JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 3, 2022, p. 52 - 62
https://publishoa.com
ISSN: 1309-3452

Enterprise Resource Planning Based Mobile Application For Hospitals To Manage Covid-19 Division

Farooq Sunar Mahammad[1*], Shaik Haji Gulab[2], Thummala Pavani[3], Gedda Swathi[4], Singireddy Anusha[5], K Haritha[6]

Department of Computer Science Engineering, Santhiram Engineering College, Nandyal
Email: hod.cse@srecnandyal.edu.in

ABSTRACT
The introduction of Enterprise Resources Planning or ERP-based mobile application was initiated in hospitals to manage the COVID-19 infections which are represented here to procure, allocate as well as alert those health care experts who are involved in various kinds of resources such as oxygen supply, drugs as well as the availability of beds. A very simple top-down information is the main basis on which the application is performing. At least one other person will be updating various resources and the data which is validated. The application will also include different profiles of various health care experts such as doctors, nurses as well as ward attendees. Shortly after work, various portfolios could be provided to those individuals who are the personal attendees of any patient.

Keywords: Artificial Intelligence, Machine Learning, Mobile Applications Top-down, Enterprise Resources Planning.

1. INTRODUCTION

The impact of the COVID-19 pandemic has nearly devastating implications on both the economy as well as human lifestyle. It almost altered the global community to make healthcare one of the most significant factors. This pandemic has impacted heavily on the healthcare industry as a whole and has been quite challenging. “The Covid-19 pandemic has created a multitude of acute challenges for health care delivery organizations, including inadequate capacity, supply shortages, the need for care redesign, and financial loss. Complexity science views health care delivery organizations as complex adaptive systems that operate in highly complex and unpredictable environments. The perspective assumes that much of organizational life is unknowable, uncertain, or unpredictable and thus cannot be standardized and controlled.”[1] This type of scenario has created a requirement for both advances as well as user-friendly software for healthcare management that can be very helpful during the COVID-19 pandemic.

2. LITERATURE SURVEY

According to the inference from the reference that is based on the paper, it can be said that "the recent research was aimed to develop a mobile application for the management of coronavirus disease 2019 (COVID-19). We analyzed the pilot version with satisfaction through a survey and an interview with health workers. The user interfaces graphics, whether at the hospital or patient application level, was reviewed for effective usability by a multidisciplinary team. The objective is to ensure communication between the mobile application and the decision support application at the emergency services level to facilitate the detection of people who had developed COVID-19 as well as follow-up at home for detected patients."[2]
Hence according to the complete study of the literature, a proposal has been initiated to build a good state-of-the-art software model by allowing a top-down approach in Machine Learning or ML as well as also introducing an application for mobile users by using Android Studio.

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3. WORKING

Proposed system:

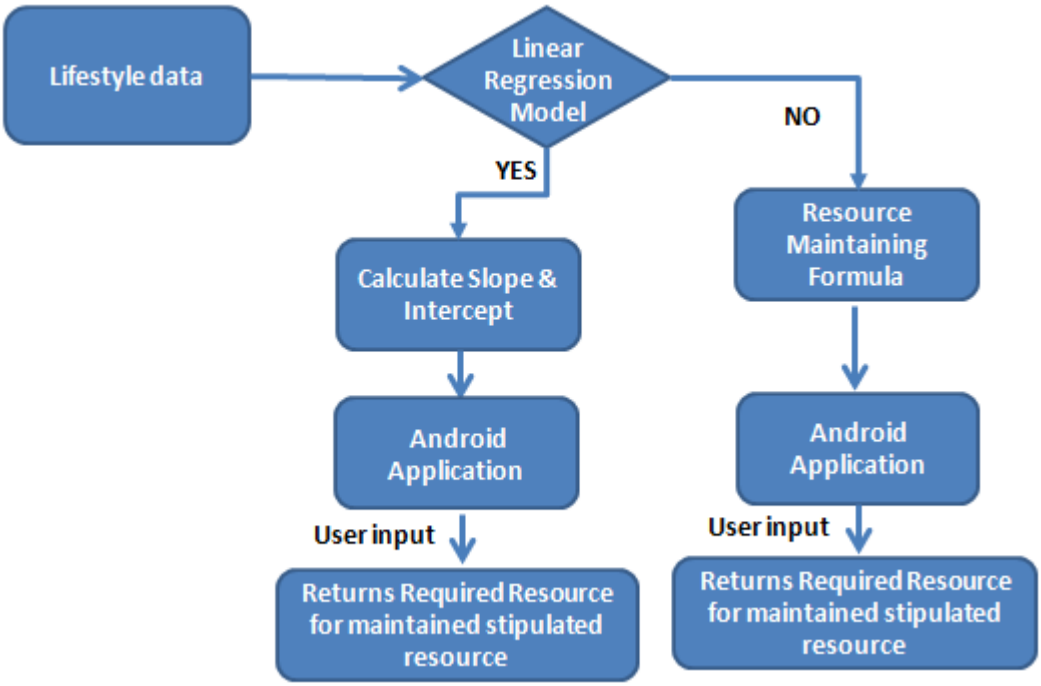

Figure 1 Block Diagram

The main purpose of this project is to build a top-down approach software that could automate and develop to manage the entire resources of any healthcare facility. This could include the records of the numbers of oxygen cylinders as well as the status of rediscovering medicine that needs to be acquired in the case of maintaining a very few weekly calculations on certain basic numerical parameters. The daily system of acquisition, the regular consumption rate as well as the current stock status. This type of software is one of the simple examples of such a "knowledge-based system. A knowledge-based system (KBS) is a computer program that reasons and uses a knowledge base to solve complex problems. The term is broad and refers to many different kinds of systems. The one common theme that unites all knowledge-based systems is an attempt to represent knowledge explicitly and a reasoning system that allows it to derive new knowledge. Thus, a knowledge-based system has two distinguishing features: a knowledge base and an inference engine." [3] In such a kind of simplified instance, the base of the knowledge is mainly the database of various counts as well as the engine that is inference is known as the Resource Maintenance Formula. Instead of a trained linear regression model in case of predictions in this stock required to maintain a stipulated stock that is there in oxygen cylinders that are based on this daily oxygen rate consumption is to be processed.

Linear Regression Model:

"Linear regression shows the linear relationship between the independent variable (X-axis) and the dependent variable (Y-axis), consequently called linear regression. If there is a single input variable (x), such linear regression is called simple linear regression. And if there is more than one input variable, such linear regression is called multiple linear regression. The linear regression model gives a sloped straight line describing the relationship within the variables." [4]

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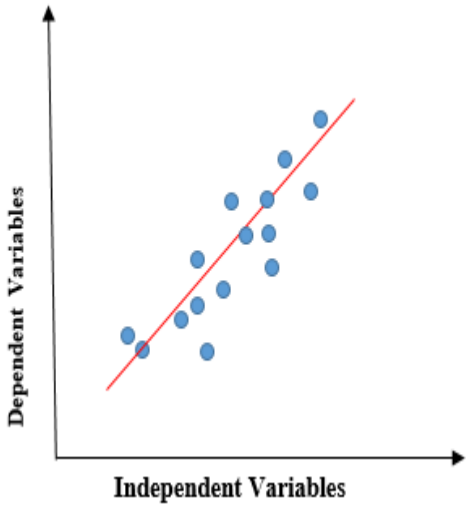

Figure 2 Linear Regression graph

"The above graph presents the linear relationship between the dependent variable and independent variables. When the value of x (independent variable) increases, the value of y (dependent variable) is likewise increasing. The red line is referred to as the best fit straight line. Based on the given data points, we try to plot a line that models the points the best."[4]

4. ARTIFICIAL INTELLIGENCE

The algorithmic flow presented in this paper falls under the field of Artificial Intelligence and Machine Learning. Presented below is an outline of those technologies.

"Artificial intelligence (AI) is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals, which involves consciousness and emotionality. The distinction between the former and the latter categories is often revealed by the acronym chosen. Strong AI is usually labeled as artificial general intelligence (AGI) while attempts to emulate 'natural' intelligence have been called artificial biological intelligence (ABI). Leading AI textbooks define the field as the study of intelligent agents: any device that perceives its environment and takes actions that maximize its chance of achieving its goals. Colloquially, the term artificial intelligence is often used to describe machines that mimic cognitive functions that humans associate with the human mind, such as learning and problem-solving."[5]

"As machines become increasingly capable, tasks considered to require intelligence are often removed from the definition of AI, a phenomenon known as the AI effect. A quip in Tesler's Theorem says AI is whatever hasn't been done yet. For instance, optical character recognition is frequently excluded from things considered to be AI, having become a routine technology. Modern machine capabilities generally classified as AI include successfully understanding human speech, competing at the highest level in strategic game systems (such as chess and Go), and also imperfect-information games like poker, self-driving cars, intelligent routing in content delivery networks, and military simulations."[5]

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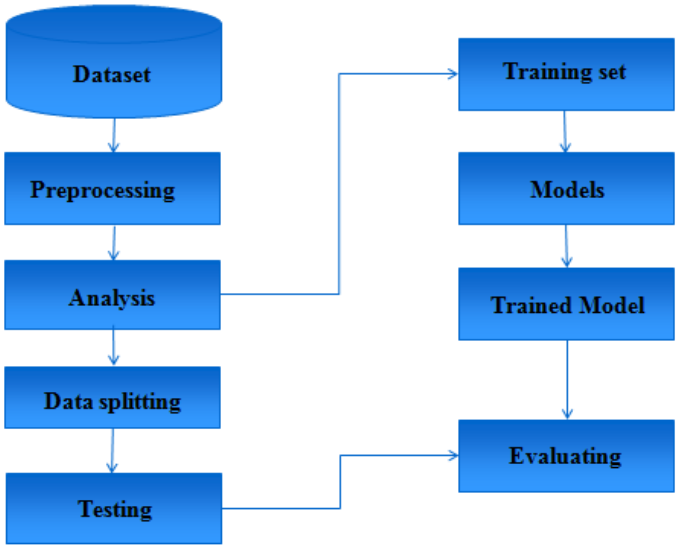

Figure 3 Flow Chart

"AI research has been divided into subfields that often fail to communicate with each other. These sub-fields are based on technical considerations, such as particular goals (e.g. robotics or machine learning), the use of particular tools (logic or artificial neural networks), or deep philosophical differences. Sub-fields have also been based on social factors (particular institutions or the work of particular researchers)." [5]

"In the twenty-first century, AI techniques have experienced a resurgence following concurrent advances in computer power, large amounts of data, and theoretical understanding; and AI techniques have become an essential part of the technology industry, helping to solve many challenging problems in computer science, software engineering, and operations research."[5]

5. MACHINE LEARNING

"Machine learning (ML) is the study of computer algorithms that improve automatically through experience and by the use of data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks."[6]

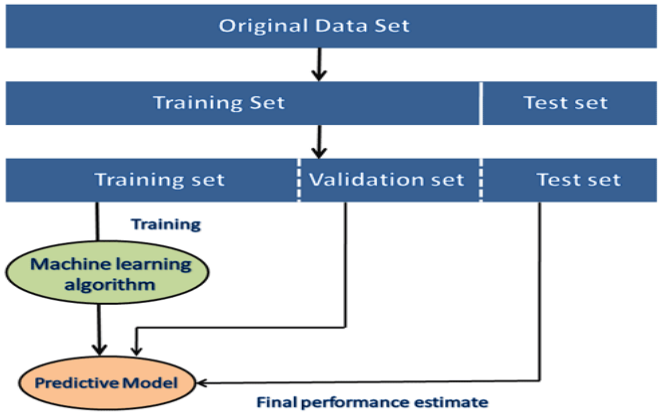

Figure 4 Machine learning dataset

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"A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory, and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics." [6]

5. INDUSTRY 4.0

"Wikipedia defines Industry 4.0 as thus: The Fourth Industrial Revolution (4IR or Industry 4.0) is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring, and production of smart machines that can analyze and diagnose issues without the need for human intervention."[7]

During the industrial age 4.0, the automation process mainly consists of a specific scheme or patterns at its outset. Presented below is how automation in the mass production industry, as well as consumer-level products, is built in today's technological era.
The schema presented in Figure 5 has a lot of other components involved but the generic outline of it stands justifiable for all kinds of automation today.

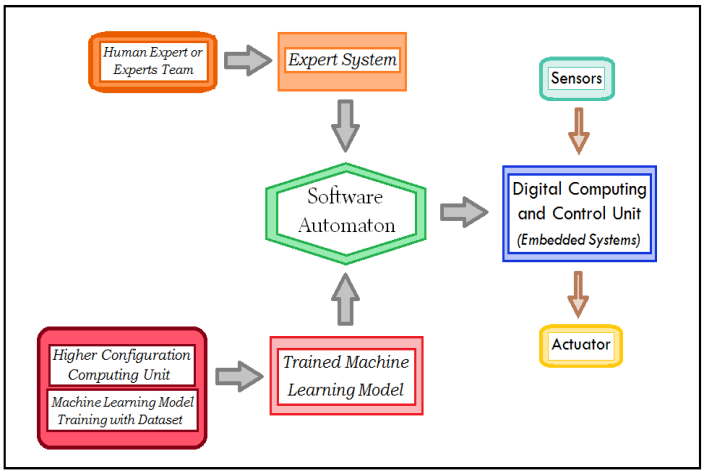

Figure 5 Schema of Automation

The conventional Automation Model is mainly software automation, which is initially the status quo, that was developed either by certain human experts or by some human expert. The automated software was ultimately not fully or directly developed or designed by human experts based on the advent of any Machine Learning technology. Different human experts have been delivering the Machine Learning software as well as giving them real-world data sets which are observed as training information. This form of a mathematical model has been transferred from a dataset that is being identified by a machine learning system that detects the various patterns of the input as well as output parameters. Such a type of mathematical model could be downloaded in the form of a working software system in the case of other computing devices. This mathematical model is referred to as the 'trained machine learning module'. The software automaton of all the current digital embedded devices is a mathematical model that gives a numerical output for a numerical input based on arithmetic and logical conditions. This software automaton, as explained above can be either directly developed by a set of human experts employing setting the boundary conditions themselves based on observation and requirement or can be downloaded as an executable module from machine learning training systems that are trained with the relevant dataset. In whatever way the software automaton is developed, it can be loaded onto the relevant embedded computing module that can be used for either sensor-based closed-loop automation or open-loop automation.

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The technological components of Industry 4.0 include IoT, augmented reality, virtual reality, cloud computing, 3D printing, big data analytics, networking, data security, human-machine interaction, and others. IoT is a very effective way to collect real-world data. Sensors integrated with data acquisition and transmission systems can be placed anywhere and the collected data can be pre-processed if required and used as datasets to train machine learning models.

Cloud computing is employed for the optimized utilization of computing resources. There are many third-party vendors like Google and Amazon which are very reliable in terms of data security and speed of computation. These services offer companies and organizations a cheap and reliable way to create the strength of Artificial Intelligence as well as Machine Learning.

Big data analysis is the set of technological components involved with collecting, collating, and managing large quantities of data for analytics and decision making. When so much data is involved, especially with third-party service providers, data security plays an important role.

One of the paramount concerns about Industry 4.0 is the unemployment it can create due to powerful automation. The field of human-machine interactions and co-working has been a very developing field now to mitigate the above-mentioned problem.

6. RESULTS AND DISCUSSION

Daily Rate of Oxygen Tank Consumption	Stock Required for Maintaining Stipulated Stock of Oxygen Tanks
1	42
1.5	38.5
2	35
2.5	32.5
3	28
3.5	40
4	21
4.5	17.5
5	14
5.5	10.5
6	7
6.5	3.5
1.2	40.6
1.8	36.4
2.8	29.4
3.8	22.4
4.8	15.4
5.8	8.4
6.2	5.6
3.6	23.8
4.6	16.8
5.6	9.8
1.6	37.8
1.3	39.9
1.7	37.1
3.7	23.1
3.9	21.7
5.9	7.7
2.9	28.7

Figure 6 Input Sample Dataset - Oxygen tank

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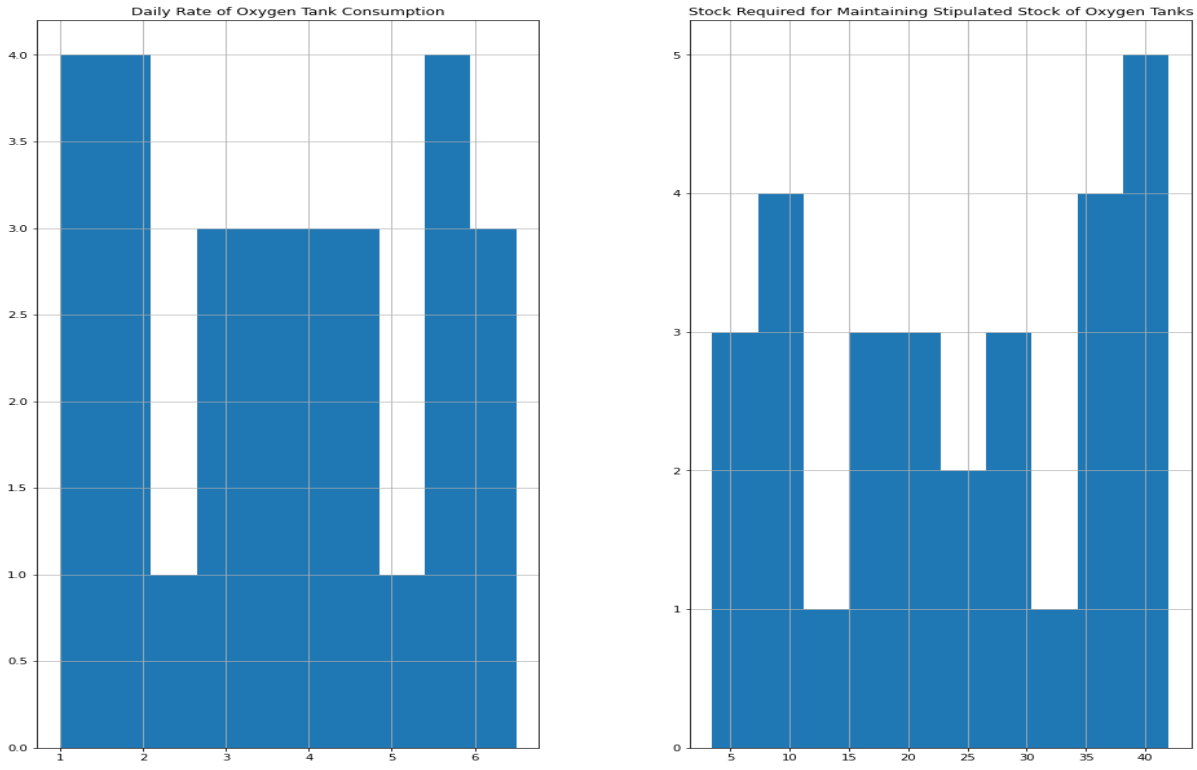

Figure 7 Oxygen tank – Input graph

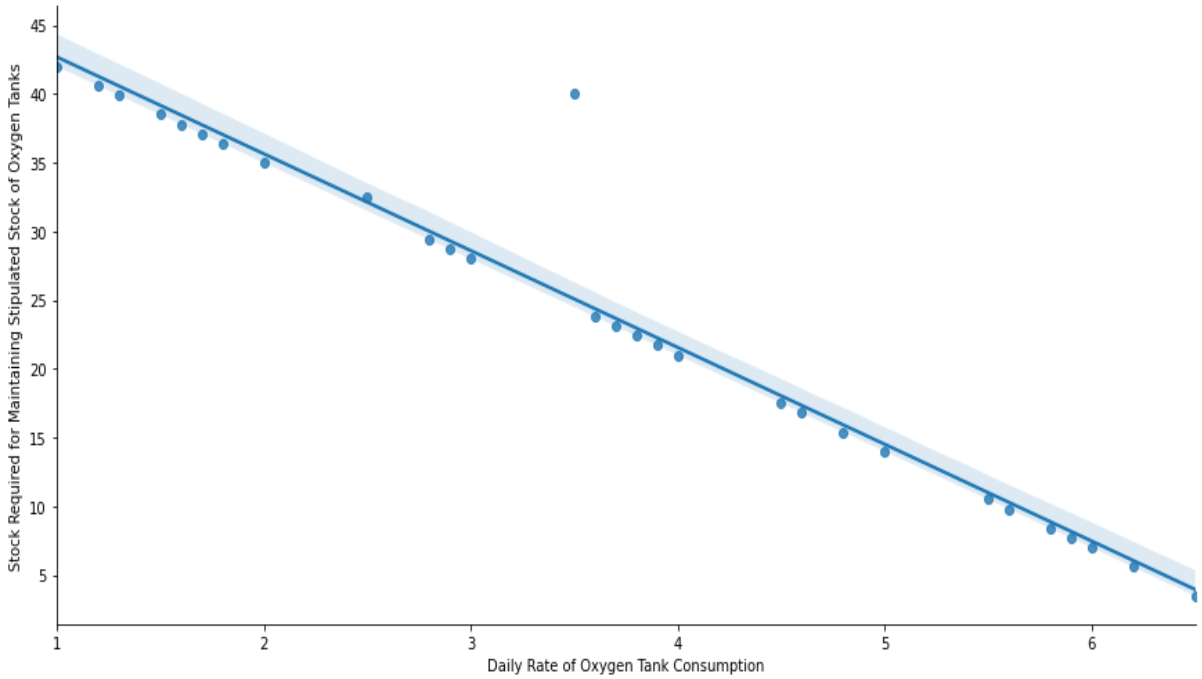

Figure 8 Oxygen tank - Output graph

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Daily Rate of Remdisiver Consumption	Stock Required for Maintaining Stipulated Stock of Remdisiver
100	8900
120	8760
220	8060
320	7360
420	6660
520	5960
620	5260
720	4560
820	3860
920	3160
1020	2460
1120	1760
1220	1060
140	8620
240	7920
340	7220
1040	2320
450	6450
750	4350
930	3090
230	7990
435	6555
565	5645
934	3062
445	6485
975	2775
282	7626
567	5631
994	2642

Figure 9 Input Sample Dataset – Remdisiver

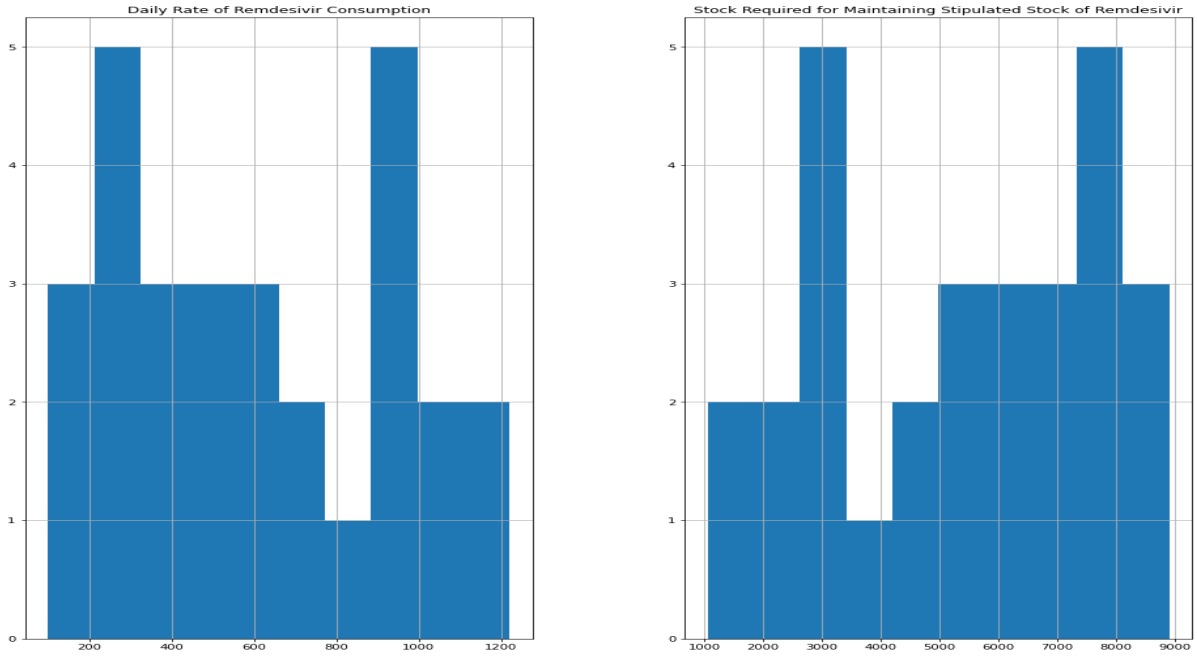

Figure 10 Remdisiver – Input graph

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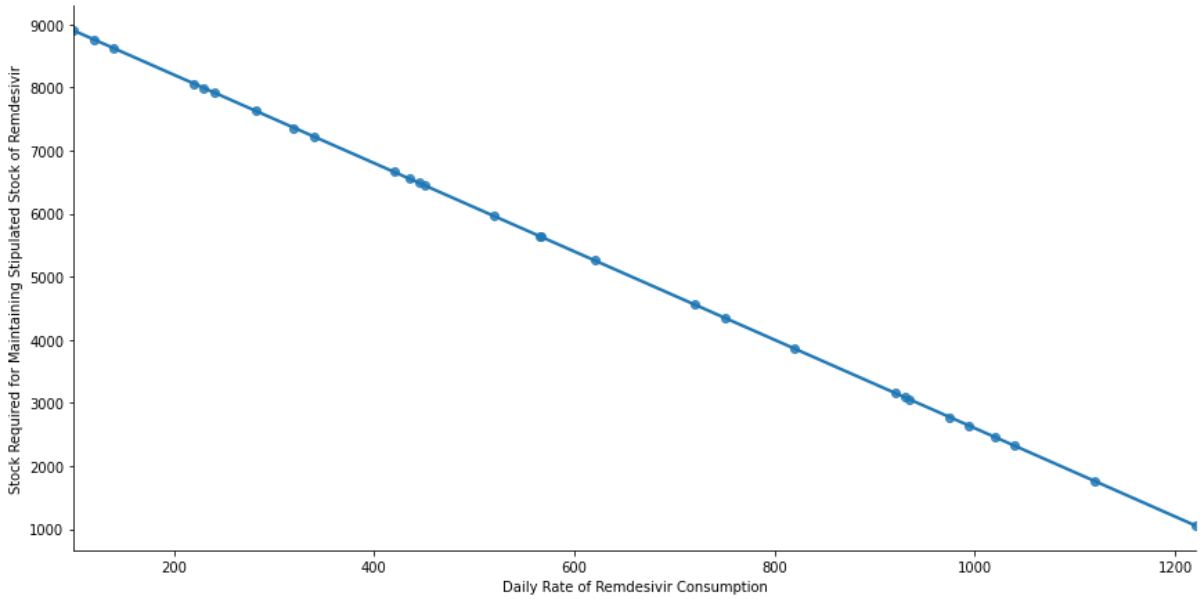

Figure 11 Remdisiver – Output graph

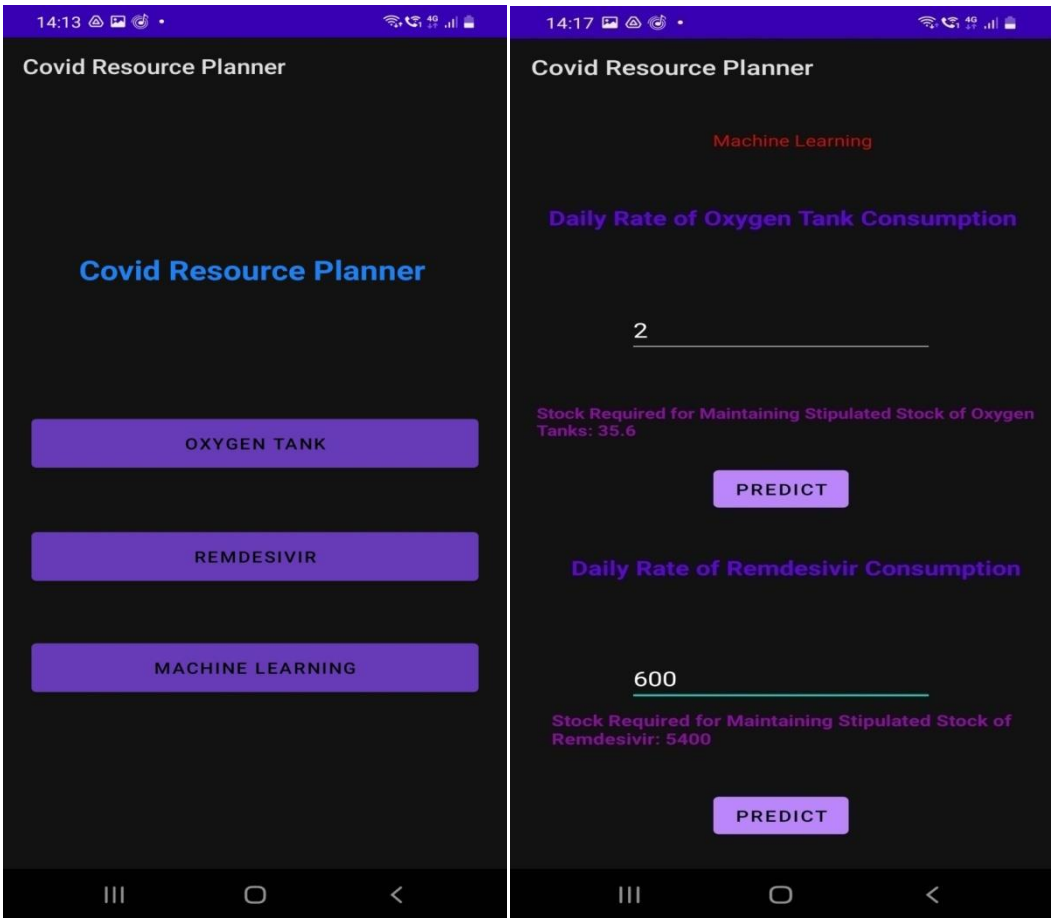

Figure 12 Mobile App – Input view

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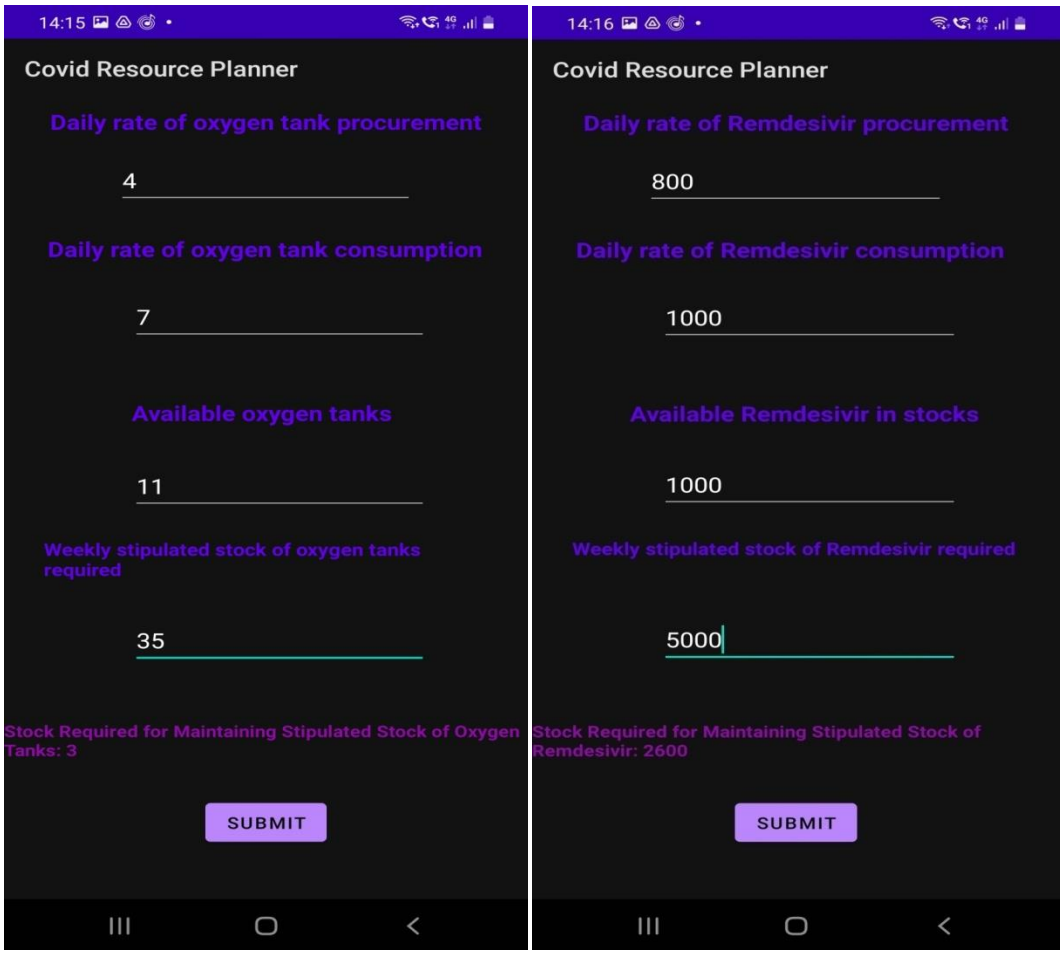

Figure 13 Mobile App – Output View

The main purpose of this project is to build a top-down approach software that could automate and develop to manage the entire resources of any healthcare facility. In this type of top-down a single logic is based on certain sequential entities that are just like formulae that can be implemented while coding. "A top-down approach (also known as stepwise design and stepwise refinement and in some cases used as a synonym of decomposition) is essentially the breaking down of a system to gain insight into its compositional sub-systems in a reverse engineering fashion. In a top-down approach, an overview of the system is formulated, specifying, but not detailing, any first-level subsystems. Each subsystem is then refined in yet greater detail, sometimes in many additional subsystem levels, until the entire specification is reduced to base elements. A top-down model is often specified with the assistance of black boxes, which makes it easier to manipulate. However, black boxes may fail to clarify elementary mechanisms or be detailed enough to realistically validate the model. The top-down approach starts with the big picture. It breaks down from there into smaller segments". [8]

7. FUTURE WORK AND CONCLUSION

Health care services have always played a very significant role in any society as well as any nation. The impact of the COVID-19 pandemic has forced many nations as well as world bodies to focus on and strengthen the healthcare industry in various ways. Already there had been a significant amount of innovation done before the pandemic which led to automation in healthcare services. However, the pandemic has triggered the system more effectively through various innovative methods such as Artificial Intelligence and Machine Learning. The future of the healthcare industry is very optimistic as well as a series of evolutions will create a robust impact in this sector. Database management strategies according to various researchers are a

major influential factor in every section of the healthcare industry which could reduce the time, wastage, and human intervention in this area. Hence such a kind of top-down model which is based on automation is presented as a type of a mobile application. Two mathematical formulas are deployed to analyze the count of mainly two types of products that are to be bought in case of minimum, viz., Task of oxygen as well as remdesivir vials. This type of mobile application was developed as well as tested to showcase the effectiveness of any such conventional top-down approach. Various kinds of automation during industry 4.0 consist of a certain scheme or pattern of its outlet. Until now such a kind automation model of such conventional Automation models is mainly software automation, which is initially the status quo, that was developed either by certain human experts or by some human expert. The automated software was ultimately not fully or directly developed or designed by human experts based on the advent of any Machine Learning technology. Machine Learning technology is developed by human experts and provides the data set as a piece of information for training. The major task of the machine learning software is to identify the patterns between both the input as well as output parameters of these datasets that are in the form of a mathematical model. Such a type of mathematical model could be downloaded in the form of a working software system in the case of other computing devices. However, despite various obstacles, the future of automation in health care services with the implications of Artificial Intelligence as well as Machine Learning seems to be very bright and optimistic.

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[8] https://en.wikipedia.org/wiki/Top-down_and_bottom-up_design