CONTACT	VARCHAR(20)	NOT NULL				

EMAIL_ID	VARCHAR (100)	NULL				
DOC_ID	VARCHAR(10)	NOT NULL			Y	

PRIVILIGES

USER	**PRIVILIGES**
Receptionist	INSERT,UPDATE

- DIAGNOSIS

COLUMN	**DATATYPE**	**NULL/NOT NULL**	**AUTO INCREMENT**	**PRIMARY KEY?**	**FOREIGN KEY**
DIAG_ID	INT	NOT NULL	Y	Y	
DIAG_DATE	DATE	NOT NULL			
DOC_ID	VARCHAR(20)	NOT NULL			Y
PATIENT_ID	INT	NOT NULL			Y ON DELETE CASCADE
DIAG_TYPE	VARCHAR(45)	NULL			
SEVERITY	VARCHAR(10)	NULL			
TREATMENT	VARCHAR(45)	NULL			
PRESC_DRUGS	VARCHAR(45)	NULL			

PRIVILIGES

USER	**PRIVILIGES**
DOCTOR	INSERT,UPDATE
PATIENT	SELECT

- DEPARTMENT

COLUMN	**DATATYPE**	**NULL/NOT NULL**	**AUTO INCREMENT**	**PRIMARY KEY?**
DEPT_ID	INT	NOT NULL	N	Y
DEPT_NAME	VARCHAR(45)	NOT NULL	N	

PRIVILIGES

USER	PRIVILIGES
Managenment	SELECT

- BILL

COLUMN	DATATYPE	NULL/NOT NULL	AUTO INCREMENT	PRIMARY KEY?	FOREIGN KEY	INDEX
BILL_ID	INT	NOT NULL	Y	Y		
BILL_DATE	CHAR(30)	NOT NULL				Y
PATIENT_ID	CHAR(30)	NOT NULL			Y ON DELETE CASCADE	
PATIENT_NM	CHAR(12)	NOT NULL				
DIAG_ID	VARCHAR(256)	NOT NULL			Y	
AMOUNT	DECIMAL	NOT NULL				

PRIVILIGES

USER	PRIVILIGES
PATIENTS	SELECT
Receptionist	INSERT,UPDATE

ii) VIEWS

- VW_SNAPSHOT

```
CREATE VIEW VW_SNAPSHOT AS
SELECT
D.DOC_ID,
CONCAT(D.F_NAME,' ',D.L_NAME) AS DOCTOR,
P.PATIENT_ID,
CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,
DG.DIAG_DATE ,
DG.DIAG_TYPE ,
```

```
DG.SEVERITY ,
DG.TREATMENT ,
DG.PRESC_DRUGS ,
B.AMOUNT
FROM DOCTOR D
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
JOIN BILL B
ON P.PATIENT_ID = B.PATIENT_ID AND
DG.DIAG_ID  = B.DIAG_ID
ORDER BY DG.DIAG_DATE;
```

- VW_DOC_PAT_RATIO_MAT

```
CREATE VIEW VW_DOC_PAT_RATIO_MAT AS
SELECT
CONCAT(D.F_NAME,' ',D.L_NAME) DOCTOR_NAME,
COUNT(P.PATIENT_ID)
FROM DOCTOR D
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
```

```
GROUP BY D.DOC_ID
ORDER BY DG.DIAG_DATE;
```

- VW_AILMENT_DIST_MAT

```
CREATE VIEW VW_AILMENT_DIST_MAT AS
SELECT
P.GENDER ,
DG.DIAG_TYPE,
COUNT(P.PATIENT_ID) COUNT
FROM
PATIENT P
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
GROUP BY P.GENDER,DG.DIAG_TYPE
ORDER BY P.GENDER,DG.DIAG_TYPE;
```

iii) STORED PROCEDURE

- PROC_REVENUE_METRIX

```
CREATE PROCEDURE PROC_REVENUE_METRIX
AS
BEGIN
SELECT A.YEAR,
A.MONTH,
SUM(A.AMOUNT) AS REVENUE_MAT
FROM (SELECT
EXTRACT(MONTH FROM BILL_DATE) AS MONTH,
EXTRACT(YEAR FROM BILL_DATE) AS YEAR,
AMOUNT
FROM BILL ) A
```

```
GROUP BY A.YEAR,A.MONTH

ORDER BY A.YEAR,A.MONTH

END;
```

b. NoSQL

i) DATABASE

a. Gridfs

ii) COLLECTIONS:

a. Patient
b. Db.ctFiles.files
c. Db.ctFiles.chunks

A. Patients

```
{"Patient_id":11221,

"Patient_name":"SIMON TAYLOR",

"gender":"MALE",

"Age":"50",

"Adderess":"LONDON",

"Contact":"877-609-2983",

"Email_id":"taylor @email.com","Doc_id":"1101"       }, ……..
```

B.fs.chunks

```
{
  "files_id": ObjectId("574a65c19f54bfea8a2fa46b"),

  "n": NumberInt(0),

  "data": "Mongo Binary Data"

} …..
```

C.fs.files


```
{
  "filename": "sample.jpeg",
  "chunkSize": NumberInt(261120),
  "uploadDate": ISODate("2017-11-28T11:32:33.557Z"),
  "md5": "7b772939325e146578b07f72c62bba4f",
  "length": NumberInt(645)
}
```


9. DATABASE POPULATION

a. SQL:

DDL and Scripts:

```
CREATE TABLE DOCTOR (
DOC_ID INT NOT NULL UNIQUE ,
F_NAME CHAR(30) NOT NULL,
L_NAME CHAR(30) NOT NULL,
DEPARTMENT VARCHAR(30) NOT NULL,
CONTACT  VARCHAR(20) NOT NULL,
EXPERIENCE INTEGER (9) NOT NULL,
CONSTRAINT doc_pkey PRIMARY KEY (DOC_ID)
);
CREATE  INDEX idx_doc_doc_id ON DOCTOR (DOC_ID);

GRANT INSERT,UPDATE ON DOCTOR TO receptionist;
GRANT SELECT ON DOCTOR TO management;


CREATE TABLE PATIENT (
PATIENT_ID INT NOT NULL UNIQUE ,
F_NAME CHAR(30) NOT NULL,
L_NAME CHAR(30) NOT NULL,
GENDER CHAR(12) NOT NULL,
AGE INT(3) NOT NULL,
ADDRESS VARCHAR(256) NOT NULL,
CONTACT VARCHAR(20) NOT NULL,
EMAIL_ID VARCHAR (100),
```

```
DOC_ID INT NOT NULL,
CONSTRAINT doc_pkey PRIMARY KEY (PATIENT_ID),
CONSTRAINT patient_doctor_fk FOREIGN KEY (DOC_ID) REFERENCES
DOCTOR (DOC_ID));
GRANT INSERT,UPDATE ON PATIENT TO RECEPTIONIST;
CREATE  INDEX idx_pat_pat_id
ON PATIENT (PATIENT_ID);

CREATE TABLE DIAGNOSIS (
DIAG_ID INT NOT NULL UNIQUE,
DIAG_DATE DATE NOT NULL,
  DOC_ID INT NOT NULL,
PATIENT_ID INT NOT NULL,
DIAG_TYPE VARCHAR(45) NULL,
  SEVERITY VARCHAR(10) NULL,
  TREATMENT VARCHAR(45) NULL,
  PRESC_DRUGS VARCHAR(45) NULL,
CONSTRAINT diag_pkey PRIMARY KEY (DIAG_ID),
CONSTRAINT diag_doc_fk FOREIGN KEY (DOC_ID) REFERENCES DOCTOR
(DOC_ID),
CONSTRAINT diag_pat_fk FOREIGN KEY (PATIENT_ID) REFERENCES
PATIENT (PATIENT_ID)
ON DELETE CASCADE
);
GRANT INSERT,UPDATE ON DIAGNOSIS TO DOCTOR_LIST;
GRANT SELECT ON DIAGNOSIS TO PATIENT_LIST;

CREATE TABLE DEPARTMENT (
  DEPT_ID INT NOT NULL AUTO_INCREMENT,
  DEPT_NAME VARCHAR(45) NOT NULL,
  CONSTRAINT dept_pkey PRIMARY KEY (DEPT_ID));
GRANT SELECT ON DEPARTMENT TO ADMIN2;
CREATE TABLE BILL(
 BILL_ID INT NOT NULL UNIQUE ,
 BILL_DATE DATE NOT NULL,
  PATIENT_ID INT NOT NULL,
  PATIENT_NM VARCHAR(200) NOT NULL,
  DIAG_ID INT NOT NULL ,
  AMOUNT INT NOT NULL,
  CONSTRAINT bill_pkey PRIMARY KEY (BILL_ID),
```

```
CONSTRAINT bill_pt_fk FOREIGN KEY (DIAG_ID) REFERENCES DIAGNOSIS
(DIAG_ID),
CONSTRAINT bill_diag_fk FOREIGN KEY (PATIENT_ID) REFERENCES
PATIENT (PATIENT_ID) ON DELETE CASCADE);
CREATE INDEX idx_bill_bill_dt
ON BILL (BILL_DATE);
GRANT INSERT,UPDATE ON BILL TO Receptionist;
GRANT SELECT ON BILL TO PATIENT_LIST;

CREATE VIEW VW_SNAPSHOT AS
SELECT
D.DOC_ID,
CONCAT(D.F_NAME,' ',D.L_NAME) AS DOCTOR,
P.PATIENT_ID,
CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,
DG.DIAG_DATE ,
DG.DIAG_TYPE ,
DG.SEVERITY ,
DG.TREATMENT ,
DG.PRESC_DRUGS ,
B.AMOUNT
FROM DOCTOR D
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
JOIN BILL B
ON P.PATIENT_ID = B.PATIENT_ID AND
DG.DIAG_ID  = B.DIAG_ID
ORDER BY DG.DIAG_DATE;

CREATE VIEW VW_DOC_PAT_RATIO_MAT AS

SELECT

CONCAT(D.F_NAME,' ',D.L_NAME) DOCTOR_NAME,

COUNT(P.PATIENT_ID)

FROM DOCTOR D
```

```
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
GROUP BY D.DOC_ID
ORDER BY DG.DIAG_DATE;

CREATE VIEW VW_AILMENT_DIST_MAT AS
SELECT
P.GENDER ,
DG.DIAG_TYPE,
COUNT(P.PATIENT_ID) COUNT
FROM
PATIENT P
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
GROUP BY P.GENDER,DG.DIAG_TYPE
ORDER BY P.GENDER,DG.DIAG_TYPE;

CREATE PROCEDURE PROC_REVENUE_METRIX
AS
BEGIN
SELECT A.YEAR,
A.MONTH,
SUM(A.AMOUNT) AS REVENUE_MAT
```

```
FROM (SELECT
EXTRACT(MONTH FROM BILL_DATE) AS MONTH,
EXTRACT(YEAR FROM BILL_DATE) AS YEAR,
AMOUNT
FROM BILL ) A
GROUP BY A.YEAR,A.MONTH
ORDER BY A.YEAR,A.MONTH
END;
```

Data Population:

Refer to DUMP.sql to find the entire dataset. Please find the samples below:

```
INSERT INTO DOCTOR
(DOC_ID, F_NAME, L_NAME, DEPARTMENT, CONTACT,  EXPERIENCE)
values ('1101', 'SAM', 'HENRY', 'CARDIOLOGY', '877-609-2233', 10),
('1100', 'MARK', 'TWAIN', 'CARDIOLOGY', '877-638-2234', 30),
 ('1102', 'CHARLES', 'DICKENS', 'OPTHAMOLOGY', '877-609-2245', 35),
('1104', 'ROWLING', 'JK', 'ONCOLOGY', '877-611-2223', 10),
('1106', 'HENRY', 'OO', 'CARDIOLOGY', '897-609-2443', 11),
('1107', 'WILLIAM', 'SHAKESPEARE', 'ONCOLOGY', '877-678-2203', 12),
('1199', 'SIDNEY', 'SHELDON', 'OPTHAMOLOGY', '857-719-2234', 25),
('1103', 'JEFFREY', 'ARCHER', 'CARDIOLOGY', '867-929-2783', 12),
('1112', 'WILLIAM', 'WORDSWORTH', 'ONCOLOGY', '887-611-2230', 21),
('1111', 'ROBERT', 'FROST', 'OPTHAMOLOGY', '887-699-2236', 11),
('1114', 'JOHN', 'MILTON', 'CARDIOLOGY', '877-689-2238', 19),
('1115', 'SHELLEY', 'PB', 'OPTHAMOLOGY', '867-679-2273', 10)
;
INSERT INTO PATIENT
(PATIENT_ID,F_NAME,L_NAME,GENDER, AGE,ADDRESS,CONTACT,EMAIL_ID,DOC_ID)
VALUES
('11221','SIMON','TAYLOR','MALE','50','LONDON','877-609-2983','taylor
@email.com','1101'),
('11222','ISAAC','NEWTON','MALE','30','CALIFORNIA','877-699-2984','newton
@email.com','1106'),
('11223','ALBERT','EINSTIEN','MALE','60','TEXAS','887-609-
2985','einstien@email.com','1101'),
```

('11224','MICHAEL','FARADEY','MALE','80','LONDON','877-689-2986','faradey@email.com','1106'),
('11225','MARIE','CURIE','FEMALE','30','CALIFORNIA','877-677-2987','curie@email.com','1112'),
('11226','ANNA','TAYLOR','FEMALE','35','TEXAS','977-659-2988','taylor@email.com','1101'),
('11227','EMILEY','MIKE','FEMALE','30','LONDON','847-609-2989','mike@email.com','1112'),
('11228','THOMAS','EDISON','MALE','40','CALIFORNIA','877-629-2990','edison@email.com','1101'),
('11229','CHARLES','DARWIN','MALE','44','TEXAS','807-640-2991','darwin@email.com','1111'),
('11230','STEPHEN','HAWKING','MALE','20','CALIFORNIA','877-909-2992','hawking@email.com','1101');

INSERT INTO DIAGNOSIS

(DIAG_ID ,DIAG_DATE, DOC_ID, PATIENT_ID, DIAG_TYPE, SEVERITY, TREATMENT, PRESC_DRUGS)

values ('2211', '2017/01/01', '1101', '11221','AGIOPLASTY', '1', 'CONSULTATION', 'ZZT YYYY'),

('2212', '2017/04/06', '1106', '11222','CATRACT', '3', 'SURGERY', 'XXXX YYYY'),

('2213', '2017/03/12', '1101', '11223','AGIOPLASTY', '1', 'CONSULTATION', 'ZZZ YYYY'),

('2214', '2016/06/04', '1106', '11224','EYE INFECTION', '1', 'CONSULTATION', 'XXXX QQQ , TUYHG SVCHN'),

('2215', '2017/03/09', '1112', '11225','STOMACH CANCER', '2', 'RADIOTHERAPHY', 'XXXX TTTT'),

('2216', '2017/12/11', '1101', '11226','AGIOPLASTY', '1', 'CONSULTATION', 'XXXX YYYY'),

('2217', '2016/03/10', '1112', '11227','BLOOD CANCER', '1', 'CONSULTATION', 'DDD YYYY'),

('2218', '2017/05/07', '1101', '11228','OPEN HEART', '4', 'SURGERY', 'XXXX YYYY'),

('2219', '2017/03/10', '1111', '11229','CATRACT', '3', 'SURGERY', 'XXXX EEEE'),

('2220', '2016/11/05', '1101', '11230','CHEST CONGESION', '2', 'CONSULTATION', 'XXXX YYYY');

```
INSERT INTO DEPARTMENT (
DEPT_ID ,DEPT_NAME)
values ('1', 'ONCOLOGY'),
('2', 'OPTHAMOLOGY'),
('3', 'CARDIOLOGY')
;
INSERT INTO BILL
(BILL_ID , BILL_DATE,PATIENT_ID, PATIENT_NM ,DIAG_ID, AMOUNT)
values ('3311', '03/21/2017', '11221', 'SIMON TAYLOR','2211', '1000'),
 ('3312', '2017/04/06',  '11222','ISAAC NEWTON','2212', '200'),
 ('3313', '2017/03/12', '11223','ALBERT EINSTIEN', '2213', '600'),
 ('3314', '2016/06/04', '11224', 'MICHAEL FARADEY', '2214', '800'),
 ('3315', '2017/03/09', '11225', 'MARIE CURIE', '2215', '550'),
 ('3316', '201712/11', '11226', 'ANNA TAYLOR', '2216', '120'),
 ('3317', '2016/03/10', '11227', 'EMILEY MIKE', '2217', '250'),
 ('3318', '2017/05/07', '11228', 'THOMAS EDISON', '2218', '100'),
 ('3319', '2017/03/10', '11229', 'CHARLES DARWIN', '2219', '390'),
 ('3320', '2016/11/05', '11230', 'STEPHEN HAWKING', '2220', '340');
```

b. NoSQL:

i) Creating Database

```
Use gridfs
```

ii) Creating Collection :

- **Patient:**

```
db.createCollection("patient")
```

Inserting data into collection Patient as shown in below screenshot:

- **ctFiles.files**
  db.createCollection("ctFiles.files ")

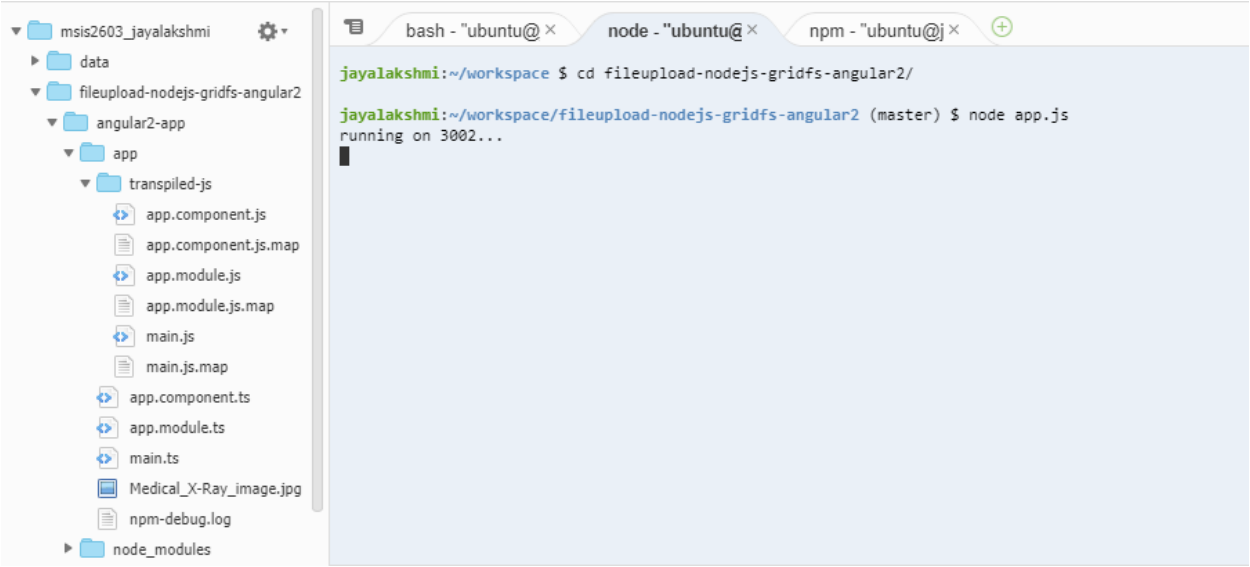
- **ctFiles.chunks**
  db.createCollection("ctFiles.chunks ")

iii) File upload using Nodejs-gridfs-angular2 – Setup

- git clone https://github.com/rahil471/fileupload-nodejs-gridfs-angular2.git
- cd fileupload-nodejs-gridfs-angular2/
- npm install
- In new terminal, started node server

  node app.js

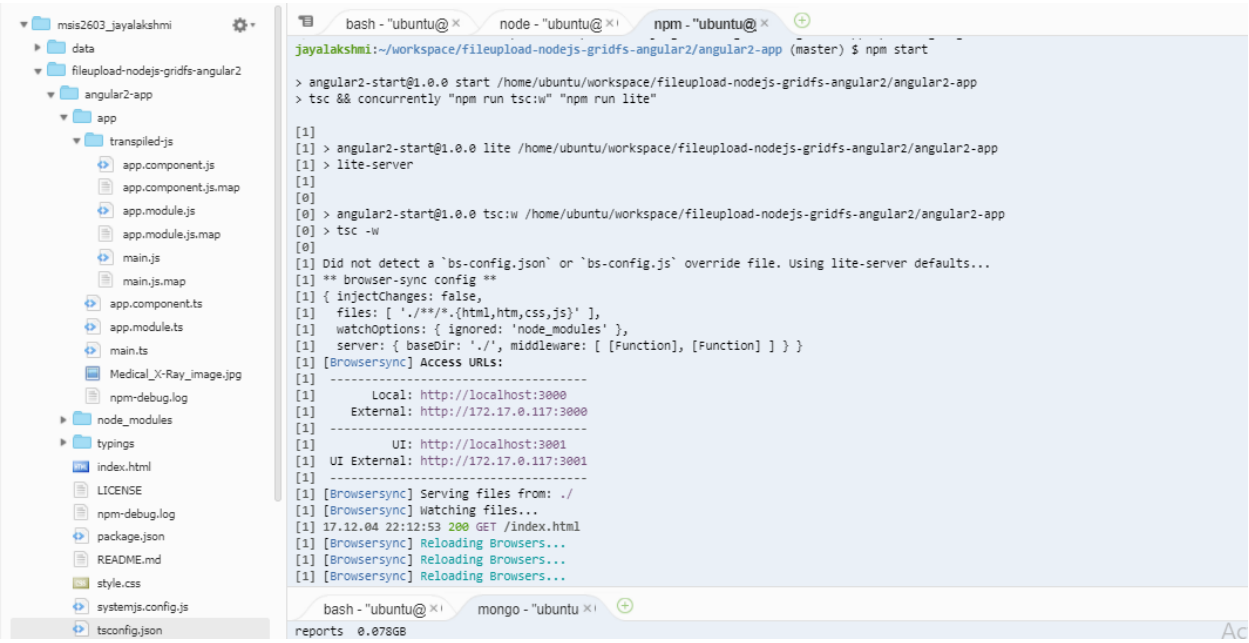
  the node server started on port 3002



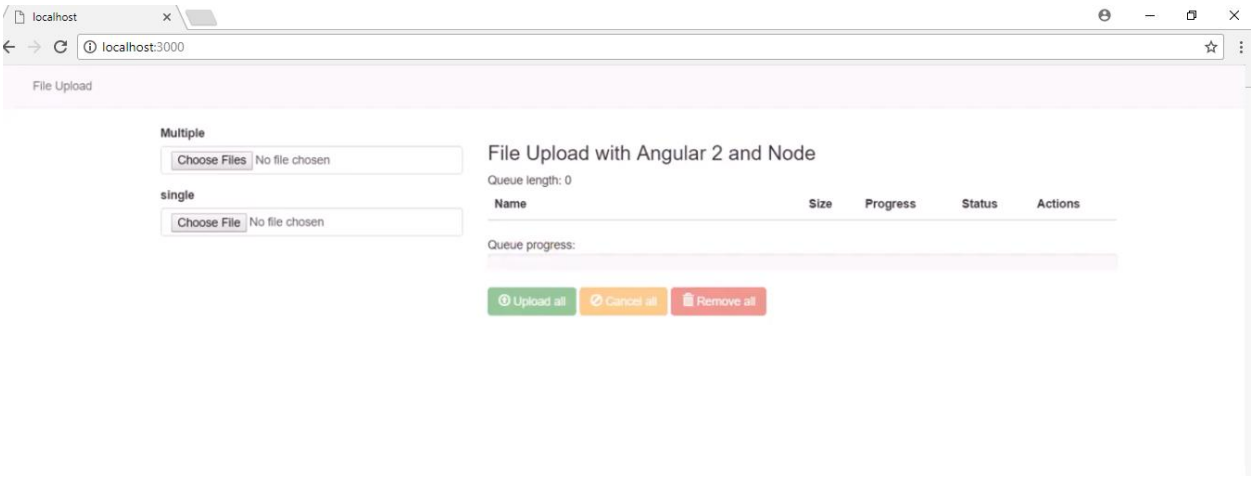
- Connection to the application:

```
cd angular2-app

npm start
```



- angular2 app will be running on port 3000 and will open in browser as shown below. The images to be stored is uploaded



iv) Queries to upload and retrieve files:

```
// Query to upload images
mongofiles -d database put Medical_X-Ray_image.jpg
```

//Query to retrieve images

mongofiles -d database get Medical_X-Ray_image.jpg

//Query to delete images

mongofiles -d database delete Medical_X-Ray_image.jpg

//Query to upload videos

mongofiles.exe -d gridfs put sample.mp3

//The below query uploads the bson data

./mongofiles –port 28017 -d gridfs put people.bson

10.QUERIES:

1. **USER: RECEPTIONIST**

i) To add new patient's profile

```
INSERT INTO PATIENT
(PATIENT_ID,F_NAME,L_NAME,GENDER, AGE,ADDRESS,CONTACT,EMAIL_ID,DOC_ID)
VALUES
('11292','SONIA','TED','FEMALE','32','CHICAGO','877-999-2983','sonia@email.com','1161');
```

Before Insert:

```
mysql> select * from PATIENT WHERE PATIENT_ID = '11292';
Empty set (0.00 sec)
```

After Insert:

```
mysql> select * from PATIENT WHERE PATIENT_ID = '11292';
+------------+--------+--------+--------+---------+--------------+-----------------+--------+------+
| PATIENT_ID | F_NAME | L_NAME | GENDER | ADDRESS | CONTACT      | EMAIL_ID        | DOC_ID | AGE  |
+------------+--------+--------+--------+---------+--------------+-----------------+--------+------+
| 11292      | SONIA  | TED    | FEMALE | CHICAGO | 877-999-2983 | sonia@email.com | 1161   |   32 |
+------------+--------+--------+--------+---------+--------------+-----------------+--------+------+
1 row in set (0.00 sec)
```

ii) When the patient's email Id needs to be updated by the receptionist

```
UPDATE PATIENT SET EMAIL_ID = 'RENNY@email.com'
WHERE PATIENT_ID = '11251';
```

Before Update:

```
mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11251';
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
| PATIENT_ID | F_NAME | L_NAME | GENDER | ADDRESS | CONTACT      | EMAIL_ID          | DOC_ID | AGE  |
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
| 11251      | RENAK  | GRAMMY | MALE   | LONDON  | 877-609-2983 | GRAMMY@email.com  | 1172   |   57 |
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
1 row in set (0.00 sec)
```

After Update:

```
mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11251';
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
| PATIENT_ID | F_NAME | L_NAME | GENDER | ADDRESS | CONTACT      | EMAIL_ID          | DOC_ID | AGE  |
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
| 11251      | RENAK  | GRAMMY | MALE   | LONDON  | 877-609-2983 | RENNY@email.com   | 1172   |   57 |
+------------+--------+--------+--------+---------+--------------+-------------------+--------+------+
1 row in set (0.00 sec)
```

iii) To delete very old consultation details of patient

```
DELETE FROM DIAGNOSIS WHERE EXTRACT(YEAR FROM DIAG_DATE) < 2018 ;
```

Before deletion:

```
mysql> SELECT * FROM BILL B  WHERE EXISTS (SELECT 1  FROM DIAGNOSIS D WHERE EXTRACT(YEAR FROM DIAG_DATE) <2008  AND B.DIAG_ID = D.DIAG_ID);
+---------+-----------+------------+-------------+---------+--------+
| BILL_ID | BILL_DATE | PATIENT_ID | PATIENT_NM  | DIAG_ID | AMOUNT |
+---------+-----------+------------+-------------+---------+--------+
|    2259 | 2017-05-01 | 11239      | POTTER RENAK | 2259    |   1000 |
|    2275 | 2017-01-01 | 11239      | RENAK JOHNNY | 2275    |   1000 |
|    3329 | 2017-02-01 | 11239      | RENAK JOHNNY | 2229    |    100 |
+---------+-----------+------------+-------------+---------+--------+
3 rows in set (0.00 sec)

mysql> SELECT * FROM DIAGNOSIS WHERE EXTRACT(YEAR FROM DIAG_DATE) <2008;
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE    | SEVERITY | TREATMENT    | PRESC_DRUGS |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| 2229    | 2007-01-01 | 1160   | 11239      | BLOOD CANCER | 3        | SURGERY      | QWE YYYY    |
| 2259    | 2007-01-01 | 1119   | 11239      | AGIOPLASTY   | 2        | CONSULTATION | ZZT YYYY    |
| 2275    | 2007-01-01 | 1160   | 11239      | BLOOD CANCER | 2        | CONSULTATION | ZZT YYYY    |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
3 rows in set (0.00 sec)
```

After Deletion:

```
mysql> DELETE  FROM DIAGNOSIS WHERE EXTRACT(YEAR FROM DIAG_DATE) <2008;
Query OK, 3 rows affected (0.00 sec)

mysql> SELECT * FROM DIAGNOSIS WHERE EXTRACT(YEAR FROM DIAG_DATE) <2008;
Empty set (0.00 sec)

mysql> SELECT * FROM BILL B  WHERE EXISTS (SELECT 1  FROM DIAGNOSIS D WHERE EXTRACT(YEAR FROM DIAG_DATE) <2008  AND B.DIAG_ID = D.DIAG_ID);
Empty set (0.00 sec)
```

iv) To delete a particular patient's details (may be upon death)

```
DELETE FROM PATIENT WHERE PATIENT_ID = '11246';
```

Before Delete:

```
mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11246';
+------------+--------+--------+--------+---------+--------------+------------------+--------+------+
| PATIENT_ID | F_NAME | L_NAME | GENDER | ADDRESS | CONTACT      | EMAIL_ID         | DOC_ID | AGE  |
+------------+--------+--------+--------+---------+--------------+------------------+--------+------+
| 11246      | JACKY  | HACKEN | MALE   | LONDON  | 877-609-2983 | HACKEN@email.com | 1167   |   30 |
+------------+--------+--------+--------+---------+--------------+------------------+--------+------+
1 row in set (0.00 sec)

mysql> SELECT * FROM DIAGNOSIS  WHERE PATIENT_ID = '11246';
+---------+------------+--------+------------+------------+----------+--------------+-------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE  | SEVERITY | TREATMENT    | PRESC_DRUGS |
+---------+------------+--------+------------+------------+----------+--------------+-------------+
| 2236    | 2017-01-07 | 1153   | 11246      | CATRACT    | 3        | SURGERY      | QWE YYYY    |
| 2266    | 2017-05-01 | 1119   | 11246      | AGIOPLASTY | 2        | CONSULTATION | ZZT YYYY    |
+---------+------------+--------+------------+------------+----------+--------------+-------------+
2 rows in set (0.00 sec)

mysql> SELECT * FROM BILL  WHERE PATIENT_ID = '11246';
+---------+------------+------------+---------------+---------+--------+
| BILL_ID | BILL_DATE  | PATIENT_ID | PATIENT_NM    | DIAG_ID | AMOUNT |
+---------+------------+------------+---------------+---------+--------+
|    2266 | 2017-01-08 | 11246      | CHARLE TAYLOR | 2266    |   1000 |
|    3336 | 2017-05-01 | 11246      | JACKY HACKEN  | 2236    |    200 |
+---------+------------+------------+---------------+---------+--------+
2 rows in set (0.00 sec)
```

After Delete:

```
mysql> DELETE FROM PATIENT WHERE PATIENT_ID = '11246';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11246';
Empty set (0.00 sec)

mysql> SELECT * FROM DIAGNOSIS  WHERE PATIENT_ID = '11246';
Empty set (0.00 sec)

mysql> SELECT * FROM BILL  WHERE PATIENT_ID = '11246';
Empty set (0.01 sec)

mysql>
```

1. **USER: DOCTOR**

i) **When Doctor needs to add new diagnosis data of his existing patient**

```
INSERT INTO DIAGNOSIS

(DIAG_ID ,DIAG_DATE, DOC_ID, PATIENT_ID, DIAG_TYPE, SEVERITY, TREATMENT,
PRESC_DRUGS)

VALUES

('2282' , '2017-07-04','1106' ,'11244','BLOOD CANCER' ,'1' ,'CONSULTATION','WJW RRB' );
```

Before Insert:

```
mysql> SELECT * FROM DIAGNOSIS WHERE PATIENT_ID = '11244';
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE    | SEVERITY | TREATMENT    | PRESC_DRUGS |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| 2234    | 2017-01-01 | 1165   | 11244      | BLOOD CANCER | 3        | SURGERY      | QWE YYYY    |
| 2264    | 2017-05-01 | 1124   | 11244      | AGIOPLASTY   | 2        | CONSULTATION | ZZT YYYY    |
| 2280    | 2017-01-03 | 1165   | 11244      | BLOOD CANCER | 2        | CONSULTATION | ZZT YYYY    |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
3 rows in set (0.00 sec)
```

After Insert:

```
mysql> SELECT * FROM DIAGNOSIS WHERE PATIENT_ID = '11244';
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE    | SEVERITY | TREATMENT    | PRESC_DRUGS |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
| 2234    | 2017-01-01 | 1165   | 11244      | BLOOD CANCER | 3        | SURGERY      | QWE YYYY    |
| 2264    | 2017-05-01 | 1124   | 11244      | AGIOPLASTY   | 2        | CONSULTATION | ZZT YYYY    |
| 2280    | 2017-01-03 | 1165   | 11244      | BLOOD CANCER | 2        | CONSULTATION | ZZT YYYY    |
| 2282    | 2017-07-04 | 1106   | 11244      | BLOOD CANCER | 1        | CONSULTATION | WJW RRB     |
+---------+------------+--------+------------+--------------+----------+--------------+-------------+
4 rows in set (0.00 sec)
```

ii) When doctor access the patient's history data

```
SELECT
P.PATIENT_ID,
CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,
DG.DIAG_DATE ,
DG.DIAG_TYPE ,
DG.SEVERITY ,
DG.TREATMENT ,
DG.PRESC_DRUGS
FROM PATIENT P
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND P.DOC_ID = DG.DOC_ID
WHERE P.DOC_ID = '1164'
AND P.PATIENT_ID = '11243'
ORDER BY DIAG_DATE DESC;
```

```
+------------+--------------+------------+--------------+----------+--------------+--------------+
| PATIENT_ID | PATIENT      | DIAG_DATE  | DIAG_TYPE    | SEVERITY | TREATMENT    | PRESC_DRUGS |
+------------+--------------+------------+--------------+----------+--------------+--------------+
| 11243      | RENAK JOHNNY | 2017-01-03 | BLOOD CANCER | 2        | CONSULTATION | ZZT YYYY    |
| 11243      | RENAK JOHNNY | 2017-01-01 | BLOOD CANCER | 3        | SURGERY      | QWE YYYY    |
+------------+--------------+------------+--------------+----------+--------------+--------------+
2 rows in set (0.00 sec)
```

iii) When Doctor prescribes a change of drug for treatment

```
UPDATE DIAGNOSIS SET PRESC_DRUGS = 'RAFAGA KFNVB'

WHERE PATIENT_ID = '11248'

AND DIAG_ID = '2238';
```

Before Update:

```
mysql> select * from DIAGNOSIS  WHERE PATIENT_ID = '11248'
    -> AND DIAG_ID = '2238';
+---------+------------+--------+------------+-----------+----------+--------------+-------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE | SEVERITY | TREATMENT    | PRESC_DRUGS |
+---------+------------+--------+------------+-----------+----------+--------------+-------------+
| 2238    | 2017-09-07 | 1155   | 11248      | CATRACT   | 1        | CONSULTATION | ZZT IYNJY   |
+---------+------------+--------+------------+-----------+----------+--------------+-------------+
1 row in set (0.00 sec)
```

After Update:

```
mysql> select * from DIAGNOSIS  WHERE PATIENT_ID = '11248' AND DIAG_ID = '2238';
+---------+------------+--------+------------+-----------+----------+--------------+--------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE | SEVERITY | TREATMENT    | PRESC_DRUGS  |
+---------+------------+--------+------------+-----------+----------+--------------+--------------+
| 2238    | 2017-09-07 | 1155   | 11248      | CATRACT   | 1        | CONSULTATION | RAFAGA KFNVB |
+---------+------------+--------+------------+-----------+----------+--------------+--------------+
1 row in set (0.01 sec)
```

2. USER: PATIENT

i) When user wants to access his profile details:

```
SELECT * FROM PATIENT
WHERE PATIENT_ID = '11223';
```

```
mysql> SELECT * FROM PATIENT
    -> WHERE PATIENT_ID = '11223';
+------------+--------+----------+--------+---------+--------------+---------------------+--------+------+
| PATIENT_ID | F_NAME | L_NAME   | GENDER | ADDRESS | CONTACT      | EMAIL_ID            | DOC_ID | AGE  |
+------------+--------+----------+--------+---------+--------------+---------------------+--------+------+
| 11223      | ALBERT | EINSTIEN | MALE   | TEXAS   | 847-619-2983 | albert@EMAIL_ID.com | 1101   |   31 |
+------------+--------+----------+--------+---------+--------------+---------------------+--------+------+
1 row in set (0.00 sec)
```

ii) When user needs to update any of his personal details:

```
UPDATE PATIENT SET CONTACT = '877-654-7565'

 WHERE PATIENT_ID = '11230';
```

Before Update:

```
mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11230';
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
| PATIENT_ID | F_NAME  | L_NAME  | GENDER | ADDRESS    | CONTACT      | EMAIL_ID             | DOC_ID | AGE  |
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
| 11230      | STEPHEN | HAWKING | MALE   | CALIFORNIA | 8797-349-2983 | stephen@EMAIL_ID.com | 1101   |   31 |
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
1 row in set (0.00 sec)
```

After Update:

```
mysql> SELECT * FROM PATIENT WHERE PATIENT_ID = '11230';
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
| PATIENT_ID | F_NAME  | L_NAME  | GENDER | ADDRESS    | CONTACT      | EMAIL_ID             | DOC_ID | AGE  |
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
| 11230      | STEPHEN | HAWKING | MALE   | CALIFORNIA | 877-654-7565 | stephen@EMAIL_ID.com | 1101   |   31 |
+------------+---------+---------+--------+------------+--------------+----------------------+--------+------+
1 row in set (0.00 sec)
```

iii) To find the latest consultation details, maximum of 5 consultations

```
SELECT
DOCTOR,
PATIENT_ID,
PATIENT,
DIAG_DATE ,
DIAG_TYPE ,
SEVERITY ,
TREATMENT ,
PRESC_DRUGS
FROM VW_SNAPSHOT
WHERE PATIENT_ID = '11231'
ORDER BY DIAG_DATE DESC
LIMIT 5;
```

```
mysql> SELECT
    -> DOCTOR,
    -> PATIENT_ID,
    -> PATIENT,
    -> DIAG_DATE ,
    -> DIAG_TYPE ,
    -> SEVERITY ,
    -> TREATMENT ,
    -> PRESC_DRUGS
    -> FROM VW_SNAPSHOT
    -> WHERE PATIENT_ID = '11231'
    -> ORDER BY DIAG_DATE DESC
    -> LIMIT 5
    -> ;
+-------------+------------+--------------+------------+---------------+----------+--------------+-------------+
| DOCTOR      | PATIENT_ID | PATIENT      | DIAG_DATE  | DIAG_TYPE     | SEVERITY | TREATMENT    | PRESC_DRUGS |
+-------------+------------+--------------+------------+---------------+----------+--------------+-------------+
| DSGDB STEVE | 11231      | RENAK DARWIN | 2017-05-01 | CATRACT       | 2        | CONSULTATION | ZZT YYYY    |
| DSGDB STEVE | 11231      | RENAK DARWIN | 2017-01-01 | EYE INFECTION | 1        | CONSULTATION | ZZT YYYY    |
+-------------+------------+--------------+------------+---------------+----------+--------------+-------------+
2 rows in set (0.00 sec)
```

3. USER: HOSPITAL MANAGEMENT

To analyze department-wise performance

```
SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE
FROM DEPARTMENT DP
JOIN DOCTOR D
ON DP.DEPT_NAME = D.DEPARTMENT
JOIN VW_SNAPSHOT S
ON D.DOC_ID = S.DOC_ID
GROUP BY DEPT_NAME
ORDER BY DEPT_NAME;
```

```
mysql> SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE
    -> FROM DEPARTMENT DP
    -> JOIN DOCTOR D
    -> ON DP.DEPT_NAME = D.DEPARTMENT
    -> JOIN VW_SNAPSHOT S
    -> ON D.DOC_ID = S.DOC_ID
    -> GROUP BY DEPT_NAME
    -> ORDER BY DEPT_NAME;
+-------------+---------+
| DEPARTMENT  | REVENUE |
+-------------+---------+
| CARDIOLOGY  |    3160 |
| ONCOLOGY    |    4100 |
| OPTHAMOLOGY |   10090 |
+-------------+---------+
3 rows in set (0.00 sec)
```

TABLES

SELECT * FROM DOCTOR LIMIT 12;

```
mysql> SELECT * FROM DOCTOR;
+--------+---------+-------------+-------------+--------------+------------+
| DOC_ID | F_NAME  | L_NAME      | DEPARTMENT  | CONTACT      | EXPERIENCE |
+--------+---------+-------------+-------------+--------------+------------+
| 1100   | MARK    | TWAIN       | CARDIOLOGY  | 877-638-2234 |         30 |
| 1101   | SAM     | HENRY       | CARDIOLOGY  | 877-609-2233 |         10 |
| 1102   | CHARLES | DICKENS     | OPTHAMOLOGY | 877-609-2245 |         35 |
| 1103   | JEFFREY | ARCHER      | CARDIOLOGY  | 867-929-2783 |         12 |
| 1104   | ROWLING | JK          | ONCOLOGY    | 877-611-2223 |         10 |
| 1106   | HENRY   | OO          | CARDIOLOGY  | 897-609-2443 |         11 |
| 1107   | WILLIAM | SHAKESPEARE | ONCOLOGY    | 877-678-2203 |         12 |
| 1111   | ROBERT  | FROST       | OPTHAMOLOGY | 887-699-2236 |         11 |
| 1112   | WILLIAM | WORDSWORTH  | ONCOLOGY    | 887-611-2230 |         21 |
| 1114   | JOHN    | MILTON      | CARDIOLOGY  | 877-689-2238 |         19 |
| 1115   | SHELLEY | PB          | OPTHAMOLOGY | 867-679-2273 |         10 |
| 1199   | SIDNEY  | SHELDON     | OPTHAMOLOGY | 857-719-2234 |         25 |
+--------+---------+-------------+-------------+--------------+------------+
12 rows in set (0.01 sec)
```

SELECT * FROM PATIENT LIMIT 10;

```
mysql> SELECT * FROM PATIENT;
+------------+---------+----------+--------+------------+--------------+----------------------+--------+
| PATIENT_ID | F_NAME  | L_NAME   | GENDER | ADDRESS    | CONTACT      | EMAIL_ID             | DOC_ID |
+------------+---------+----------+--------+------------+--------------+----------------------+--------+
| 11221      | SIMON   | TAYLOR   | MALE   | LONDON     | 877-609-2983 | simon@EMAIL_ID.com   | 1101   |
| 11222      | ISAAC   | NEWTON   | MALE   | CALIFORNIA | 876-623-2945 | isaac@EMAIL_ID.com   | 1106   |
| 11223      | ALBERT  | EINSTIEN | MALE   | TEXAS      | 847-619-2983 | albert@EMAIL_ID.com  | 1101   |
| 11224      | MICHAEL | FARADEY  | MALE   | LONDON     | 867-639-2986 | mich@EMAIL_ID.com    | 1106   |
| 11225      | MARIE   | CURIE    | FEMALE | LONDON     | 897-659-2983 | marie@EMAIL_ID.com   | 1112   |
| 11226      | ANNA    | TAYLOR   | FEMALE | TEXAS      | 857-669-2583 | anna@EMAIL_ID.com    | 1101   |
| 11227      | EMILEY  | MIKE     | FEMALE | CALIFORNIA | 887-649-2985 | emiley@EMAIL_ID.com  | 1112   |
| 11228      | THOMAS  | EDISON   | MALE   | LONDON     | 877-689-2483 | thomas@EMAIL_ID.com  | 1101   |
| 11229      | CHARLES | DARWIN   | MALE   | LONDON     | 857-609-2987 | charles@EMAIL_ID.com | 1111   |
| 11230      | STEPHEN | HAWKING  | MALE   | CALIFORNIA | 8797-349-2983| stephen@EMAIL_ID.com | 1101   |
+------------+---------+----------+--------+------------+--------------+----------------------+--------+
10 rows in set (0.00 sec)
```

SELECT * FROM DIAGNOSIS LIMIT 10;

```
mysql> SELECT * FROM DIAGNOSIS ;
+---------+------------+--------+------------+----------------+----------+--------------+------------------------+
| DIAG_ID | DIAG_DATE  | DOC_ID | PATIENT_ID | DIAG_TYPE      | SEVERITY | TREATMENT    | PRESC_DRUGS            |
+---------+------------+--------+------------+----------------+----------+--------------+------------------------+
| 2211    | 2017-01-01 | 1101   | 11221      | AGIOPLASTY     | 1        | CONSULTATION | ZZT YYYY               |
| 2212    | 2017-04-06 | 1106   | 11222      | CATRACT        | 3        | SURGERY      | XXXX YYYY              |
| 2213    | 2017-03-12 | 1101   | 11223      | AGIOPLASTY     | 1        | CONSULTATION | ZZZ YYYY               |
| 2214    | 2016-06-04 | 1106   | 11224      | EYE INFECTION  | 1        | CONSULTATION | XXXX QQQ , TUYHG SVCHN |
| 2215    | 2017-03-09 | 1112   | 11225      | STOMACH CANCER | 2        | RADIOTHERAPHY | XXXX TTTT             |
| 2216    | 2017-01-01 | 1101   | 11226      | AGIOPLASTY     | 1        | CONSULTATION | XXXX YYYY              |
| 2217    | 2016-03-10 | 1112   | 11227      | BLOOD CANCER   | 1        | CONSULTATION | DDD YYYY               |
| 2218    | 2017-01-01 | 1101   | 11228      | OPEN HEART     | 4        | SURGERY      | XXXX YYYY              |
| 2219    | 2017-03-10 | 1111   | 11229      | CATRACT        | 3        | SURGERY      | XXXX EEEE              |
| 2220    | 2016-11-05 | 1101   | 11230      | CHEST CONGESION | 2       | CONSULTATION | XXXX YYYY              |
+---------+------------+--------+------------+----------------+----------+--------------+------------------------+
10 rows in set (0.00 sec)
```

SELECT * FROM DEPARTMENT ;

```
mysql> SELECT * FROM DEPARTMENT ;
+---------+-------------+
| DEPT_ID | DEPT_NAME   |
+---------+-------------+
|       1 | ONCOLOGY    |
|       2 | OPTHAMOLOGY |
|       3 | CARDIOLOGY  |
+---------+-------------+
3 rows in set (0.00 sec)
```

SELECT * FROM BILL LIMIT 10;

```
mysql> SELECT * FROM BILL;
+---------+------------+------------+-----------------+---------+--------+
| BILL_ID | BILL_DATE  | PATIENT_ID | PATIENT_NM      | DIAG_ID | AMOUNT |
+---------+------------+------------+-----------------+---------+--------+
|    3311 | 2017-05-01 | 11221      | SIMON TAYLOR    | 2211    |   1000 |
|    3312 | 2017-04-06 | 11222      | ISAAC NEWTON    | 2212    |    200 |
|    3313 | 2017-03-12 | 11223      | ALBERT EINSTIEN | 2213    |    600 |
|    3314 | 2016-06-04 | 11224      | MICHAEL FARADEY | 2214    |    800 |
|    3315 | 2017-03-09 | 11225      | MARIE CURIE     | 2215    |    550 |
|    3316 | 2017-05-01 | 11226      | ANNA TAYLOR     | 2216    |    120 |
|    3317 | 2016-03-10 | 11227      | EMILEY MIKE     | 2217    |    250 |
|    3318 | 2017-05-07 | 11228      | THOMAS EDISON   | 2218    |    100 |
|    3319 | 2017-03-10 | 11229      | CHARLES DARWIN  | 2219    |    390 |
|    3320 | 2016-11-05 | 11230      | STEPHEN HAWKING | 2220    |    340 |
+---------+------------+------------+-----------------+---------+--------+
10 rows in set (0.00 sec)
```

VIEWS:

```
CREATE VIEW VW_SNAPSHOT AS
SELECT
D.DOC_ID,
CONCAT(D.F_NAME,' ',D.L_NAME) AS DOCTOR,
P.PATIENT_ID,
CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,
DG.DIAG_DATE ,
DG.DIAG_TYPE ,
DG.SEVERITY ,
DG.TREATMENT ,
DG.PRESC_DRUGS ,
B.AMOUNT
FROM DOCTOR D
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
JOIN BILL B
ON P.PATIENT_ID = B.PATIENT_ID AND
DG.DIAG_ID  = B.DIAG_ID
ORDER BY DG.DIAG_DATE;
```

DOC_ID	DOCTOR	PATIENT_ID	PATIENT	DIAG_DATE	DIAG_TYPE	SEVERITY	TREATMENT	PRESC_DRUGS	AMOUNT
1112	WILLIAM WORDSWORTH	11227	EMILEY MIKE	2016-03-10	BLOOD CANCER	1	CONSULTATION	DDD YYYY	250
1106	HENRY OO	11224	MICHAEL FARADEY	2016-06-04	EYE INFECTION	1	CONSULTATION	XXXX QQQ , TUYHG SVCHN	800
1101	SAM HENRY	11230	STEPHEN HAWKING	2016-11-05	CHEST CONGESION	2	CONSULTATION	XXXX YYYY	340
1161	JOHNNATHAN GUILY	11240	GRAND TARZAN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1152	DSGDB STEVE	11231	RENAK DARWIN	2017-01-01	EYE INFECTION	1	CONSULTATION	ZZT YYYY	1000
1157	BOBAGE DENIS	11236	GRAND BOBAGE	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1162	RENNY GRAND	11241	TIMMI POTTER	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1153	HAG WARNER	11232	HENRY STELLA	2017-01-01	EYE INFECTION	1	CONSULTATION	ZZT YYYY	100
1158	QWERTY PENNY	11237	JOBSS MEGHAN	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1163	JOHNNY RONNY	11242	TOMMY HACKEN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1154	ION JAMES	11233	RONNY GRAMMY	2017-01-01	CATRACT	1	CONSULTATION	ZZT YYYY	100
1159	ANNA MEGHAN	11238	BROSS GRANDS	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1164	TOMMY WARNER	11243	RENAK JOHNNY	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1155	DARWIN JOHN	11234	JACKY CHARLE	2017-01-01	CATRACT	1	CONSULTATION	ZZT YYYY	100
1160	TERRY DARWIN	11239	RENAK JOHNNY	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	100
1101	SAM HENRY	11221	SIMON TAYLOR	2017-01-01	AGIOPLASTY	1	CONSULTATION	ZZT YYYY	1000
1165	JIMMY JOBS	11244	HENRY TARZAN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1156	DAMN HARRY	11235	GUILY WARNER	2017-01-01	CATRACT	3	SURGERY	ZZT YYYY	100
1166	TARZAN BROS	11245	RONNY POTTER	2017-01-07	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1161	JOHNNATHAN GUILY	11240	GRAND TARZAN	2017-01-08	BLOOD CANCER	2	CONSULTATION	ZZT YYYY	1000
1112	WILLIAM WORDSWORTH	11225	MARIE CURIE	2017-03-09	STOMACH CANCER	2	RADIOTHERAPHY	XXXX TTTT	550

```
| 1111   | ROBERT FROST       | 11229      | CHARLES DARWIN   | 2017-03-10 | CATRACT         | 3        | SURGERY       | XXXX EEEE             |    390 |
| 1101   | SAM HENRY          | 11223      | ALBERT EINSTIEN  | 2017-03-12 | AGIOPLASTY      | 1        | CONSULTATION  | ZZZ YYYY              |    600 |
| 1106   | HENRY OO           | 11222      | ISAAC NEWTON     | 2017-04-06 | CATRACT         | 3        | SURGERY       | XXXX YYYY             |    200 |
| 1154   | ION JAMES          | 11233      | RONNY GRAMMY     | 2017-05-01 | CATRACT         | 2        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1155   | DARWIN JOHN        | 11234      | JACKY CHARLE     | 2017-05-01 | CATRACT         | 1        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1152   | DSGDB STEVE        | 11231      | RENAK DARWIN     | 2017-05-01 | CATRACT         | 2        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1153   | HAG WARNER         | 11232      | HENRY STELLA     | 2017-05-01 | CATRACT         | 2        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1101   | SAM HENRY          | 11228      | THOMAS EDISON    | 2017-05-07 | OPEN HEART      | 4        | SURGERY       | XXXX YYYY             |    100 |
| 1158   | QWERTY PENNY       | 11237      | JOBSS MEGHAN     | 2017-05-08 | CATRACT         | 1        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1159   | ANNA MEGHAN        | 11238      | BROSS GRANDS     | 2017-05-08 | CATRACT         | 2        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1160   | TERRY DARWIN       | 11239      | RENAK JOHNNY     | 2017-05-08 | BLOOD CANCER    | 2        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1156   | DAMN HARRY         | 11235      | GUILY WARNER     | 2017-05-08 | CATRACT         | 1        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1157   | BOBAGE DENIS       | 11236      | GRAND BOBAGE     | 2017-05-08 | CATRACT         | 1        | CONSULTATION  | ZZT YYYY              |   1000 |
| 1101   | SAM HENRY          | 11226      | ANNA TAYLOR      | 2017-12-11 | AGIOPLASTY      | 1        | CONSULTATION  | XXXX YYYY             |    120 |
+--------+--------------------+------------+------------------+------------+-----------------+----------+---------------+-----------------------+--------+
35 rows in set (0.00 sec)

mysql>
```

```
CREATE VIEW VW_DOC_PAT_RATIO_MAT AS
SELECT
CONCAT(D.F_NAME,' ',D.L_NAME) DOCTOR_NAME,
COUNT(P.PATIENT_ID)
FROM DOCTOR D
JOIN
PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
GROUP BY D.DOC_ID
ORDER BY DG.DIAG_DATE;
```

```
mysql> SELECT * FROM VW_DOC_PAT_RATIO_MAT ;
+--------------------+----------------------+
| DOCTOR_NAME        | COUNT(P.PATIENT_ID) |
+--------------------+----------------------+
| TERRY DARWIN       |                    2 |
| SAM HENRY          |                    5 |
| TOMMY WARNER       |                    2 |
| JOHNNATHAN GUILY   |                    2 |
| QWERTY PENNY       |                    2 |
| DARWIN JOHN        |                    2 |
| DSGDB STEVE        |                    2 |
| JIMMY JOBS         |                    2 |
| RENNY GRAND        |                    2 |
| ANNA MEGHAN        |                    2 |
| DAMN HARRY         |                    2 |
| HAG WARNER         |                    2 |
| JOHNNY RONNY       |                    2 |
| BOBAGE DENIS       |                    2 |
| ION JAMES          |                    2 |
| TARZAN BROS        |                    2 |
| WILLIAM WORDSWORTH |                    2 |
| ROBERT FROST       |                    1 |
| HENRY OO           |                    2 |
+--------------------+----------------------+
19 rows in set (0.01 sec)
```

```
CREATE VIEW VW_AILMENT_DIST_MAT AS
SELECT
P.GENDER ,
DG.DIAG_TYPE,
COUNT(P.PATIENT_ID) COUNT
FROM
PATIENT P
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
GROUP BY P.GENDER,DG.DIAG_TYPE
ORDER BY P.GENDER,DG.DIAG_TYPE;
```

```
mysql> SELECT * FROM VW_AILMENT_DIST_MAT ;
+--------+-----------------+-------+
| GENDER | DIAG_TYPE       | COUNT |
+--------+-----------------+-------+
| FEMALE | AGIOPLASTY      |     5 |
| FEMALE | BLOOD CANCER    |     1 |
| FEMALE | STOMACH CANCER  |     1 |
| MALE   | AGIOPLASTY      |    23 |
| MALE   | BLOOD CANCER    |    14 |
| MALE   | CATRACT         |    22 |
| MALE   | CHEST CONGESION |     1 |
| MALE   | EYE INFECTION   |     3 |
| MALE   | OPEN HEART      |     1 |
+--------+-----------------+-------+
9 rows in set (0.00 sec)
```

STORED PROCEDURE:

```
CREATE PROCEDURE REVENUE_METRIX
AS
BEGIN
SELECT A.YEAR,
A.MONTH,
SUM(A.AMOUNT) AS REVENUE_MAT
FROM (SELECT
EXTRACT(MONTH FROM BILL_DATE) AS MONTH,
EXTRACT(YEAR FROM BILL_DATE) AS YEAR,
AMOUNT
FROM BILL ) A
GROUP BY A.YEAR,A.MONTH
ORDER BY A.YEAR,A.MONTH
END;
```

```
+------+-------+-------------+
| YEAR | MONTH | REVENUE_MAT |
+------+-------+-------------+
| 2007 |     4 |        1120 |
| 2007 |     1 |        1000 |
| 2007 |     2 |         100 |
| 2007 |     5 |        1000 |
| 2016 |     2 |         700 |
| 2016 |     3 |         250 |
| 2016 |     6 |         800 |
| 2016 |    11 |         340 |
| 2017 |     1 |       12600 |
| 2017 |     2 |        1600 |
| 2017 |     3 |        1540 |
| 2017 |     4 |         200 |
| 2017 |     5 |       13060 |
+------+-------+-------------+
```

iv) **NoSQL:**

2. USER: LAB TECHNICIAN

i) **To retrieve patient details:**

Db.patients.find({“Patient_id”:11221}).pretty()

```
> db.patients.find({"Patient_id":11221}).pretty()
{
        "_id" : ObjectId("5a25e62e5a67ba8735086052"),
        "Patient_id" : 11221,
        "Patient_name" : "SIMON TAYLOR",
        "gender" : "MALE",
        "Age" : "50",
        "Adderess" : "LONDON",
        "Contact" : "877-609-2983",
        "Email_id" : "taylor @email.com",
        "Doc_id" : "1101"
}
```

ii) To retrieve and view the images in mongo:

- **The metadata of the uploaded files are viewed as follows:**

Use gridfs

Db.ctFiles.files.find()

Meta data of uploaded files from collection ctFiles

```
> show dbs
admin     (empty)
gridfs    0.078GB
local     0.078GB
reports   0.078GB
> use gridfs
switched to db gridfs
> show collections
ctFiles.chunks
ctFiles.files
patients
system.indexes
> db.ctFiles.files.find()
{ "_id" : ObjectId("5a25df2c5a67ba873508604f"), "filename" : "Xray.jpeg", "contentType" : "image.jpeg", "length" : 23539, "chunkSize" : 261120, "uploadDate" : ISODate("2017-12-02T03:32:50.915Z"), "meta
data" : { "originalname" : "Xray.jpeg" }, "md5" : "e4f53379c909f7bed2e9d631e15c1c41" }
{ "_id" : ObjectId("5a25e0c35a67ba8735086051"), "filename" : "Xray_2.jpeg", "contentType" : "image.jpeg", "length" : 81779, "chunkSize" : 261120, "uploadDate" : ISODate("2017-12-02T05:32:50.915Z"), "me
tadata" : { "originalname" : "Xray_2.jpeg" }, "md5" : "e4f53379c909f7be4e9d643e15c1c44" }
```

- Chunks of the uploaded files are viewed as:

  Db.ctFiles.chunks.find()

Information about the chunks and the file id:


```
> db.ctFiles.chunks.find()
{ "_id" : ObjectId("5a25ec755a67ba873508605c"), "files_id" : ObjectId("5a25df2c5a67ba873508604f"), "n" : 0, "data" : "BinData(0,/9j/4AAQSkZJRgABAQEAlgCWAAD/2wBDAAEBAQEBAQEBAQEBAQEBAQEBAQEBAQEBAQEBAQEBA
QEBAQEBAQICAQECAQEBAgICAgICAgICAQICAgICAgICAgL/wAALCAKnA+YBAREA/8QAHwABAAAFBQEAAAAAAAAAAAAAAECAwQKBQcICQsG/8QAdBAAAQMCBAIGBQcGBggPCgkNAQACAwQRBQYSIQcxCBMiQVFhCQoUMnEjQlKBkaGxFTNiwdHwFiRDcpLhFzRTdYKitL
UaJSY1Njc4VXR2k7K31vEYOURUY2SzwtLiGSdFRmV3g4aXtsPXSFZXc5RmhIWW1P/aAAgBAQAAPwDP4RERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERREVB+tzw3QSwczcdom32W3Vu6VkjmwwTtjeDd7CxziQeQu5u291LHMGPEboS2XVa2s
nU24Al2GwJ7u5QlA9obPLEdLWBofd2x1lwFm8+fgvmcWzbgeX5JZcXxiHDo3PeY+iIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIi
IiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIi//9k=)" }
{ "_id" : ObjectId("5a25ecb95a67ba873508605d"), "files_id" : ObjectId("5a25e0c35a67ba8735086051"), "n" : 0, "data" : "BinData(0,/9j/8AAQWDDFRgABAQEAlgCWAAD/2wBDAAEBAQEBAQERERERERERERERERERERERQEBAQEBAQI
CAQECAQEBAgICAgICAgICAQICAgICAgICAgL/wAALCAKnA+YBAREA/8QAHwABAAAFBQERERERERERERECAwQKBQcICQsG/8QAdBAAAQMCBAIGBQcGBggPCgkNAQACAwQRBQYSIQcxCBMiQVFhCQoUMnEjQlKBkaGxFTNiwdHwFiRDcpLhFzRTdYKitLUaJSY1Njc4VXR2
k7K31vEYOURUY2SzwtLiGSdFRmV3g4aXtsPXSFZXc5RmhIWW1P/aAAgBAQAAPwDP4RERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERERREVB+tzw3QSwczcdom32W3Vu6VkjmwwTtjeDd7CxziQeQu5u291LHMGPEboS2XVa2snU24Al2GwJ7u5Q
lA9obPLEdLWBofd2x1lwFm8+fgvmcWzbgeX5JZcXxiHDo3PeY+iIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIi
IiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIiIi//9k=)" }
> 
```


iii) **To retrieve and view the images in application**

By Typing the below host address the image is retrieved from Mongo DB into the application:

localhost3002/files/Xray.jpeg

Screenshot of the retrieved image from mongo

11. BUSINESS MATRICS

a. Overall Snapshot of the hospital management – View

```
SELECT * FROM VW_SNAPSHOT ;
```

DOC_ID	DOCTOR	PATIENT_ID	PATIENT	DIAG_DATE	DIAG_TYPE	SEVERITY	TREATMENT	PRESC_DRUGS	AMOUNT
1112	WILLIAM WORDSWORTH	11227	EMILEY MIKE	2016-03-10	BLOOD CANCER	1	CONSULTATION	DDD YYYY	250
1106	HENRY OO	11224	MICHAEL FARADEY	2016-06-04	EYE INFECTION	1	CONSULTATION	XXXX QQQ , TUYHG SVCHN	800
1101	SAM HENRY	11230	STEPHEN HAWKING	2016-11-05	CHEST CONGESION	2	CONSULTATION	XXXX YYYY	340
1161	JOHNNATHAN GUILY	11240	GRAND TARZAN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1152	DSGDB STEVE	11231	RENAK DARWIN	2017-01-01	EYE INFECTION	1	CONSULTATION	ZZT YYYY	1000
1157	BOBAGE DENIS	11236	GRAND BOBAGE	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1162	RENNY GRAND	11241	TIMMI POTTER	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1153	HAG WARNER	11232	HENRY STELLA	2017-01-01	EYE INFECTION	1	CONSULTATION	ZZT YYYY	100
1158	QWERTY PENNY	11237	JOBSS MEGHAN	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1163	JOHNNY RONNY	11242	TOMMY HACKEN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1154	ION JAMES	11233	RONNY GRAMMY	2017-01-01	CATRACT	1	CONSULTATION	ZZT YYYY	100
1159	ANNA MEGHAN	11238	BROSS GRANDS	2017-01-01	CATRACT	3	SURGERY	QWE YYYY	100
1164	TOMMY WARNER	11243	RENAK JOHNNY	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1155	DARWIN JOHN	11234	JACKY CHARLE	2017-01-01	CATRACT	1	CONSULTATION	ZZT YYYY	100
1160	TERRY DARWIN	11239	RENAK JOHNNY	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	100
1101	SAM HENRY	11221	SIMON TAYLOR	2017-01-01	AGIOPLASTY	1	CONSULTATION	ZZT YYYY	1000
1165	JIMMY JOBS	11244	HENRY TARZAN	2017-01-01	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1156	DAMN HARRY	11235	GUILY WARNER	2017-01-01	CATRACT	3	SURGERY	ZZT YYYY	100
1166	TARZAN BROS	11245	RONNY POTTER	2017-01-07	BLOOD CANCER	3	SURGERY	QWE YYYY	200
1161	JOHNNATHAN GUILY	11240	GRAND TARZAN	2017-01-08	BLOOD CANCER	2	CONSULTATION	ZZT YYYY	1000
1112	WILLIAM WORDSWORTH	11225	MARIE CURIE	2017-03-09	STOMACH CANCER	2	RADIOTHERAPHY	XXXX TTTT	550
1111	ROBERT FROST	11229	CHARLES DARWIN	2017-03-10	CATRACT	3	SURGERY	XXXX EEEE	390
1101	SAM HENRY	11223	ALBERT EINSTIEN	2017-03-12	AGIOPLASTY	1	CONSULTATION	ZZZ YYYY	600
1106	HENRY OO	11222	ISAAC NEWTON	2017-04-06	CATRACT	3	SURGERY	XXXX YYYY	200
1154	ION JAMES	11233	RONNY GRAMMY	2017-05-01	CATRACT	2	CONSULTATION	ZZT YYYY	1000
1155	DARWIN JOHN	11234	JACKY CHARLE	2017-05-01	CATRACT	1	CONSULTATION	ZZT YYYY	1000
1152	DSGDB STEVE	11231	RENAK DARWIN	2017-05-01	CATRACT	2	CONSULTATION	ZZT YYYY	1000
1153	HAG WARNER	11232	HENRY STELLA	2017-05-01	CATRACT	2	CONSULTATION	ZZT YYYY	1000
1101	SAM HENRY	11228	THOMAS EDISON	2017-05-07	OPEN HEART	4	SURGERY	XXXX YYYY	100
1158	QWERTY PENNY	11237	JOBSS MEGHAN	2017-05-08	CATRACT	1	CONSULTATION	ZZT YYYY	1000
1159	ANNA MEGHAN	11238	BROSS GRANDS	2017-05-08	CATRACT	2	CONSULTATION	ZZT YYYY	1000
1160	TERRY DARWIN	11239	RENAK JOHNNY	2017-05-08	BLOOD CANCER	2	CONSULTATION	ZZT YYYY	1000
1156	DAMN HARRY	11235	GUILY WARNER	2017-05-08	CATRACT	1	CONSULTATION	ZZT YYYY	1000
1157	BOBAGE DENIS	11236	GRAND BOBAGE	2017-05-08	CATRACT	1	CONSULTATION	ZZT YYYY	1000
1101	SAM HENRY	11226	ANNA TAYLOR	2017-12-11	AGIOPLASTY	1	CONSULTATION	XXXX YYYY	120

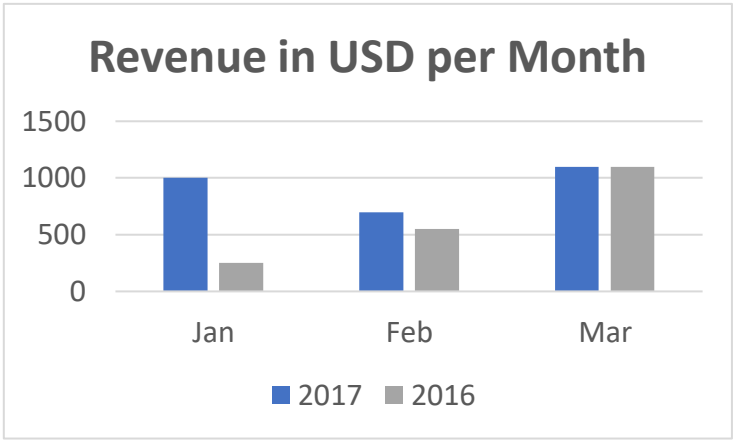
35 rows in set (0.00 sec)

mysql>

b. Revenue Metrics – Stored procedure

```
EXEC REVENUE_METRIX;
```

YEAR	MONTH	REVENUE_MAT
2007	4	1120
2007	1	1000
2007	2	100
2007	5	1000
2016	2	700
2016	3	250
2016	6	800
2016	11	340
2017	1	12600
2017	2	1600
2017	3	1540
2017	4	200
2017	5	13060

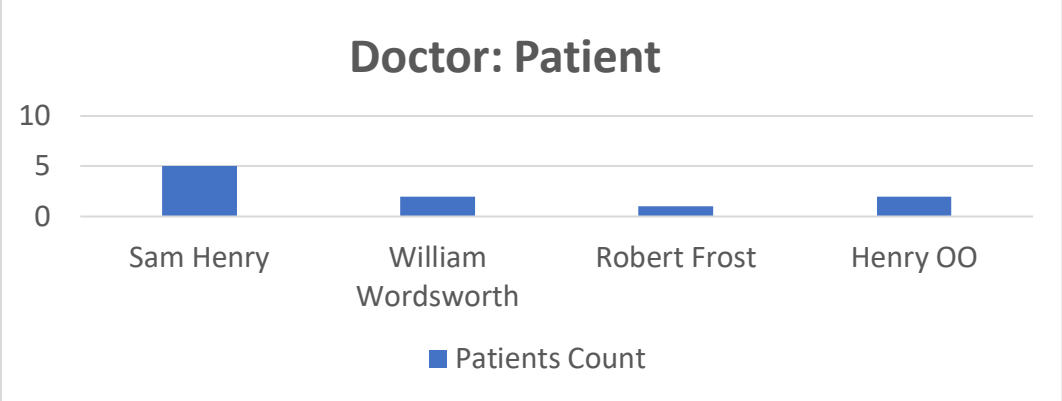


Note: Despite the syntax for stored procedure being right, the procedure did not get executed in icloud9. Executed the select statement and derived the above result

c. Doctor to Patient Ratio - View

SELECT * FROM VIEW VW_DOC_PAT_RATIO_MAT LIMIT 4 ;

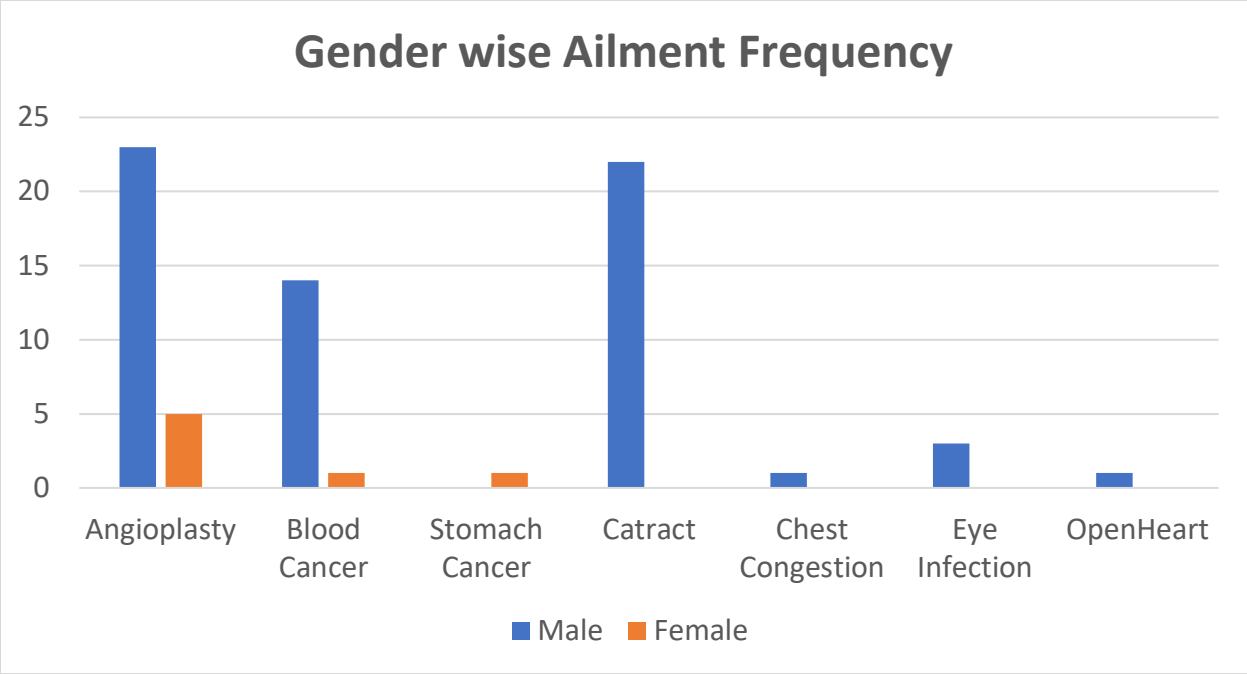
```
mysql> SELECT * FROM VW_DOC_PAT_RATIO;
+--------------------+-----------------------+
| DOCTOR_NAME        | COUNT(P.PATIENT_ID) |
+--------------------+-----------------------+
| SAM HENRY          |                     5 |
| WILLIAM WORDSWORTH |                     2 |
| ROBERT FROST       |                     1 |
| HENRY OO           |                     2 |
+--------------------+-----------------------+
4 rows in set (0.00 sec)
```



d. Gender wise Ailment Frequency

SELECT * FROM VIEW VW_AILMENT_DIST_MAT ;

```
mysql> SELECT * FROM VW_AILMENT_DIST_MAT ;
+--------+----------------+-------+
| GENDER | DIAG_TYPE      | COUNT |
+--------+----------------+-------+
| FEMALE | AGIOPLASTY     |     5 |
| FEMALE | BLOOD CANCER   |     1 |
| FEMALE | STOMACH CANCER |     1 |
| MALE   | AGIOPLASTY     |    23 |
| MALE   | BLOOD CANCER   |    14 |
| MALE   | CATRACT        |    22 |
| MALE   | CHEST CONGESION|     1 |
| MALE   | EYE INFECTION  |     3 |
| MALE   | OPEN HEART     |     1 |
+--------+----------------+-------+
9 rows in set (0.00 sec)
```



12. PERFORMANCE IMPROVEMENT:

For performance improvement, indexing was used to tables **PATIENT, DOCTOR and BILL**.As table **DIAGNOSIS** requires frequent updating, indexing was not applied as it will slow down the update process. Refer below tabulation and screenshot for time taken to fetch data before and after indexing. The execution time has reduced after adding index to corresponding tables

Queries:

- CREATE INDEX idx_pat_pat_id
  ON PATIENT (PATIENT_ID);
- CREATE INDEX idx_doc_doc_id
  ON DOCTOR (DOC_ID);
- CREATE INDEX idx_bill_bill_dt
  ON BILL (BILL_DATE);

Query_ID	QUERIES	DURATION WITHOUT INDEX	DURATION WITH INDEX
1	SELECT A.YEAR,A.MONTH,SUM(A.AMOUNT) AS REVENUE_MAT FROM (SELECT EXTRACT(MONTH FROM BILL_DATE) AS MONTH,EXTRACT(YEAR FROM BILL_DATE) AS YEAR, AMOUNT FROM BILL) A GROUP BY A.YEAR,A.MONTH ORDER BY A.YEAR,A.MONTH ;	0.000532	0.0003015
2	SELECT * FROM VW_SNAPSHOT ;	0.00110075	0.0005615
3	SELECT * FROM VW_DOC_PAT_RATIO;	0.00126275	0.00014575
4	SELECT * FROM VW_AILMENT_DIST_MAT ;	0.00086425	0.00052375
5	SELECT * FROM PATIENT WHERE PATIENT_ID = '11223' ;	0.00037675	0.00015275
6	SELECT DOCTOR,PATIENT_ID,PATIENT,DIAG_DATE ,DIAG_TYPE ,SEVERITY ,TREATMENT ,PRESC_DRUGS FROM VW_SNAPSHOT WHERE PATIENT_ID = '11231' ORDER BY DIAG_DATE DESC LIMIT 5 ;	0.0011355	0.00047475
7	SELECT P.PATIENT_ID,CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,DG.DIAG_DATE ,DG.DIAG_TYPE ,DG.SEVERITY ,DG.TREATMENT ,DG.PRESC_DRUGS FROM DOCTOR D JOIN PATIENT P ON D.DOC_ID = P.DOC_ID JOIN DIAGNOSIS DG ON P.PATIENT_ID = DG.PATIENT_ID AND D.DOC_ID = DG.DOC_ID JOIN BILL B ON P.PATIENT_ID = B.PATIENT_ID AND DG.DIAG_ID = B.DIAG_ID WHERE D.DOC_ID = '1166' AND P.PATIENT_ID = '11245' ORDER BY DIAG_DATE DESC ;	0.000723	0.000433

8	SELECT DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE FROM DEPARTMENT DP JOIN DOCTOR D ON DP.DEPT_NAME = D.DEPARTMENT JOIN VW_SNAPSHOT S ON D.DOC_ID = S.DOC_ID GROUP BY DEPT_NAME ORDER BY DEPT_NAME ;	0.0011335	0.00107425

Screenshot without indexing:

```
mysql> SET profiling = 1;

Query OK, 0 rows affected (0.00 sec)

mysql> SHOW PROFILES;

+----------+------------+----------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------+

| Query_ID | Duration   | Query
                                                                                                       |

+----------+------------+----------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------+

|        1 | 0.00037675 | SELECT * FROM PATIENT WHERE PATIENT_ID = '11223'
                                                                                                    |
|        2 | 0.00820350 | UPDATE PATIENT SET CONTACT = '877-654-7565' WHERE PATIENT_ID = '11230'
                                                                                                    |
|        3 | 0.00113550 | SELECT DOCTOR,PATIENT_ID,PATIENT,DIAG_DATE ,DIAG_TYPE ,SEVERITY ,TREATMENT ,PRESC_DRUGS FROM VW_SNAPSHOT WHERE PATIENT_ID = '11231' ORDER BY DIAG_DATE DESC LIMIT 5
                                                                                                    |
|        4 | 0.00360550 | UPDATE DIAGNOSIS SET PRESC_DRUGS = 'RAFAGA KFNVB' WHERE PATIENT_ID = '11248' AND DIAG_ID = '2238'
                                                                                                    |
|        5 | 0.00072300 | SELECT P.PATIENT_ID,CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,DG.DIAG_DATE ,DG.DIAG_TYPE ,DG.SEVERITY ,DG.TREATMENT ,DG.PRESC_DRUGS FROM DOCTOR D JOIN PATIENT P
ON D.DOC_ID = P.DOC_ID
JOIN DIAGNOSIS DG
ON P.PATIENT_ID = DG.PATIENT_ID
AND D.DOC_ID = DG.DOC_ID
JOIN BILL B
ON P.PATIENT_ID = B.PATIENT_ID |
|        6 | 0.00603850 | UPDATE PATIENT SET EMAIL_ID = 'RENNY@email.com' WHERE PATIENT_ID = '11251'
                                                                                                    |
|        7 | 0.00113350 | SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE FROM DEPARTMENT DP JOIN DOCTOR D ON DP.DEPT_NAME = D.DEPARTMENT JOIN VW_SNAPSHOT S
ON D.DOC_ID = S.DOC_ID
GROUP BY DEPT_NAME
ORDER BY DEPT_NAME                                                                                  |
|        8 | 0.00053200 | SELECT A.YEAR,A.MONTH,SUM(A.AMOUNT) AS REVENUE_MAT FROM (SELECT EXTRACT(MONTH FROM BILL_DATE) AS MONTH,EXTRACT(YEAR FROM BILL_DATE) AS YEAR,AMOUNT FROM BILL ) A
GROUP BY A.YEAR,A.MONTH
ORDER BY A.YEAR,A.MONTH                                                                             |
|        9 | 0.00110075 | SELECT * FROM VW_SNAPSHOT
                                                                                                    |
|       10 | 0.00126275 | SELECT * FROM VW_DOC_PAT_RATIO_MAT
                                                                                                    |
|       11 | 0.00086425 | SELECT * FROM VW_AILMENT_DIST_MAT
                                                                                                    |
```

Screenshot After Indexing:

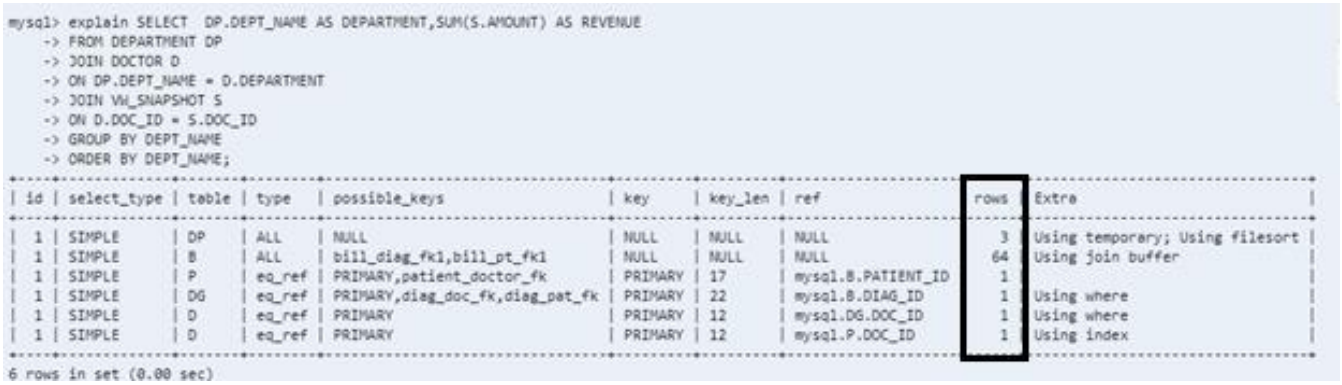
```
                                                                                                    |
|       72 | 0.00107425 | SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE FROM DEPARTMENT DP
JOIN DOCTOR D
ON DP.DEPT_NAME = D.DEPARTMENT
JOIN VW_SNAPSHOT S
ON D.DOC_ID = S.DOC_ID
GROUP BY DEPT_NAME
ORDER BY DEPT_NAME                                                                                  |
|       73 | 0.00030150 | SELECT A.YEAR,A.MONTH,SUM(A.AMOUNT) AS REVENUE_MAT FROM (SELECT EXTRACT(MONTH FROM BILL_DATE) AS MONTH,EXTRACT(YEAR FROM BILL_DATE) AS YEAR,
             AMOUNT
             FROM BILL ) A
             GROUP BY A.YEAR,A.MONTH
             ORDER BY A.YEAR,A.MONTH                                    |
|       74 | 0.00056150 | SELECT * FROM VW_SNAPSHOT
                                                                                                    |
|       75 | 0.00014575 | SELECT * FROM VW_DOC_PAT_RATIO
                                                                                                    |
|       76 | 0.00052375 | SELECT * FROM VW_AILMENT_DIST_MAT
                                                                                                    |
|       77 | 0.00015275 | SELECT * FROM PATIENT WHERE PATIENT_ID = '11223'
                                                                                                    |
|       78 | 0.00047475 | SELECT DOCTOR,PATIENT_ID,PATIENT,DIAG_DATE ,DIAG_TYPE ,SEVERITY ,TREATMENT ,PRESC_DRUGS FROM VW_SNAPSHOT WHERE PATIENT_ID = '11231' ORDER BY DIAG_DATE DESC LIMIT 5
                                                                                                    |
|       79 | 0.00043300 | SELECT P.PATIENT_ID,CONCAT(P.F_NAME,' ',P.L_NAME) AS PATIENT,DG.DIAG_DATE ,DG.DIAG_TYPE ,DG.SEVERITY ,DG.TREATMENT ,DG.PRESC_DRUGS FROM DOCTOR D
             JOIN PATIENT P ON D.DOC_ID = P.DOC_ID JOIN DIAGNOSIS DG ON P.PATIENT_ID = DG.PATIENT_ID AND D.DOC_ID = DG.DOC_ID JOIN BILL B ON P.PATIENT_ID  |
+----------+------------+----------------------------------------------------------------------------------------------------------
```

Sample:

```
SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE
FROM DEPARTMENT DP
JOIN DOCTOR D
ON DP.DEPT_NAME = D.DEPARTMENT
JOIN VW_SNAPSHOT S
ON D.DOC_ID = S.DOC_ID
GROUP BY DEPT_NAME
ORDER BY DEPT_NAME;
```

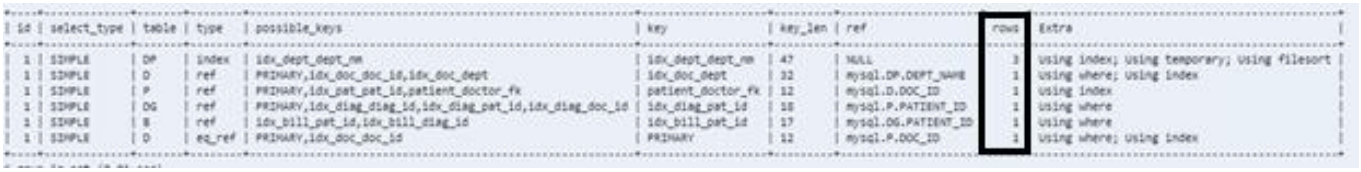
From below screenshots its clear that the number of rows processed for the above query has reduced after indexing.

Before Indexing:



```
mysql> explain SELECT  DP.DEPT_NAME AS DEPARTMENT,SUM(S.AMOUNT) AS REVENUE
    -> FROM DEPARTMENT DP
    -> JOIN DOCTOR D
    -> ON DP.DEPT_NAME = D.DEPARTMENT
    -> JOIN VW_SNAPSHOT S
    -> ON D.DOC_ID = S.DOC_ID
    -> GROUP BY DEPT_NAME
    -> ORDER BY DEPT_NAME;
+----+-------------+-------+--------+-------------------------------------+---------+---------+-------------------+------+-----------------------------+
| id | select_type | table | type   | possible_keys                       | key     | key_len | ref               | rows | Extra                       |
+----+-------------+-------+--------+-------------------------------------+---------+---------+-------------------+------+-----------------------------+
|  1 | SIMPLE      | DP    | ALL    | NULL                                | NULL    | NULL    | NULL              |    3 | Using temporary; Using filesort |
|  1 | SIMPLE      | B     | ALL    | bill_diag_fk1,bill_pt_fk1           | NULL    | NULL    | NULL              |   64 | Using join buffer           |
|  1 | SIMPLE      | P     | eq_ref | PRIMARY,patient_doctor_fk           | PRIMARY | 17      | mysql.B.PATIENT_ID |    1 |                             |
|  1 | SIMPLE      | DG    | eq_ref | PRIMARY,diag_doc_fk,diag_pat_fk     | PRIMARY | 22      | mysql.B.DIAG_ID   |    1 | Using where                 |
|  1 | SIMPLE      | D     | eq_ref | PRIMARY                             | PRIMARY | 12      | mysql.DG.DOC_ID   |    1 | Using where                 |
|  1 | SIMPLE      | D     | eq_ref | PRIMARY                             | PRIMARY | 12      | mysql.P.DOC_ID    |    1 | Using index                 |
+----+-------------+-------+--------+-------------------------------------+---------+---------+-------------------+------+-----------------------------+
6 rows in set (0.00 sec)
```

After Indexing:



```
+----+-------------+-------+-------+-------------------------------------------------------------+-------------------+---------+-------------------+------+-----------------------------------------+
| id | select_type | table | type  | possible_keys                                               | key               | key_len | ref               | rows | Extra                                   |
+----+-------------+-------+-------+-------------------------------------------------------------+-------------------+---------+-------------------+------+-----------------------------------------+
|  1 | SIMPLE      | DP    | index | idx_dept_dept_nm                                            | idx_dept_dept_nm  | 47      | NULL              |    3 | Using index; Using temporary; Using filesort |
|  1 | SIMPLE      | D     | ref   | PRIMARY,idx_doc_doc_id,idx_doc_dept                         | idx_doc_dept      | 32      | mysql.DP.DEPT_NAME |    1 | Using where; Using index                |
|  1 | SIMPLE      | P     | ref   | PRIMARY,idx_pat_pat_id,patient_doctor_fk                    | patient_doctor_fk | 12      | mysql.D.DOC_ID    |    1 | Using index                             |
|  1 | SIMPLE      | DG    | ref   | PRIMARY,idx_diag_diag_id,idx_diag_pat_id,idx_diag_doc_id    | idx_diag_pat_id   | 18      | mysql.P.PATIENT_ID |    1 | Using where                             |
|  1 | SIMPLE      | B     | ref   | idx_bill_pat_id,idx_bill_diag_id                            | idx_bill_pat_id   | 17      | mysql.DG.PATIENT_ID |    1 | Using where                             |
|  1 | SIMPLE      | D     | eq_ref | PRIMARY,idx_doc_doc_id                                     | PRIMARY           | 12      | mysql.P.DOC_ID    |    1 | Using where; Using index                |
+----+-------------+-------+-------+-------------------------------------------------------------+-------------------+---------+-------------------+------+-----------------------------------------+
```

13.SUMMARY:

The project gave me hands on experience on SQL and NoSQL. Gained deeper knowledge on handling Database - starting from design, implementation and validation of a database application. Also, explored the file handling features of mongo using Nodejs and GridFS starting from installation to file data retrieval. Got a better perspective of DBMS from a business point.

a. **hardest part of this project**
   - Installation and implementing the GridFS and mongofiles features using Nodejs
   - Performance improvement for SQL
   - Populating source dataset for both structured and Unstructured DB
   - Deciding between SQL Vs NoSQL

b. **problems faced this project**
   - Designing the management system
     - Choosing the tables and their attributes were challenging
     - Framing the relationship between the tables
     - Designing views and stored procedure for Business Metrics
   - Execution errors while deploying the code
   - Performance improvement for SQL
     - Choosing the appropriate attribute to perform indexing was challenging
     - Preparing large dataset for testing the performance improvement code consumed more time
   - Installation and implementing errors while using Nodejs feature to upload images and vidoes as mongofiles

c. **How was the problem solved?**

- **Designing the management system**
  - The table attribute and constraints were planned and penned down before writing the scripts.
  - The views and stored procedures were also designed based on the Business Metrics requirements

- **Execution errors while deploying the code**

Based on the error code returned, corresponding solution were referred online and the errors were fixed

- **Performance improvement for SQL**
  - Major impacting columns were identified. Indexing was applied to those columns. The time taken to execute the queries before and after applying index were noted and compared.
  - indexing was used to tables **PATIENT (PATIENT_ID), DOCTOR (DOC_ID) and BILL (BILL_DATE)**.
  - As table **DIAGNOSIS** requires frequent updating, indexing was not applied as it will slow down the update process.

- **Installation and implementing errors while Using Nodejs feature The file upload was done using Nodejs,gridFs features of mongo**
    - Referenced SQL MogoDB manual
    - The fix for the error codes were searched in various forums online
    - Referenced https://github.com/rahil471/fileupload-nodejs-gridfs-angular2
    - For the Nodejs setup

d. If I were to do this project again

- Include Trigger on deletion of records from tables. Since hospital data are very confidential and important it is necessary to record the changes done to data. Also,they can be referred incase of auditing or any future purpose
- Include sharding features in NoSQL for performance improvement
- Improvise on the design by analyzing the real hospital scenario
- Include trend analysis for each patient based on the Lab test results in NoSQL
- Expand the scope to handle Drug Department

14. Reference:

https://github.com/rahil471/fileupload-nodejs-gridfs-angular2

https://www.w3schools.com/nodejs/nodejs_mongodb_createcollection.asp