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AI based E-Healthcare in Rural Areas

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Abstract*: This research objective is to provide valuable healthcare services to the people who are unable to access the health services. Many rural and agency people till date struggling like anything without having proper health care. Where there is a shortage of Medical services such as Doctors, Nurses, and Paramedical Staff member, Artificial Intelligence Technology can be handy. There is a huge amount of data being generated from different hospitals, handling this amount of data using relative database system is very difficult. This is the place where big data come to the rescue. Big data is one of the key pillars in the digitization of the world. There are many NGO's or healthcare organizations in the world who is trying to provide various services to the people. But they need information of people who are suffering in order to provide services. Where do they get the information? This is where AI & Big Data come into the picture. After analyzing the disease pattern with big data offers different solutions to accomplish disease control steps. We should ensure a process for the collection of data and processing of the data through AI. The main theme is how Artificial Intelligence helps authorities to take a decision in critical situations for providing compassionate healthcare services to the rural & agency people..

Keywords: AI, Healthcare, Diagnostic center, Medical Research Centre, Medical Report.

I. INTRODUCTION

Maintaining good health care is an international issue. Of course, there are certain remedial actions taken against urban and semi-urban healthcare, but a lot of issues are still pending with respect to rural health. Healthcare can be perceived as the fundamental right of a person. Always good human health is wealth, integral to pleasure & prosperity. Also contributes to the economic progress of the nation. Not only that healthy people are happy. Happy people are productive in terms of resourcefulness [2].

The healthcare sector is rapidly growing in IT industry. In the present digital world the amount of data that is produced is huge and is very difficult to hold with the normal traditional database. This is where Big Data comes and helps in tackling the huge amounts of data and processing the data. Big data is a word which is used to describe the huge extent of the facts. Data might be in organized format or unorganized format.

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The analytics of data lead any association for enhanced choice production and tactical phases [3].

Big data have found widespread applications within the health care industry. By indulging big data into the health care sector some of the benefits are accurate and precise diagnosis, correct treatment decisions, effective prevention planning, early and efficient discovery of the root causes of a disease. Also, timely prediction in epidemiology.

AI is the buzzword and making its steps towards digitization, smartphone usage is rapidly growing in all parts of the world. Using the smartphone for right cause can help us in many different ways. Many health care apps are available in smartphones, which helps in improving the health of an individual. We have seen many apps in the mobile that helps us in tracking the weight and diet. Providing the necessary information for people to know about the health camps organized around them through an app in smartphone helps a lot for both individuals as well as government and non-profit organizations.

II. LITERATURE REVIEW

A.Big data in Healthcare:

The five V's that defines big data are Volume, Velocity, Variability, Veracity and Variety. In healthcare we do have large volumes of data coming in, which is difficult for a traditional RDBMS to handle. Expertise and Security are the two factors that are acting as a barrier for the practice of big data in the healthcare sector. People through expertise on big data are very few as it is an emerging technology and may be in a few years we may find may people with expertise on big data. By using big data, we can improve healthcare quality and coordination, reduce health care costs and predictive analytics to improve outcomes [3].

B.Real-Time vs Historical Data:

The transactional healthcare data and historical health care data are very crucial for clinicians while taking best medical results which helps in improving the health of patients. Collection of data is the primary thing that helps in achieving the whole process. A lot of time may be wasted for repeated routine checkups that may lead to loose patient life. The collection of medical reports like blood test should be done accurately without any malfunctions. Malfunctioning in entering the data will dilute the entire process. Wrongful data should not be encouraged. Delay in entering the data will slow down the process as we deal with actual facts [1].

C. HL7 Messages:

At present, all most ninety five percentages of hospitals in the whole America in the medical community uses,

Health Level 7 (HL7), the familiar standards for medical information exchange, for medical related equipment's in IT. [9].. Not only that Most popular countries like Germany, Japan and other developed countries are also following HL7.[8]
It refers to set of international standards for transferring the clinical data and administrative data between different software applications. [10] In other words, HL7 is an electronic document generated by a healthcare source system of electronic health care data. [7] The information present in the HL7 message is collected. An HL7 message is divided into segments. Each segment contains sample is given below format for better understanding [1].

```
MSH|^~\&|HL7Soup|Instance1|HL7Soup|Instance2|201407271408||ADT^A04|18
17457|D|2.5.1|123456||AL
PID||0797675^^^^MR|454721||Sam^Brown^^^^^B|Smith^Mary^^^^|19780203|
M||2106-3|254 East St^^Howick^OH^3252^USA||(216)671-
4859|||S|AGN|400003603~1629086|999-8888|
NK1||Brown^Mary^^^^|MTH||(216)891-3459||EC|||||||||||||||||||||||||
PV1||O|O/R|A|||060277^Allen^Katrina^J^^^|||||||||
||2668684|||||||||||||||||||||||||201407271408|
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III. RESEARCH OBJECTIVE

In many areas the average health of a human being is very low due to some issues. In spite of their life style their direct contribution to the society is as follows:

- Contribution to National Income
- Supply chain health services
- Provision of Surplus Resources
- Shift of amenities
- Managing Infrastructure
- Helpful to Reduce Inequality
- Operative demand between public and other sectors
- Employment Opportunities – Medical AI Operator
- Health via unlimited wealth

IV. PROPOSED HEALTHCARE SYSTEM - AI BASED

A. Artificial Intelligence

Is proving a godsend for Medicine - Man versus Machine is now Man & Machine.

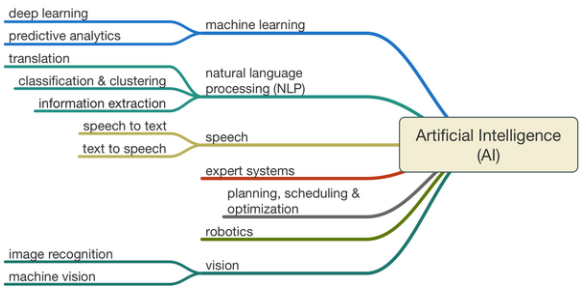


Fig. 1 Artificial Intelligent System

B. Patient E-Health Checkups

Good quality of health or diseased should maintain E-Health Records.

C. *Stage in AI based Healthcare:* *Smart procedures discussed in detail to better understand:*

Step 1: Outpatient medication preparation

Prepare Outpatient Record or retrieve data

Step 2: Robots

Assisting Doctors to conduct precise surgeries

Step 3: Virtual Nursing

Assist as nurse & virtual intensives in ICUs

Step 4: E-Records

At prioritize work force for emergency / normal.

Step 5: AI holds Promise of Fraud Detection

There are case the medical treatment people, government, organizations have been cheated by many. Those can be detected and controlled properly.

Step 6: Accurately Efficiency & Speed Diagnosis

Include scientific approach achieve this task.

Step 7: Treatment path with based on big data

- Use of Mobile Technology in Health Care:

Health care systems are gradually moving toward

- ***Mobile technologies***
- ***mHealth***
- ***Web-based information resources***
- ***Telephone messaging***
  - SMS
  - MMS
  - Remote monitoring of patients
  - Remote interpretation of medical reports
  - Videoconferencing
- **Tele-Health - including the remote services**
  - The Surgeon operating at a distance
  - Tele-Robotics
  - Use of mobile and ubiquitous computing devices
- ***Collecting and sharing patient data***
  - Web Apps.
- ***Tele-Medicine***

Step 8: Monitoring - *Compassionate HealthCare:*

Care and compassion, which are grounded in relationships and relatedness, have much to contribute to an interconnected, suffering, and surprising world. [11]
A recent survey of with around a thousand hospitalized patients and five hundred physicians found comprehensive settlement that compassionate attention is "very important" to effectively medical dealing.

- Sympathy
- Empathy
- Altruism
- Concern
- Consideration
- Care
- Kindheartedness
- Respect
- Comfort

With above actions a person can improve health care.

Step 9: Deep Learning in Operation theatres

With the help of technology – ECGs, Diagnosis, Pathology, Microscope, Ophthalmology etc.

Step 9: Insurance

- The main objective is to provide timely support in terms of medical aid through insurance details.
- An accurate system should in in place to check the originality and prevent frauds. Whatever it was certainly lose to the nation in many ways in general and lose to patient in particular [14].
- When claim settlement comes into reality a person having millions of dollars he or she may die then the amount will release to the nominee or not.

V. VIRTUAL IMPLANTATION

To solve an issue with man-made machines we require a procedure, which should be approved out to convert the given source input in different

For example, after the rain, the farmer can easily identify the soil, whether it is fit for or not!

System design by Machine Learning such as

- **Problem Assessment**

Specify the Objective - Smart Systems with Learning.

- **Data and Knowledge Acquisition**

➢ ***Analyze Data with available knowledge***

Once a person hospitalized some important data should be tracked immediately.

➢ Outpatient ID
➢ Patient Ward
➢ Patient Name
➢ Father/Mother/Son/Daughter of/Spouse/ Name
➢ Age
➢ Gender
➢ AadharID
➢ Blood Group
➢ Allergies if any
➢ Special Care if any
➢ Organization where working
➢ In case of Emergency – Contact no
➢ Disease Name
➢ Disease Category
➢ Severity
➢ Doctor Referred
➢ Previous hospital / clinic data
➢ Previous medical history link
➢ Advance payment
➢ Total Bill
➢ Mode of Payment DD / Card / Cash
➢ Insurance Type / Coverage
➢ Health Card Details
➢ Vehicle Type / Details
➢ Other Support if any

- **Development of a Prototype System**

➢ Tool Identification with the situation

Table- I: Tool Identification with Diet

Diet Quality	Rural	Urban	Semi-Urban	Agency
Banana	High	High	High	High
Coconut	Low	Low	Low	Nil
Cashew	Low	Low	Low	Low
Mango	High	High	High	High
Papaya	High	High	High	High
Vegetables	High	High	High	Nil
Rice	High	Moderate	Medium	Low
:::::	:::::	:::::	:::::	:::::

The System can take a decision on the given situation and appropriate action will takes place with a proper measure.

- **Development of a Complete System**

➢ User Interface Design

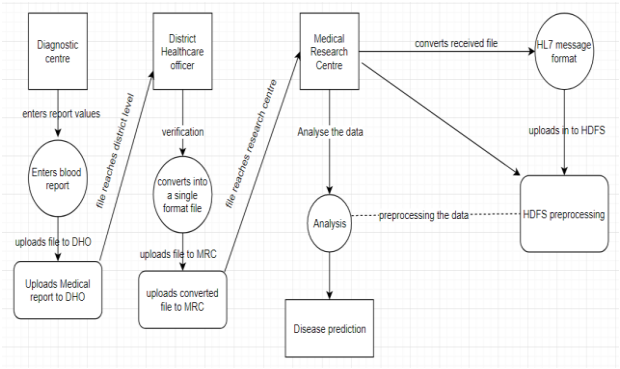


Fig. 2 Intelligent System for Data Collection UI

- **Evaluation and Revision of the System**

➢ Revise as per Performance Criteria

- **Integration and Maintenance of the System**

➢ Technology to fix the problem

As per the present estimation, what amount of resources required or what kind of remedial actions should be taken to bring the situation into our control on both normal and emergency..

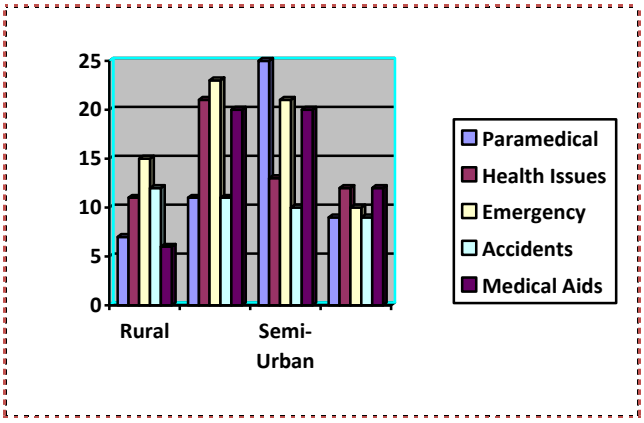


Fig. 3 Issues with respect to Areas

Hence, as shown in the fig. 7 Issues with respect to Areas and other infrastructure for treatment adoption of the technology that improves the economy.

VI. RESULTS AND DISCUSSION

In the initial stage, the background work like creating a web portal and providing different authorization details to all the diagnostic centers and health care officer should be done.

Table- II: E-Health Records for Data Analysis

Acsess Head	AI based E-Health Records		
	Patient Record	Traditional	AI Role
1	Outpatient ID	Yes	Yes
2	Patient Ward	Yes	Yes
3	Patient Name	Yes	Yes
4	Father/Mother/Son/Daughter of/Spouse/ Name	Yes	Yes
5	Age	Yes	Yes
6	Gender	Yes	Yes
7	AadharID	Yes	Yes
8	Blood Group	Yes	Yes
9	Allergies if any	No	Yes
10	Special Care if any	No	Yes
11	Organization where working	No	Yes
12	In case of Emergency – Contact no	No	Yes
13	Disease Name	No	Yes
14	Disease Category	No	Yes
15	Severity	Yes	Yes
16	Doctor Referred	Yes	Yes
17	Previous hospital / clinic data	No	Yes
18	Previous medical history link	No	Yes
19	Advance payment	No	Yes
20	Total Bill	No	Yes
21	Mode of Payment DD / Card / Cash	No	Yes
22	Insurance Type / Coverage	No	Yes
23	Health Card Details	No	Yes
24	Vehicle Type / Details	No	Yes
25	Other Support if any	No	Yes

There are two versions in HL7 message format, HL7 V2.x and HL7 V3.x in which V2.x is adopted more. The segments present in the hl7 message are

The segments are divided into components and components are further divided into subcomponents

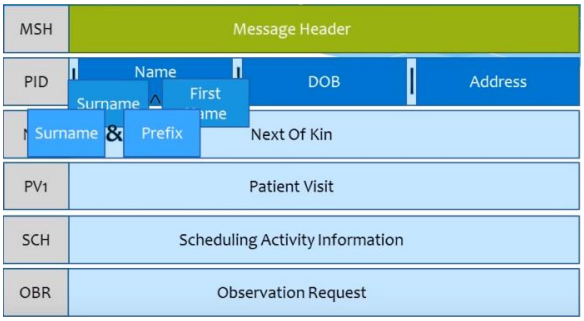


Fig. 4 Components and Sub Components present in HL7

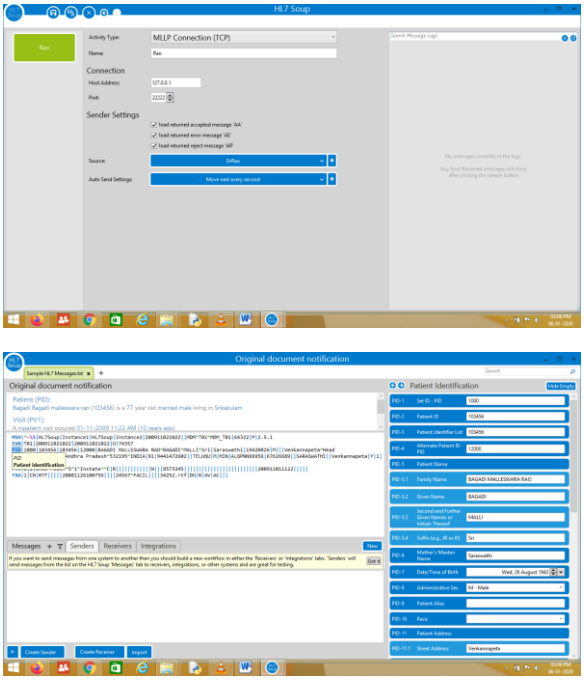
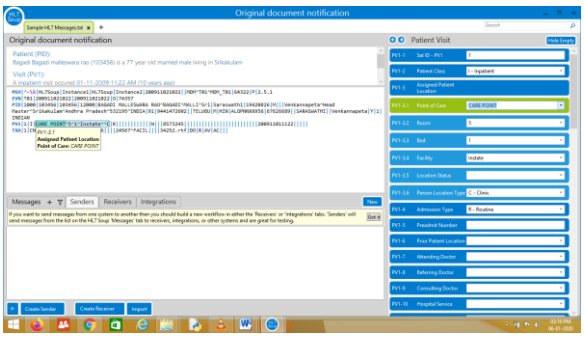


Fig. 5 Patient Record Entry

MSH|^~\&|HL7Soup|Instance1|HL7Soup|Instance2|200911021022||MDM^T01^MDM_T01|64322|P|2.5.1
EVN|T01|200911021022|200911021022|O|74357
PID|1000|103456|103456|12000|BAGADI_MALLESWARARAO^BAGADI^MALLI^Sri|Saraswathi|19420826|M|||Venkannapeta^Head Master^Srikakulam^Andhra Pradesh^532195^INDIA|91|9441472602||TELUGU|M|HIN|ALGPNNXXX56|67626689||SARASWATHI||Venkannapeta|Y|1|INDIAN
PV1|1|I|CARE POINT^5^1^Instate^^C|R||||||||||N|||8573245|||||||||||||||||200911011122|||||**TXA**|1|CN|RTF|||||20081126100756||||24567^FACIL||||34252.rtf|DO|R|AV|AC|||



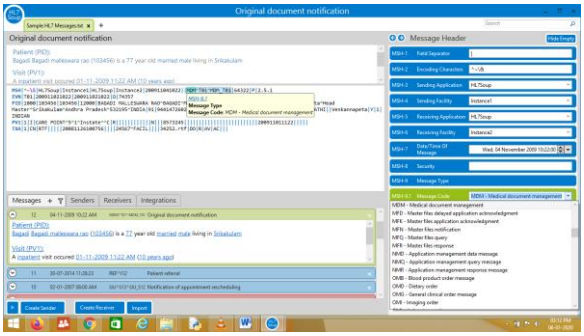


Fig. 6 Patient Record Management

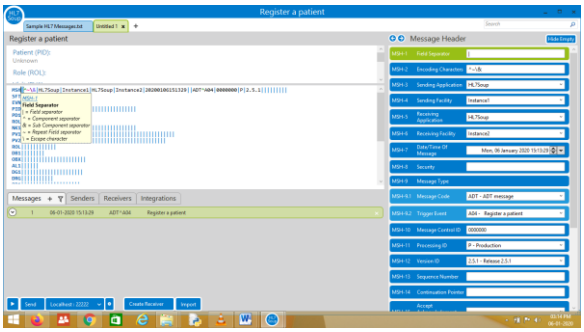


Fig. 7 Patient Data Retrieval

Each diagnostic center should authorize into their account and fill the real time or near real time blood test report values in the web portal. These values should be updated in a real time manner in a csv format or txt format or xml format as a dataset. Why we choose different formats is, in reality different organizations may use different formats.

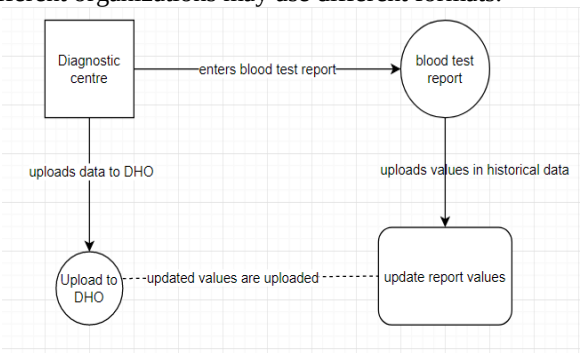


Fig. 8 Flow in diagnostic centers

After collecting the blood test values or samples, dataset should be uploaded to the district health care officer. The district health care officer should examine those datasets sent by different diagnostic centers and should make the necessary changes like filling the missing value, etc. Later the district health officer combines different dataset formats received from different diagnostic centers in the district into a single dataset format and sends the updated blood test report dataset to medical research center.

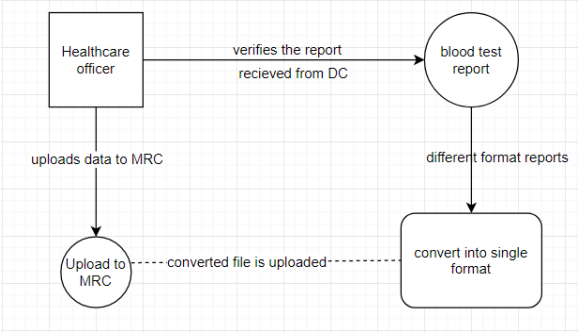


Fig. 9 Work flow in District Health Care

The medical research center collects the data sets from different district health care officers and converts the data sets into a single HL7 message format file. The converted HL7 message format file is stored in HDFS. After uploading the file into HDFS we perform different analytics to draw results related to a particular disease, particular area and particular year etc.

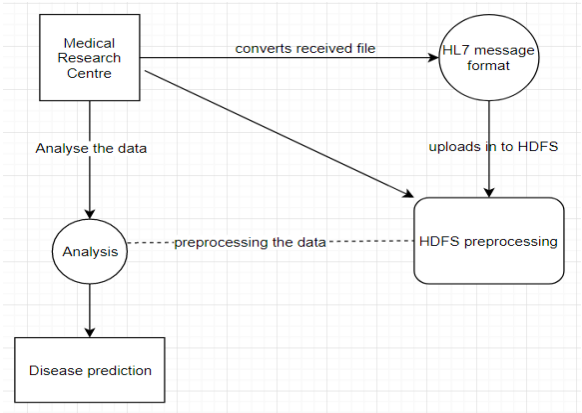


Fig. 10 Work Flow in Medical Research center

For patient's awareness about camp resources, services, place and time detail, we developed a mobile app. In this module patient can register themselves and then can provide all details like name, Aadhar number, contact number, address, and health related problem description. The Patient can view camps based on camp services, place and time.

For transparency and competence rating of camps will be visible based on feedbacks past the patient's camp of particular organization based on several parameters like medicine & vaccine, staff condition, infrastructure, distance and connectivity, quality of care.

There are many issues to be discussed while conducting a campaign. Some of them are the quality of the service we provide, infrastructure, medicine & vaccine availability, distance and connectivity etc.

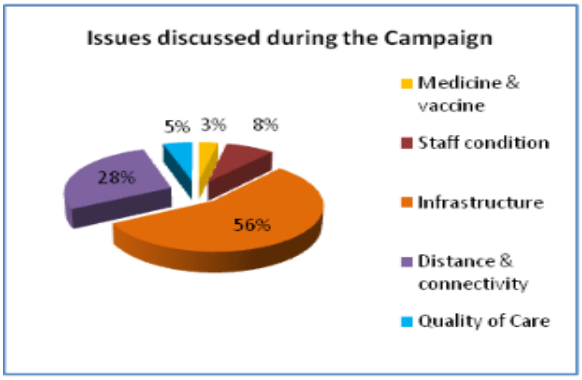


Fig. 11 Medical Issues during Health Campaign

Dengue as an example:

We will discuss an example of dengue disease. When people are affected with dengue disease which is caused by mosquito, government cannot be able to guess which area is most affected with dengue disease across the state or country.

When the government has the details of the patient reports then can locate which area is most affected with dengue disease. In our proposed system we will collect the blood test reports from various diagnostic centers and we will upload the data to state medical research centers.

The medical research centers will collect the combined data and will predict different disease predictions across the state or country. With these disease predictions we can find which area is most affected and we can send required medical facilities in different areas. We can also provide information to NGO's which helps in conducting different campaigns in different places required.

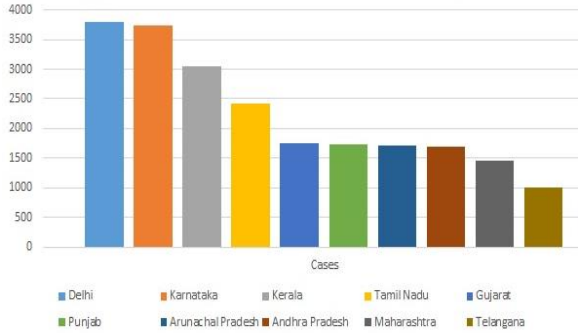


Fig. 12 Areas most affected by Dengue Disease

A custom mobile application for health organization can be an integrative solution for patient care and communication. Your healthcare organization can hugely benefit from leveraging on the increased dependency your patients have on their mobile phones for information and communication. Having a custom mobile application would, therefore, ensure you are accessible to your patients at a click of a button. Globalizing the work is bit difficult because patterns may vary from place to place.

Fig. 13 Deaths due to Dengue Disease

When a particular patient is having a health card. This system has to tell that whatever a disease having by the patient the treatment covers his expenses or not. Also the limit on the card. When the estimated expenses don't meet the requirement what are the other alternative they have, if not! What alternate help we can suggest through our system so that any NGO's can look into this? Otherwise, any charitable trust or non-profit organization can afford the expenses the suggestion can be given after analyzing the available data.

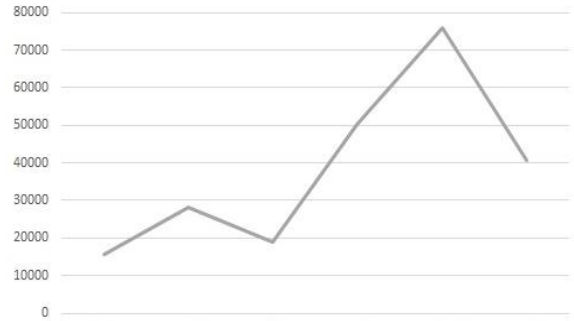


Fig. 14 Dengue cases reported

There are lots of new projects like crowd sourcing is done in which an organization communicates a problem to participants in the online community. Online communities ignite enthusiasm by creating a compelling virtual experience in problem solving. Medical Officials will offer suitable solutions as per the advice given by the system. The advantage of using big data is very high, from which we can predict the deceased category based on collecting samples.

VII. CONCLUSION

This research work concludes that there are many algorithms and analytic techniques that help in drawing different healthcare analytics. But using the right algorithms or analytic techniques helps in drawing the right solution to the problem. The data collection should be done with at most care so that the predictions will be helpful for the government or non-government organizations. By identifying the disease predictions we can help the people who are lacking of medicines and we can outbreak different disease epidemics. Finally, this intelligent system can suggest Governments. NGOs, Non-Profit organizations to provide adequate logistics and medicine to the hospitals, which helps people to get better treatment.

FUTURE WORK

In India the government does not provide the healthcare data to the public which stops many individuals or organizations doing their research on rightful data. Whereas countries like US provide the healthcare data publicly n websites which helps researchers to use the data to their research work in the area of health care. Public-private partnership will certainly improve the health service in an effective way. Many Non-Government Organizations and Non-Profit Organizations provide their service in an extensive way for good health community development. These communities' focused mainly for rural people. Without showing any discrimination with respect to urban, semi-urban or agency.

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Mr. Pidugu sundeep, has completed his bachelor from VIT University in Computer Science and Engineering. Later worked as Software Engineer at Intellect Design Arena, being a part of strategy and innovation team always gave him opportunities to leverage his skills on artificial intelligence and cross-platform web applications which bagged him an award for the "Continuous hard work and excellence being a role model to fellow peers" and received it from Saurav Ganguly was a triumph. His interest in working and contributing to Open Source projects and research, always helped him in gaining global practical exposure towards the latest technologies across varying platforms. He is currently working at Pagemajik Developing Deep Learning models for NLP and Image Processing projects. He is always passionate about bridging academic intellect towards practicalities in the industry.