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RNH Hospital Application and Data Analysis

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Abstract: This application incorporates various factors needed for smooth working and management of RNH hospital. This hospital application allows administrator to store and manage various resources according to patients' and doctor's requirements. The application is developed to eliminate human efforts in managing hospital records and data manually. The system also stores the doctor's data in a well defined manner. The doctor's details include his name, number, experience, consultant type specialty and current doctor's status. This app also provides the information offered by the hospital and details about health packages, data analysis and billing generation. User can also request an appointment as per his/her requirements and ask queries. This application uses the data which is collected from RNH Hospital to perform analysis: on medicines which compares Medicines (on the basis of types of Medicines); set values (Above & Below), on Hospital Growth which compares and computes average (Number of Registrations & Surgeries), on Treatments; comparing them (on the basis of Male & Females, Age Groups) by applying statistical and inferential analysis like Mean, Median, Standard deviation, T-test and Analysis of Variance (ANOVA). The application uses Android Studio as a front end, SQL Server to store it's back end data and Morris.js using Hypertext Preprocessor (PHP) and Java Script Object Notation (JSON) to perform data analysis. The back end data includes accommodation details and related doctor's data for effectively managing a hospital. The analyzed data is in graphical format which includes bar graph, pie-chart.

Keywords: ANOVA, Application, Data analysis, JSON, PHP, T-test.

I. Introduction

There is a significant growth of mobile phone technology. Due, to this world is moving swiftly. The number of users is increasing day by day, different applications are being developed for users. It started with the simple regular handset which were used for calling, mobile have changed everyone's lives. Now mobile phones but have countless uses and can be used as a Camera, Music player, Tablet, PC, TV, Web browser, Application etc. Likewise, android applications play an important role in today's life. Applications can be used in medical stream also. Our application, Rathi Nursing Home Hospital & Data Analysis i.e. RNH hospital & Data Analysis is easy to use, flexible, powerful application for users and doctors in RNH hospital. RNH hospital is situated in the heart of Nagpur city, Dhantoli, where all medical activities and multi-speciality facilities are provided.

Our application provides major activity entities: Doctor's Info, Doctor's Status, Data analysis (to analyse data of Medicines, Hospital Growth and Treatments for RNH Hospital), Appointments, Health Packages, Billing, Query, about hospital which is handled by Admin. The Admin can add, delete, and update them simultaneously on the online system. These can then be viewed by the users. The users can get the bill, can book an appointment, can ask queries, can get report and can check doctor's details.

A. The Need

RNH Hospital Application: The necessity of developing this Application was to eliminate the manual pen and paper work. This software is good and meaningful application for doctors and patients as well.

B. Scope

- It informs patients about the activities and various details related to hospital.
- Patient does not need to visit the hospital every time.
- Any person can book an appointment anywhere, anytime.
- Doctors use application for making medical decisions.
- It offers fast and precise transactional and management reports about how the business is doing.
- It helps patients to have all the data on their smartphones, they can observe the dynamics of being on the mend, report doctors.
- It helps hospital officials and administration to monitor statistics like Availability of Doctors, Patient intake, Medicines, Hospital Growth and Diseases with the help of analysis of the database.

C. Disadvantages of Existing System in RNH Hospital

Currently, MedNetis the software used by RNH Hospital. Following are the disadvantages:

- Difficulty in report generation.
- Difficulty in bill generation.
- Time consuming.
- MedNet software provides facilities only to doctors not patients. Hence, booking an appointment, viewing facilities, reaching to doctors is difficult for new users.
- Though it is a good software, still a complex one to understand. It contains whole data at one place, not bifurcated. Hence, if lost data, it can't be retrieved easily.

Apart from MedNet, manual system is also used. Following are the disadvantages:

- The content in the files or the folders can deteriorate with time due to many factors.
- It becomes hard for people to maintain information in files and collect information they require. This call leads to human errors also.
- Booking an appointment is through phonic conversation or booking directly through hospital.

D. Data Analysis

Data analysis is a procedure which includes examining the data, purifying it, changing and moulding data to find useful information, providing conclusions, and supporting decision-making. This presents a wide range of data analytic techniques and it has man broad concepts of the different types of data analytics, namely, descriptive, inferential, predictive, and prescriptive analytics.

II. Literature Review

A mobile app "Careggi Smart Hospital" is considered for the study [1]. The author L. Marzi stated that this app is developed for the Careggi Polyclinic in Florence. It is designed for android users for personnel and structures finding, way-finding and the possibility to access personal medical records collected on regional electronic health record. Hence, author stated the importance of Android application in Hospitals.

A mobile app is considered for the study [2]. The author M. K. Hossain stated that this app provides an effective health care system which includes finding hospital information in the city, information about cabin, cabin booking with payment, intelligent suggestion on choosing suitable hospital, finding a doctor, emergency service calling, first aid information, alarm system for medication, Body Mass Index (BMI) calculator etc. Hence, author stated the importance of Android application in Hospitals.

A Near Field Communication Based Patient Appointment is considered for the study [3]. The author S. Sankaranarayanan stated drawbacks of existing systems like manual system and software which is used in various hospitals [3]. Author further stated an alternate patient appointment system using Near Field Communication (NFC) technique and Android enabled mobile application with a view to redefining the core of hospital waiting time towards appointment.

Choosing of important genes for cancer classification using using a 2 way Analysis of Variance (ANOVA) ranking scheme is considered [4]. The author Dr. A. M. Natarajan states that by finding the smallest set of genes we can ensure highly accurate classification of cancer from micro array data by using supervised machine learning algorithms. He states that the past work in this direction has worked on many genes. Examples of such methods included those based on a statistical method called nearest shrunken centroids, standard nearest centroids and SVM classifier and the separability based gene importance ranking. Author used 2 way ANOVA to compare means of the response data for various combinations of the classification variables. Two-way ANOVA determines how a response is affected by two factors. The two independent variables in a two-way ANOVA are called factors. The idea is that there are two variables, factors, which affect the dependent variable. Each factor will have two or more levels within it, and the degrees of freedom for each factor is one less than the number of levels. In the 2 way ANOVA interactions between row and column.

The authors studied the implementation of the Analysis of Variance (ANOVA) method for the energy efficiency analysis of a given smart grid [5]. The author Adrian Danila stated that the aim of the study has been to provide a method for the analysis of the impact of the in-line power factor correction system on the global energy efficiency of the grid and due to the noisy measurements, the classical approach consisting in the analysis

of the statistical moments of the power components is inefficient for the energy efficiency estimation. Hence author proved that the Analysis of Variance (ANOVA) is more efficient than the evaluation of the statistical moments while the acquired data is corrupted by the Gaussian noise.

Experiments of various factor which affects the response variable of interest is considered [6]. The author Yoshifumi Ukita states that the model in experimental design can be expressed in terms of an orthonormal system. He states that the past theorem contains redundant parameters which is not executed in orthonormal system because a considerable amount of time is necessary to execute the steps for determining the effects. On the other hand, it has recently been shown that the effect of each factor in theorem contains no redundant parameters and sum of squares for the 2-factor interaction need the ANOVA (Analysis of Variance) test. However, it also states that of squares for the 3-factor interaction, 4-factor interaction or more factors can be obtained using ANOVA in the model based on an orthonormal system. Examples of such model is expressed by using Fourier coefficients. Fourier transform is a software which allows the implementation for estimating the Fourier coefficients. This software can execute the ANOVA because the model represents the sum of squares for the general mean, the main factor and the 2-factor interaction has been obtained using the Analysis of Variance (ANOVA).

T-test filter technique is considered to improve detectability of hidden message for Blind Image Steganalysis [7]. The author Rita Rana Chhikara stated that to find most sensitive of the selected feature, t-test technique is being applied. Hence author observed that accuracy is improved by 5-10% with features selected through proposed algorithm of combination of firefly algorithm and t-test algorithm and reduces the features set dimensionality by almost 67% for DCT features and 37.5% for DWT features.

T-test filter technique is considered to rank the voxel values (Voxel based morphometry is a numerical method used to perform inter-group and intra-group analysis of MR images) corresponding to the same point as the loss point [8]. The author Muhammet Üsame stated that to find significant differences a t-test technique is being used. Hence, author observed that since the pattern data was too many, the feature ranking was done by t-test. To reduce the size, the voxel values between the groups were analyzed by t-test and the most significant clusters were sorted.

T-test technique is considered to quantify the indistinguishability between distributions of different PUF responses, i.e., the values from on-chip locations measured across multiple devices [9]. The author Vincent Immler investigated the threshold levels of the t-test which depends on the number of evaluated PUF cells and the desired confidence of the hypothesis test. Also, these t-values are computed from the statistical moments, such as mean and variance, of the tested distributions and indicate if they were not drawn from the same source. Hence, T-test is best suitable for the process of quantification.

Mean IQ-value method is considered to extract true angular information about incident waves in a Rician fading channel [10]. The author Koichi Ogawa conducted extensive investigations on interferometric Angle of Arrival (AOA) estimation in Rician multipath propagation environments. The author proved that high accuracy is achieved using the Mean IQ-method. Hence, Mean IQ-method was considered for the better performance.

III. Implementation

A. Functional Requirements

In order to make this application functional, we require the following:

(1) Download Mobile Application

A user can download the application through mobile app store and application is free to download.

(2) DashBoard

When the user has the application, he sees first page which is called a dashboard. The user should be able to see all the modules given in the application like Doctor's Info, Doctor's Status, Data analysis (to analyse data of Medicines, Hospital Growth and Diseases for RNH Hospital), Appointments, Health Packages, Billing, Query.

B. Creation of User Interface Using XML and JAVA

To create user interface of the proposed system, Android Studio was used. Android Studio IDE provides various options to make a working interface with support for programming as well.

For creating basic layout, following steps are there:

1. Go to Android Studio, example, click on create new activity 'Signup'.
2. While creating it, two entities will be generated i.e. Signup.java and layout_signup.xml.
3. XML is used to create basic layout for signup page.
4. Java is used as a programming language to build signup activity.

C. Database Creation Using MYSQL and PHP

Following steps are implemented to create database:

1. Type http://localhost/dashboard/.
2. VisitphpMyAdmin.
3. Sign in to the page.

4. Click Databases at the top of the page.
5. Choose a name e.g. Ram.
6. Go into the new database and click on Privileges on the top sidebar.
7. Click to add a new user.
8. Enter a name for the user (e.g. Ram), a password and the host. Select the type of host, you can select local.
9. Click Go.

For creating database for RNH hospital, following are the steps:

1. Firstly, go phpMyAdmin.
2. Create table named 'signup'.
3. Add rows and columns to it.
4. For signup table, we added id as a primary key, username, password and email.
5. Click on create table.

Basic php code for signup: It consist of database hostname, username, id provided by 000webhost. In this, data which is entered in signup application is fetched with the help of php code and stored in MYSQL database.

D. Connectivity Using 000Webhost and JSON

Following steps are implemented to perform connectivity:

1. Register to 000Webhost and login.
2. After logging in, go to create database.
3. You will get host name, host id, database name.
4. After clicking to manage database using phpMyAdmin you can create table which will fetched using php code.
5. Click on manage file manager, click on public_html add php code.
6. Click save & exit.

Myjson is a simple JSON STORE which is used to store the data of our Mobile Application. It is the service we have used in RNH Application to store the data regarding Doctor's Status which includes Doctor Name, Status and Ward. JSONLint is used as a validator and reformatter for JSON in RNH Application. The information of Doctor Name, Status and Ward is written in JSONLint to validate them essy JSON code.

Steps to store the Doctor's Status data in JSON are as follows:

1. Firstly, we have copied the valid JSON code of Doctors Status from JSONLint.

   Example:

   [{"Name":"DR.DILIP RATHI","Status":"IN","Ward":"A-01"},{"Name":"DR.DINESH KABRA","Status":"OUT","Ward":"-"},{"Name":"DR.NITA RATHI","Status":"IN","Ward":"A-02"},{"Name":"DR.NAINESH PATEL","Status":"IN","Ward":"A-03"}]

2. Then, JSON code is pasted in myjson.com and we got an URI (Uniform Resource Identifier) which is further used in Android Application java file.

   Example:

   URI to access this JSON directly- https://api.myjson.com/bins/m8tar

3. Further, we have copied the Uniform Resource Identifier (URI) in java class to get connected to internet and the JSON data is being displayed whenever there is user call.
4. JSONArray is used to display the data in structure format and program for JSONArray is given below-

```
JSONArray JA = new JSONArray(data);
for(int i =0 ;i <JA.length(); i++)
{
JSONObject JO = (JSONObject) JA.get(i);
singleParsed = "Name:" + JO.get("Name") + "\n"+"Status:" +
JO.get("Status") + "\n"+"Ward:" + JO.get("Ward") + "\n";
dataParsed = dataParsed + singleParsed +"\n" ;}
```

E. Data Analysis: Methods

Database was taken from RNH hospital, Nagpur in the month of January, 2018. Database consist of following:

(1) *Data of Types of Medicines.*

(2) *Dataset Consisting of Entities:* Age of the patient, Gender of the patient, Types of diagnosis, Admission date, Department, Primary doctor and days admitted.

Methods which will be used will be according to the following type of analysis:

(a) *Based on Medicines:* It will compare Medicines on the basis of types of the Medicines. It will set values which can be above or below according to the doctor. Following method can be used:

Descriptive Analysis & Inferential Analysis: For setting a value mean or standard deviation can be calculated. For comparison *T test* can be used.

(*b) Based on Growth of Hospital:* It will compare and compute the average number of Registrations, Laboratory investigations and Surgeries. Following method is used:

Descriptive Analysis: Average can be calculated by formula of Mean or Standard deviation.

(*c*) *Based on Types of Treatments:* It will compare various treatments done in hospital in the following ways: Males & Females, Various Age Groups, Monthly.

Following method can be used:

Inferential Analysis: T test and Analysis of Variance (ANOVA) can be used for the comparison of the data.

F. Data Analysis: Tests

(1) *T test:* It is a statistical test used to verify the difference of means between two samples. When standard deviation is not known we use T-test. It is used to examine whether the two which are drawn are from the same population.

(2) *Z-Test:* It is a statistical test used to determine whether two population means are different when the variances are known and the sample size is large.

(3) *T-test is Better than Z-test:* a) Z-test requires reliable conditions and less adaptable than T-Test. Also, T-test has many methods that will adapt to any need. b) T-tests are more commonly used than Z-tests.

(4) *ANOVA - Analysis of Variance:* Analysis of Variance (ANOVA) is a set of statistical models and their associated procedures (such as "variation" among and between groups) used to analyze the differences among group means. It is conceptually similar to multiple two-sample t-tests, but is more conservative and is therefore suited to a wide range of practical problems.

(5) *MANOVA:* It is almost same as an ANOVA with several dependent variables. It's similar to many other tests and experiments in that it's purpose is to find out if the response variable (i.e. your dependent variable) is changed by manipulating the independent variable.

(6) *ANOVA is Better than MANOVA and T-test:*

MANOVA is quite complicated hence it makes difficult to check which independent variables affecting dependent ones. Addition of new variable causes lost of degree of freedom.

(a) T-test can cause errors if applied twice.

(b) Tools used for implementing the above methods are:

1) Morris.js Using PHP: It is a charting library which supports Line and area charts, Bar charts, Donut charts.

Steps:

1. First we have load required cdn library link for use Morris.js chart with PHP and Mysql.

```
<linkrel="stylesheet" href="//cdnjs.cloudflare.com/ajax/libs/morris.js/0.5.1/morris.css">
<script src="//ajax.googleapis.com/ajax/libs/jquery/1.9.0/jquery.min.js"></script>
<script src="//cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-min.js"></script>
<script src="//cdnjs.cloudflare.com/ajax/libs/morris.js/0.5.1/morris.min.js"></script>
```

2. After defining required CDN library link, we have create on division tag and we will display chart under this tag.

```
<div id="chart"></div>
```

3. For fetch data from table we have write php code for fetch data from Mysql table and arrange them that data in format which are allowed in Morris.js charts javascript library.

4. After fetching data from Mysql table now we have write javscript code for load Morris.js chart library for different chart like Line chart, Area chart, Bar chart and Bar chart with stacked option.

2) Morris.js Using JSON: JSON: JavaScript Object Notation. JSON is a syntax for storing and exchanging data. JSON is text, written with JavaScript object notation.

Steps:

1. Create JSON file contents.

.json file contents:

```
[
   {"day":1,"pageviews":"687928"},
   {"day":2,"pageviews":"688331"},
   {"day":3,"pageviews":"603741"},
   {"day":4,"pageviews":"542002"},
   {"day":5,"pageviews":"657730"},
   {"day":6,"pageviews":"804183"},
   {"day":7,"pageviews":"776029"},
   {"day":8,"pageviews":"654589"}
]
```

2. Render Morris.js chart with JSON

```
$(document).ready(function() {
  $.getJSON("pageviews.json", function (json) {
    var jason_data = JSON.stringify(json);
    var jasonstuff = (jason_data.replace(/\"/g, ""));
    Morris.Line({
      element: 'mydiv',
      data: jason_data,
      xkey: 'day',
      ykeys: ['Filename'],
      labels: ['Filename]
    });
  });
});
```

IV. Process Flow

A. Stages of Application

To create User Interface of the proposed system, Android Studio was used. Android Studio provides various options to make a

working interface with support for android programming as well. It would contain the login screen where in the user and admin both register themselves for the application.

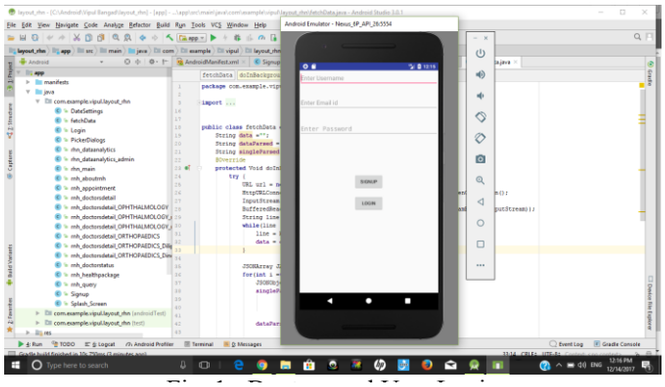


Fig. 1: Doctors and User Login

(1) It provides dashboard for RNH hospital.

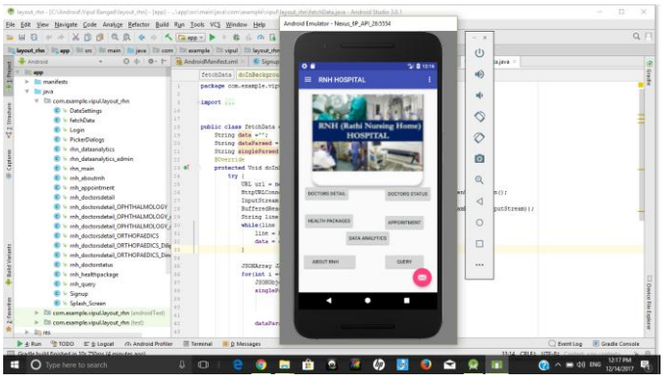


Fig. 2: Dashboard for RNH Hospital

(2) It provides the details of doctor's details.

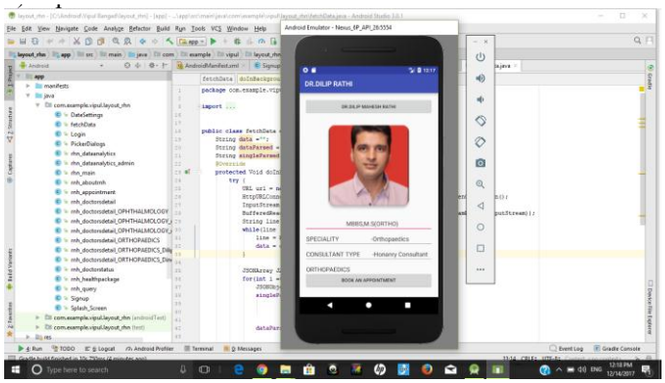


Fig. 3: Doctor's Detail

(3) It provides the status of doctors i.e. their presence or absence.

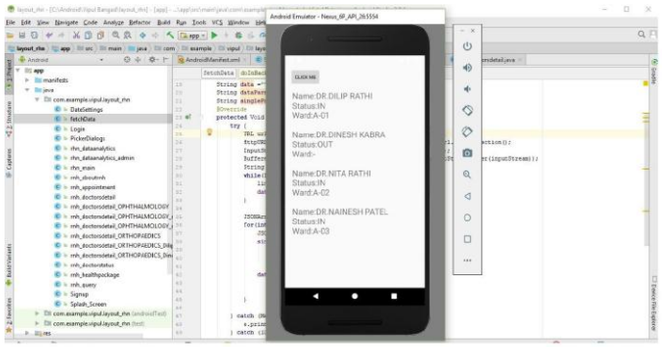


Fig. 4: Doctor's Status

(4) It provides detail information about all the health packages provided by the hospital.

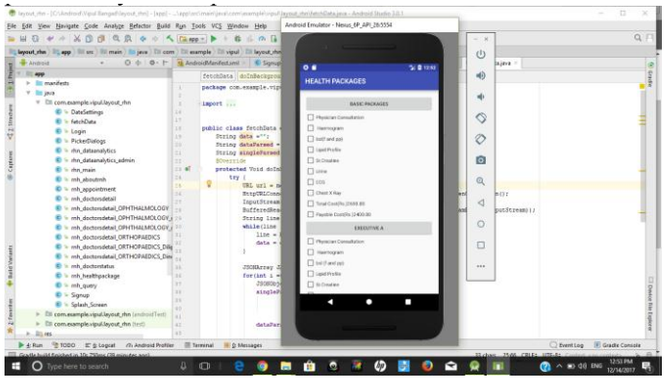


Fig. 5: Health Packages

(5) It provides appointment form which can be used by users to book an appointment.

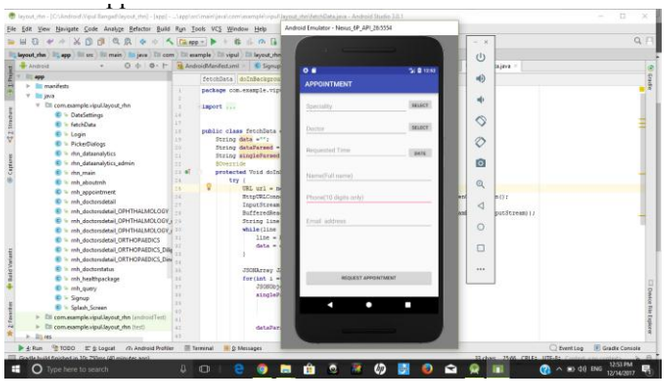


Fig. 6: Appointment Form

B. Data Analysis

(1) View of database given by RNH hospital

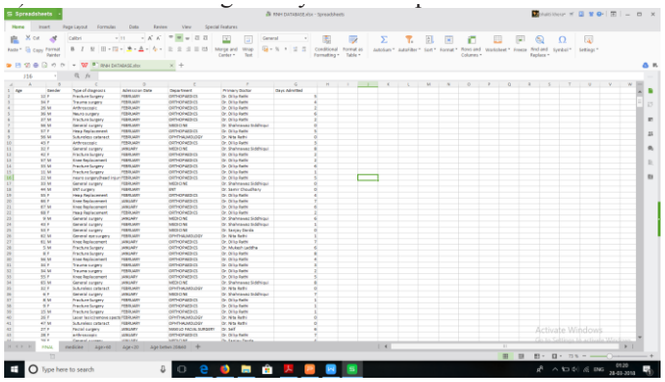
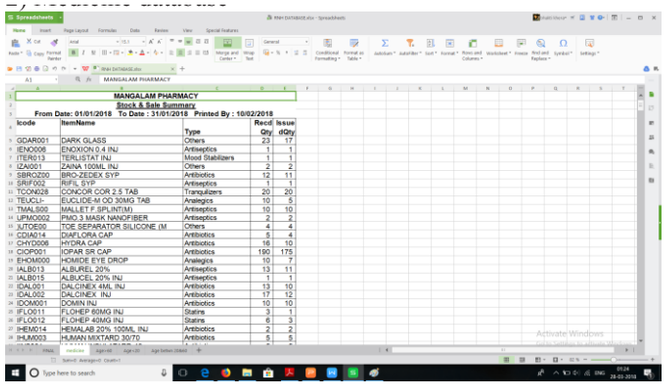


Fig. 7: Database

(2) Medicine database



MANGALAM PHARMACY

Stock & Sale Summary

From Date: 01/01/2018 To Date : 31/01/2018 Printed By : 10/02/2018

Icode	ItemName	Type	Recd Qty	Issue qty
GDAR001	DARK GLASS	Others	23	17
IENO006	ENOXION 0.4 INJ	Antiseptics	1	1
ITER013	TERLISTAT INJ	Mood Stabilizers	1	1
IZAI001	ZAINA 100ML INJ	Others	2	2
SBRO2000	BRO-ZEDEX SYP	Antibiotics	12	11
SRIF002	RIFIL SYP	Antiseptics	1	1
TCON028	CONCOR COR 2.5 TAB	Tranquilizers	20	20
TEUCli-	EUCLIDE-M OD 30MG TAB	Analegics	10	5
TMAL500	MALLET P.SPLINT(M)	Antiseptics	10	10
UPMO002	PMO.3 MASK NANOFIBER	Antiseptics	2	2
IUTOE00	TOE SEPARATOR SILICONE (M	Others	4	4
CDIA014	DIAFLORA CAP	Antibiotics	5	4
CHYD006	HYDRA CAP	Antibiotics	16	10
CIOP001	IOPAR SR CAP	Antibiotics	190	175
EHOM000	HOMICE EYE DROP	Analegics	10	7
IALB013	ALBUREL 20%	Antiseptics	13	11
IALB015	ALBUCEL 20% INJ	Antiseptics	1	1
IDAL001	DALCINEX 4ML INJ	Antibiotics	13	10
IDAL002	DALCINEX INJ	Antibiotics	17	12
IDOM001	DOMIN INJ	Antibiotics	10	10
IFLO011	FLOHEP 60MG INJ	Statins	3	1
IFLO012	FLOHEP 40MG INJ	Statins	6	3
IHEM014	HEMALAB 20% 100ML INJ	Antibiotics	2	2
IHUM003	HUMAN MIXTARD 30/70	Antibiotics	5	5

Fig. 8: Medicine Database

(3) Analysis which shows the age and the number of days admitted in a graph.

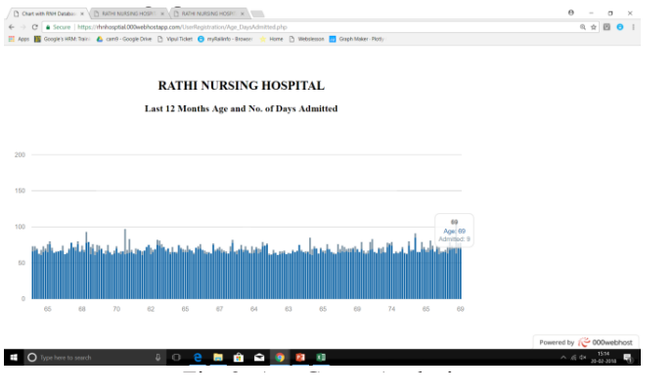


Fig. 9: Age Group Analysis

In this, age count is calculated with the help of ANOVA.

ANOVA Formula

$$F = \frac{MST}{MSE}$$

Where,

FF = Anova Coefficient.

MSTMST = Mean sum of squares due to treatment.

MSEMSE = Mean sum of squares due to error.

Formula for MST is given below:

$$MST = \frac{SST}{p-1}$$

$$SST = \sum n(x - \bar{x})^2$$

Where,

SSTSST = Sum of squares due to treatment.

pp = Total number of populations.

nn = Total number of samples in a population.

Formula for MSE is given below:

$$MSE = \frac{SSE}{N-p}$$

$$SSE = \sum (n-1)S^2$$

Where,

SSESSE = Sum of squares due to error

SS = Standard deviation of the samples

NN = Total number of observations.

FOR AGE LESS THAN 20,

N=512

Standard deviation=4.275257

Mean=11.376953

Min=2

Max=20

Anova Coefficient = 860.194238

FOR AGE BETWEEN 20 AND 60,

N=1091

Standard deviation=11.518451

Mean=37.3070577

Min=20

Max=61

Anova Coefficient = 8216.086425

FOR AGE GREATER THAN 60,

N=200

Standard deviation = 4.134622

Mean=66.43

Min=61

Max=85

Anova Coefficient=18282.437168

(4) Analysis showing Percentage, count of department name.

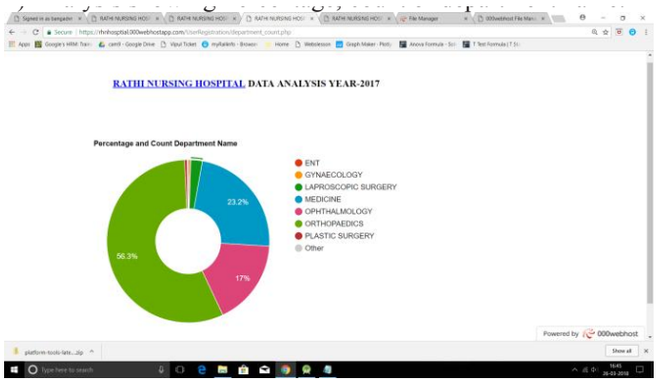


Fig. 10: Department Analysis

In this, department count is calculated using Standard deviation:

The formula for standard deviation is given by:

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

N=7
Min=4
Max= 1001
Mean=253.5713
Median=41
Standard Deviation=341.27234

(5) Analysis which shows percentage and count of the types of treatment happened in RNH hospital.

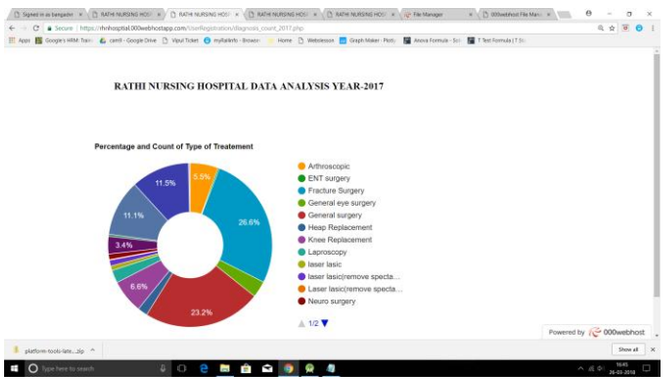


Fig. 11: Types of Treatment Analysis

In this, treatment count is given by Standard deviation:
The formula for standard deviation is given by:

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

N=16
Min=3
Max= 474
Mean=110.8125
Median=51.5
Standard Deviation=139.94472

(6) Analysis which shows percentage and count of number of admissions in a month.

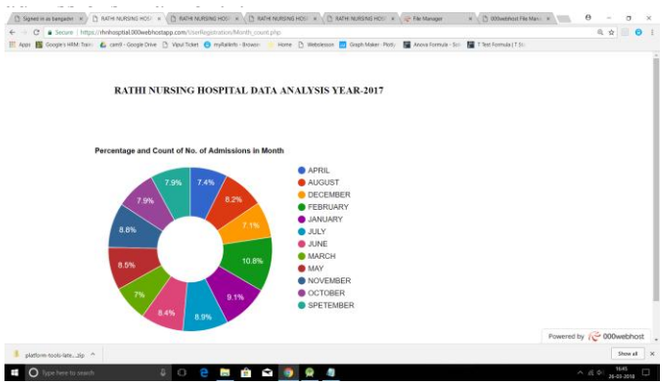


Fig. 12: Admission Analysis in a Month

In this, no. of admissions in a month is given by T test:
T test formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where,

$x1^{-}x1^{-}$ = Mean of first set of values.
$x2^{-}x2^{-}$ = Mean of second set of values.
S_1 = Standard deviation of first set of values.
S_2 = Standard deviation of second set of values.
n_1 = Total number of values in first set.
n_2 = Total number of values in second set.

The formula for standard deviation is given by:

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Mean=148.25
Standard deviation=17.72533
T-Test=27.068119

(7) Analysis which shows percentage and count of doctors in a month.

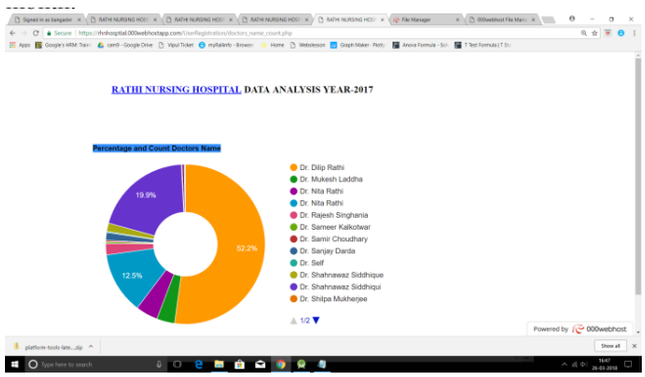


Fig. 13: Doctor's Analysis

In this count of doctors is calculated by Standard deviation:

The formula for standard deviation is given by:

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

N=13

Min=3

Max= 928

Mean=136.46153

Median=30

Standard Deviation=249.3485

V. Advantages

(1) This App is going to help a lot to patients and new users to book an appointment.

(2) Doctor can make decisions using the data analysis provided by the application.

(3) Billing generation will be simple.

(4) It helps to reduce the time for administrative tasks.

(5) It offers fast and precise transactional and management Reports about how the business is doing.

(6) It helps patients to have all the data on their smartphones, they can observe the dynamics of being on the mend, report doctors.

(7) It helps hospital officials and administration to monitor Statistics like Availability of Doctors, Patient intake, Medicines, Hospital Growth and Diseases.

VI. Conclusion

Overall, it is concluded from Rathi Nursing Home (RNH) hospital application and Data analysis that maximum count in the type of treatment is observed in Fracture surgeries and growth of hospital depends on the Orthopaedics department which is 56.30% of the total departments. Dr. Rathi is a key asset of the hospital, contributing 924 surgeries per year. RNH hospital application access the real time data of patients to maintain the good relationship and improve operational efficiency.

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