

Enhanced Automated Oxygen Level controller for COVID Patient By Using Internet of Things (IoT)

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Abstract—The Internet of Things (IoT) shall be merged firmly and interact with a higher number of altered embedded sensor networks. It provides open access for the subsets of information for humankind's future aspects and on-going pandemic situations. It has changed the way of living wirelessly, with high involvement and COVID-related issues that COVID patients are facing. There is much research going on in the recent domain, like the Internet of Things. Considering the financial-economic growth, there isn't much significance as IoT is growing with industry 5.0 as the latest version. The newly spreading COVID-19 (Coronavirus Disease, 2019) will emphasize the IoT based technologies in a greater impact. It is growing with an increase in productivity. In collaboration with Cloud computing, it shows wireless communication efficiently and makes the COVID-19 eradication in a greater way. The COVID-19 issues which are faced by the COVID patients. Many patients are suffering from inhalation because of lung problems. The second wave attacks mainly on the lungs, where there is a shortage of breathing problems because of less supply of oxygen (insufficient amount of oxygen). The challenges emphasized as proposed are like the shortage of monitoring the on-going process. Readily being active in this pandemic situation, the mentioned areas are from which need to be discussed. The frameworks and services are given the correct data and information for supply of oxygen to the COVID patients to an extent. The Internet of Things also analyzes the data from the user perspective, which will later be executed for making on-demand technology more reliable. The outcome for the COVID-19 has been taken completely to help the on-going COVID patients live, which can be monitored through Oxygen Concentration based on the IoT framework. Finally, this article discusses and mentions all the parameters for COVID patients with complete information based on IoT.

Keywords— *Cloud Computing; Internet of Things; Oxygen Concentration; Smart Pulse Oximeter; Peak Detection Algorithm*

I. INTRODUCTION

The Internet of Things makes the world enthusiastic about the ecosystem. They are coming across and mentioning the peer's needs and knowledge, too. It describes technological aspects with little human intervention. It is completely embedded with sensing objects (led's to measure or sense basic activity or performance of an object). The on-going COVID-19 (Coronavirus Disease, 2019), which led the Internet of Things based on proposed ideas. Enhance the framework more crucially, as it helps the COVID patients. Besides, the Internet of Things has evolved into a more future-

realistic concept. Likely, they are communicating wirelessly with cloud servers and services [1]. The Cloud server and services are composed of on-demand technology with the prior needs. IoT framework contributes with it, using the principles and architecture used too. The Internet of Things from the area of concepts strikes as it works with complete scalability. IoT can now be used in monitoring the Oxygen levels in this COVID-19 situation, as proposed [2]. It's associated with performance-based computerized parameters. The technology and physical networks are nowadays more reliable for COVID patients. The IOT helps in connecting devices and sensing to enable the monitoring of COVID patients in this pandemic situation. Many patients are having problems like in lungs, where inhalation problems arise. IoT based services are being proposed [3]. It also manages the outcomes of individuals by making the point where it's connected to the internet. The so-called IoT framework shows the same importance as mentioned above. The Cloud Server and services which emphasize COVID-19 situations and it is monitoring all the aspects throughout. The Cloud server does it work and makes the information or data much easier. The IoT framework needs to just make the frame more reliable as discussed [4]. The Cloud server acts like a host in the complete architecture. Ensures the data or information is making it to a greater extent as flexible and scalable. The network or framework which will be connected will act virtually to host the application. Cloud Computing likes utility or on-demand vacancies of the system resources [5]. Cloud computing is ensuring the storing of data and data analysis. The functions arise which are relatively closer; it may also be nominated as an edge server in this pandemic situation. It also helps in sharing eco-friendly resources and scaling of economic barriers. The obtainability of high networks with capabilities is also being adopted by hardware and utility virtualization, widely used in Linux. Cloud computing is now being interrelated with the Internet of Things to make the COVID-19 more connected via the internet through the proposed architecture, with complete analysis [6]. Cloud computing already has some ideas, as Artificial Intelligence also goes with cloud computing for the upcoming future goals. Cloud is leading the most with the technological market and also helpful in COVID-19 areas [7]. It has some unique identification to sustain new programming algorithms and structures. The Cloud services provide a mixture of services to data storage, data that are needed to make it more effective and scalable. Figure 1 is to elaborate on different fields involved in the Internet of Things.

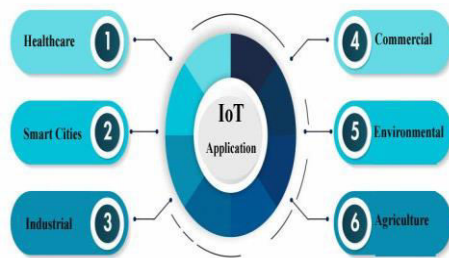


Fig. 1. Applications of Internet of Things

The services combine with the effectiveness and are much more physically and practically scalable enough. It gives resilience to the data storage with domestic public clouds. And cloud based services are meant to be full-time applications and with complete development platforms. The outskirts of the services and storage need to do some modification and analyze the pandemic situations to make the services through a greater forum. Among these, several other common attributes are likely on-demand resources, elasticity, and network-access. Mobile applications from the word we are readily familiar and characterized. These applications intended to help with productivity such as databases related to contacts like the phone icon. Apps are downloaded from app stores (play store usually used by the users). Digital distributions are mainly referred to as content delivery or distribution of digital contents such as electronic books and software's mainly available outdoors. The distribution also influences the business where it's meant for going to some other track. The access to the internet requires the apps to grow with day-to-day updates. Rather than directly on through the mobile applications, it's designed to run desktop computers, too. The COVID-19 situations and the frameworks are mainly based on the Internet of Things [8]. The framework shows the time to construct IOT based products for accelerating the development cycle. The required time will deploy the instant products or objects and help the pandemic situations. The capabilities and immense analysis of the IoT framework will depend mainly on the various organizations [10]. The architecture has been proposed as the main roadmap, is about the supply of Oxygen for COVID related issues, where the framework does work with complete monitoring. We know that Oxygen Concentration will supply the amount of oxygen for the COVID patient up to the desired level. The Concentration should also have some analyzing skills to fetch how much amount of liters to supply. The overview will have some curious knowledge of the important physical parameters. The Comparison of the mixture of gasses and the measurements all will handle by oxygen concentration. Inspired by this, the concentration has some logic implants, so that the COVID patient should not be at risk [11]. The Smart Pulse oximeter sensor indulges in the principle and works on the peak detection algorithm with the making of a scalability measurement. The scalability measurement is meant for complete histogram analysis of the on-going COVID patient oxygen levels to send to the server. The devices and servers which are used as mentioned in the proposed architecture. Enhance the patient from relief and risk with proper inhalation

using the IoT-based framework. The following responsibilities and ideas behind the architecture are given.

II. STATE OF ART

These particular surveys will emphasize the work of many researchers around the globe (complete research around the world). The various domains are based on the proposed architectures. The broad regions with well-known architects, proposals, connected live, smart IoT-based automation, cloud computing, pulse oximeter, fault detection and management. It's been tried with as many complexes and directions into the papers. Because of some limitations in the sizes, the present impediments have been made with a complete analysis. To deeply investigate the current situations concerning the domains or parameters that have been proposed in the architectures. It is executed to analyze the present and realistic scenario of the Internet of Things and Cloud Server and services. The latest trends and technologies, which are wide apart to the make, showed connectivity in prior level-we are looking into it extremely.

The thoughts and ideas are on the Internet of Things. There is a collection of so many terms with the ongoing internet where it is defined about the networking sites. Networks that are connected with a count of billions or trillions of user's perspective with standardized human needs [12]. It is mentioned living in the technology where a person has to become more conscious. The layers of architecture are (Internet of Things) nowadays not much sufficient for the current scenario. Likely proposed about the layers, the interesting fact is about the application layer where the sensors sense the actuators to achieve in needs based on IoT. The NFC is dealing with two factors as active and passive modes, where each domain does it work [13]. RFID deals with three factors as active, passive and active reader active tag. Then about the connection between the machine to machine and vehicle to the vehicle where they both work with different principles and theory, as clearly mentioned with the key issues. The article discussed the revolutionary approaches for the future aspects with enhancing the goals and challenges. It provides an immense contribution to different aspects of the Internet of Things [14]. The real-world thoughts, which have been discussed both technological and social eventualities. The Internet of things enables communication with utility technology and sensors via the internet to make it more reliable for our lives. Various types of smart systems have also been proposed as mentioned [15]. Therefore, it has a lot of scope with all the technological fields to facilitate mankind. It also shows the importance and benefit of emerging and economic growth. Here has been mentioned with analysis of the line fragments about the privacy issues, which will be the most challenging phase in IoT. They are very much important to develop credibility. However, some IoT applications or objects require some different logic to work, as their algorithms are also quite different from regulatory rights, availability and reliability. IoT is now completely emerging, with financial benefits at a certain range to accomplish all the goals. There are so many concepts like traffic congestion, waste management, and health of buildings. The author also mentioned some emerging platforms in urban IOT architecture. The objects, devices, and infrastructure support

the progressive of evolution in IoT [16]. The smart street light analysis is the graphs to make the Internet of Things frameworks much more scalable.

The Internet of Things describes diverse preferences with three main characteristics. From the characteristics as it's been proposed, the reliable transmission has come up with more significance, as in it mentioned the telecommunication networks. The Internet of Things can further create more interaction with the future world and on-demand technologies. It represents connection and communications. The opportunities of IOT, as proposed by the author's complex processes and relationships with the technology via internet - based technology. Everything about the physical and practical world is possibly connected by the Internet of Things. The status of IoT might be domain-specific and monitoring with the cross-industry application based on information regarding the services. Then propose the capabilities with a secure connection. Thereafter, IoT in China tells about the development of IoT which was released by their government. Acceleration is the projects and public services platforms. The general IoT architecture is led to sensing and gateway platforms, resource and administration platforms. There are typically many applications to the development of IoT with some main features and proposals. The analysis and proposed survey on Cloud Computing, mentions the convenient models and on-demand access of networks to configurable computing resources, which will be provisionally related to the server as provided [17]. This describes the dynamic changes and evolves virtualized resources. It works with a typical agenda, as they are co-related with artificial intelligence. Cloud computing which evolved through several phases of introduction to websites and web servers [18]. More information gathered among the ideas proposed is like costis, device and location in dependable users, reliability, and security cloud. They also mentioned the advantages like cost reduction, disaster management, and easy management. About the architecture, they have typically been involved with each other, applications with the structures, and algorithms as an interface. They are keen to have the architecture with the front end and back end, too. Servers also consist of products much more specific for the delivery of cloud services. The scopes are likely to emerge, solutions that are too slow, and the need to examine new approaches, quality of services. Therefore, this paper gives pleasure about the needs and phrases of Cloud Computing very much conveniently [19]. The Server and services in the Cloud as the server take the data, which they analyze and return to the user whenever it needs. The storage models need to manipulate the classical thoughts in technology. There are two salient features as mentioned in it. The main aim of this proposed project is to provide a reliable security for the information or data that is being stored in the cloud servers. It also mentions and talks about the existing and proposed system more effectively with distributed schemes, with explicit dynamic support ensuring the user's correctness. The algorithm used to propose the architecture is Merkle Hash Tree Algorithm.

The high availability in Cloud Computing is with systemic challenges, which enhanced the biggest provision for the providers. It has also been proposed that Cloud Computing

services are the key major in its current scenario. The final consideration and discussions in terms of Cloud Computing are like Google's Dropbox: systematic review. The systematic review process flowchart is mentioning the protocols, conduct and final results. Mentioning the high availability in Clouds there it's presenting about the number of articles per year and research sources. In result, description also emphasized the technological aspects of underlying, redundancy services, monitoring, and recovery. The discussion is that it has been implemented with algorithms. The solutions are dependent on a specific technology platform. There is also an essential aspect for the clouds presenting to the real solutions with security mechanisms. The upcoming scheme is cultivating the denial of service and to a proposed unit. Modules with complete framework like app deployment, profiles, and planning. The consideration is no matter how long the economic losses. Here is particularly focused on the interfaces as described and discussed. The overview and study of this model is an oxygen supply and how to monitor it for radiation therapy. It has been designed and discussed in such a way that the supply of oxygen and monitoring the saturation level. There are some saturation levels with the data as collected. From the architecture, it was proposed very clearly that the saturation system was breath- holding time, then there, shortening rest time. Materials and methods for monitoring the proposed architecture are shown in the paper. Monitor the statistical analyses and scalability. The result is also about the outcomes, overview, and variation during rest time and without being capable of taking oxygen.

III. PROBLEM STATEMENT

The implications of the IoT-based sensing devices and systems are features of human intervention and COVID lives. The intricate transfer of data between immerse devices gives rise to key issues and problem statements. To emphasize is the term of limited time and to make it with innovative qualities to impart in these pandemic situations. These types of problems are much more challenging for COVID-19 patients [20]. The IoT framework with advanced sensing techniques can sense, but there can be some issues that can arise. The statement for the COVID patients gives a very important parameter to confidently develop in this field with various objects. Implementing the proposed architecture based on COVID-19 deals with the relevant problems, which may be faced by the user's thoughts? Eventually, a COVID patient who is suffering from a shortage of oxygen can have some mishandling because of the measurement from the guide who's taken the initiative. The guide can also forget to switch off the devices, mainly the servers, while in the patient's absence. The problem can happen due to some checking in the oxygen levels, as it would be completely computerized. The threshold oxygen level must be monitored regularly and ideally kept above 85%. The guide even needs to check whether it is giving correct information with how much supply is given to a patient in that case. Conflicts can happen, because mankind may lead to an outage of appliances. Various functionalities need to improve before activating it. In that case, suppose if in the absence of a guide and at that moment, because of some technical fault happens there; the oxygen supply goes to an extent as not accepted then it led to a different type of disease.

Before the process needs to execute, the guide needs to monitor and check all the devices, sensors, and systems with complete satisfaction. So, there shouldn't be any type of likelihood that the devices are giving correct output or not. We have already proposed the appliances for the COVID patients who don't have the availability to be in motion. To give a scalability output without intervention, but there should be some cross-check for exchanging the information among different frameworks. The systems should be much more scalable if possible and available with its performance. From these circumstances, the IoT-based sensors and Cloud servers and Services make the most of it to handle the COVID protocols and to minimize the statement as possible.

IV. PROPOSED METHODOLOGY

Contemporary devices are being active and readily used with such computerized-based technology. From the current situations and scenario, we're already familiar with the COVID-19 (Coronavirus Disease, 2019) situations and about the sensing objects (which are basically based on the Internet of Things). The proposed architecture is based on computerized technology, which emphasizes the pandemic situations that are facing. Nowadays with the increase of staging, there is some decrease in the device's value. The parameters which are used in the proposed architecture for the need of COVID patients, as shown in Figure 2 are as follows: Patient, Smart Pulse Oximeter Sensor, Mobile Applications, Cloud Server and Services, IOT FrameWork, and Oxygen Concentration. Figure 2 shows a completely cyclic process. So thereafter the information or data concerning the COVID patient analyzing overcame the problem we can specify it to get further instruction. Smart Pulse Oximeter Sensor, which helps in sensing the COVID patient and analyzing the different SpO2 levels. The Smart Pulse Oximeter Sensor is smart as it is likely where it provides the pulse oximetry tools, which are necessary for giving accurate and dependable SpO2 readings. It comprises smart sensing computerized technology that helps in giving professional Oxygen saturation readings. Throughout the complete technology, as we are indirectly measuring that is led be fast, uncomplicated way of measuring the blood oxygen saturation with the need for non intrusive and costly blood sampling.

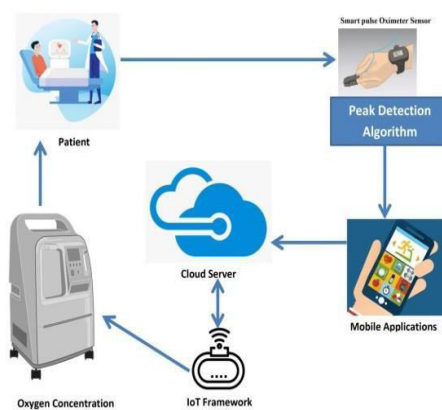


Fig. 2. Proposed IoT Based Oxygen Controller

The Smart Pulse Oximeter works on the principle of electromagnetic spectroscopy (Spectrophotometry). The Spectrophotometry emphasis is the dependable measurement of the dissemination properties of materials, which leads to function of wavelength. So, from the practical thoughts, the absorption of red (Deoxygenated blood absorbs more red light) and Infrared (Oxygenated blood absorbs more infrared light) comprises two wavelengths. Here in the Smart Pulse Oximeter sensor, it readily uses the principle and works under the Peak Detection algorithm. Peak Detection Algorithm tells about the datasets and also the diminishing of data (quantitated). This algorithm and principle are both completely combined with the Smart Pulse Oximeter Sensor and go to the mobile applications. Mobile Applications being a part of the process, from which the data will be collected from Smart Pulse Oximeter sensor and using the applications, the user can easily be handled and seen. It'll led the sensor to sense the SpO2 levels and with use of any type of wireless connection, the user can see through it. Mobile applications are therefore like physical objects, which are interlinked and accessible to all the applications through the internet. The applications are also meant to help the user perspective of keeping a track of their actions and other useful data with complete monitoring. We know about some functionality, as it has been assigned through IP address and led to have the curiosity to collect the data or information and then transfer over a wide network with no type of help or ecosystem. Mobile applications work as a predominant interface through which it manages all smart things with a complete jurisdiction. This monitoring of data and other users will get through by the cloud server and services. Cloud server and services its work as a physical server that runs in a utility computing environment (on-demand computing). It hosts and dispatches via a utility computing platform. Access through all the needs the software requires running and able to function with all the services independently through all units. The proposed figure is to show the working method of the automated oxygen controller. The Cloud server and services, its main agenda is to take the information or data from the user's perspective and make it with the frame. Cloud services do work remotely through cloud computing servers, either through on-ground servers. They are apart, but their main aim is to analyze and inspect the ongoing problems about sending data correctly or not. The Services also manipulate the points with complete scalability. We're already familiar with the outgoing services held in computing strategies. Before going in deep into it, as it provides a faster and makes resources more enthusiastic. And because of its fast connection and durability, we can be more conscious of the IoT framework. From Figure 2 as shown, the IoT frameworks will do it need with signs of wireless communication. The IoT framework emphasizes the collection of data from the cloud server and services and they both will communicate wirelessly. In that case, the information from the user will arise at cloud servers and services; they will make the data more reliable and send it to the IoT framework. Before sending it to the IoT framework the Cloud server needs to do some nourishment in that. After receiving the information from Cloud Server and Services, the IoT will do its framework up to a satisfactory level. The framework will make it transferable and with little human intervention. The

framework will require the support of cloud capabilities and other terms. The required capabilities for the cloud to support will happen side-by-side. IoT technology will satisfy the need for an on- ground environment frequently. The IoT framework makes the most of the processes and reduces the labor cost and it's one of the best technologies of our everyday life. Reducing the labor cost emphasizes about the importance in offering an incentive and optimization control. The key factor of the IoT framework is to be a part of an ecosystem, which can be led to the linking of all the elements in the scheme. It allows the devices to manage and how to handle, then communication protocols.

V. RESULT AND DISCUSSION

The thing is that the Internet of Things does, as a variety of needs to enhance the services to human thinking abilities. Thereafter, the IoT framework completes its communication and then indulges with some aspects of the utility and cloud computing devices. Other than this, it also empowers the flow of information and also through the functionalities of different intuitive apps. After fulfilling, the information getting from the cloud server, will now be related to the user. IoT framework will send the communication of data or information to the Oxygen concentration. Oxygen Concentration is meant for the supply of oxygen as accepted. The model concentration which is shown in Figure 2, deals with the complete process under the Internet of Things Framework. The IoT framework will do its parameters as accepted before the information goes to the concentration. At last, concentration makes the most of it, so that the patient gets the ongoing supply of oxygen (in liters).

Table 1: General Oxygen Level for COVID Patients

SpO2 level	Oxygen Level (in Liters)
> 95	No need, in Observation
90 – 95	1.25
85 – 90	2.15
80 – 85	2.85
75 - 80	3.15
70 – 75	3.85
< 70	4 – 5

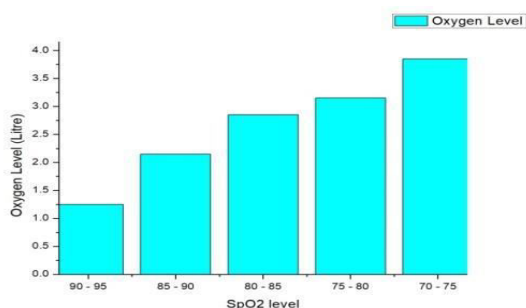


Fig. 3. COVID Patient Oxygen Level

The Oxygen concentration increases the fragment of oxygen level in the form of a mixture of gases. The saturation

of oxygen may impact the fragment of oxygen, which will now be conveyed through fluids. If the Oxygen concentration is restrained, then the concentration under which emphasis igniting cannot take place. The Oxygen Concentration supplies the oxygen to the COVID patient, which the IoT framework will send to. How many liters of oxygen does the COVID patient need to be, as shown in table 1. Figure 3 shows the representation of graphs between oxygen and SpO2 levels. The fig 3 specifies about the oxygen level concentration that needs to be recognized, when the simulation is being performed. Then readings from the smart pulse oximeter sensor have been sent to the ongoing levels. The IoT frameworks will analyze it by referring to the tabular column as shown in table 1. The IoT frameworks will tell how much amount of Oxygen needed to supply (in liters) for the COVID patients as they are suffering from the inhalation problem through the lungs. That much of supply will be done through the Oxygen Concentration to COVID patient perspective. At last, the IoT-based Architecture has been completely applied through the ongoing COVID patients and noticed by working with the help of devices and services.

Table 2: IoT appliances comparison with different specifications

Specifications/ Appliances	Permanence	Development	Processing Capabilities	Security and Support	Connectivity
Smart Pulse Oximeter	3	4	4	4	4
Smart IoT apps	2	4	3	3	4
Cloud Servers	2	3	4	4	5
IoT Framework	3	3	4	4	5
Oxygen Concentration	4	3	4	3	4

The table 2 mentioned the comparative analysis mainly focusing on the IoT appliances and technologies used in COVID-19 are as follows: Smart Pulse Oximeter, Smart IoT apps, Cloud Servers, IoT framework, and Oxygen Concentration were discussed. The table is pleasant for comparison executed based on several specifications such as permanence, development, processing capabilities, security and support, and connectivity. Here the specifications are worth starting with 1 that specified very bad then 2 specified bad. Moderate and good specified 3 and 4. Then very good are specified 5. So this table 2 is pleasant to choose different IoT appliances and sensors based on their capabilities. Also, the sensors and appliances depend on user satisfaction, where some users need more connectivity and security.

VI. CONCLUSION

Internet of Things (IOT) leads to the development of smart sensing objects and COVID-19 protocols to manage the technological aspects as likely used in these pandemic situations: monitoring the natural environment and remote areas. The development of unique devices capable of collecting data and information with the interest that corresponds to this situations is invoked. In the proposed architecture, as mentioned about the COVID-19 issues and solutions. Based on the IoT framework, it works with the engagement of Cloud servers and services. To transfer the collected information or to solve the pandemic situation in handling it, too. It'd make easier for the mobility and development of devices and sensors, along with the protective COVID-19 environment. The devices and sensors are implemented in the proposed architectures with the help of Cloud Server and Services, IOT framework, Smart Pulse Oximeter Sensor, Oxygen Concentration and Mobile Applications. Hence, the proposed idea helps the COVID patients and doctors with little intervention and also saves a lot of time as with this pandemic situation. We are already familiar that in these pandemic situations, there is a shortage of doctors too for monitoring the COVID patients' health and retrieving from the life risk. Inspired by this, the architecture will help the doctors and COVID patients. This is based on utility and on-demand technology because Cloud Computing is involved. In future, this framework or proposed method can be considered helping the COVID patients with any type of circumstances using the applications. The Internet of Things (IoT) has appeared as a major technology around the globe. It has acquired a lot of popularity in less time. It can further be used with several technologies that can secure the security and support of people and monitoring devices in real-time while also safeguard their capabilities. The scope from the proposed architecture helps the real-world scenario in any form or circumstances. Give immense pleasure to get rid of the diseases while suffering from lack of oxygen in any aspect of a situation. We are already much more familiar with appliances and due to this IoT has also expanded its area. The greater range and control over the specified appliances that are very much crucial be a part. Therefore, the use of IoT is to intensify the security capabilities with deliberation.

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