

## **Comparison Between a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data: A Review**

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### **ABSTRACT**

The world is now experiencing a pneumonia outbreak caused by a novel coronavirus. The huge volume of medical literature on coronavirus has useful information that may assist medical research communities in addressing specific challenges. Health care professionals may improve their policies by quickly reviewing and getting specific data regarding coronavirus from various published research and the larger struggle against infectious disease. It has developed a technique for extracting actionable knowledge that automatically gathers pertinent data from sections and paragraphs related to a particular topic. There are continuous efforts to construct intelligent systems capable of automatically extracting useful information from many unstructured texts. In this paper, the comparison between many papers based on IoT and the knowledge base for solving the problem of Covid-19 has been conducted.

**KEY WORDS:** Internet of Things (IoT) – Knowledge based – Covid 19 - Monitoring System.

### **1. Introduction**

An outbreak of the 2019-C virus in Wuhan, China, has become a major worldwide health issue since its appearance in December 2019 [1] [2] [3] [4]. The WHO has classified this viral epidemic as the world's sixth most urgent public health emergency. The Coronavirus COVID-19 is a new kind never before seen in humans. [5]. Some Coronaviruses, like the common cold, are moderate in their effects. COVID-19, on the other hand, may cause significant disease in specific individuals, notably the elderly and those with substantial underlying medical issues. [6] [7] [8].

As we've all heard, the Internet of Things (IoT) links everything around us, allowing these connected objects to speak with one another in a vast, ubiquitous network. IoT's pervasiveness provides end-users with easy access, rapid distribution of information, and a high-cost level. [9] [10] [11] [12]. The Internet of Things is widely employed in healthcare because of the significant advantages it provides, and it serves as the major facilitator for global healthcare. Because of the many advantages that IoT provides, it is clear that it provides us with freedom for handling a shortage of medical resources such as infrastructure and medical

personnel, managing chronic illnesses, addressing medical concerns related to ageing populations, and managing pandemic occurrences[13] [14] [15]. Hospitals that use IoT to automate most of their tasks and various intelligent IoT devices, this can be used to provide community assistance, track patients and monitor their medical condition, and gather and analyze real-time data, which is crucial for reducing and controlling the majority of the negative consequences of pandemics, which can lead to an acceptable or a minimum level.[16] [17] [18].

Medical and specialist websites for coronavirus disorders are the major sources of information for this expert system. The information that was gathered has been organized into a Knowledge Base [19]. Currently, the expert system has recognized day-by-day symptoms of coronavirus[2] [20] [21]. The Data Analysis Center receives the detected symptom data. Each user's Online symptom data is then utilized to build a model that may see possible instances. The data center also provides a knowledge library and real-time dashboard, which analyzes all of its data. Doctors may learn a lot about the virus' characteristics by looking at

that dashboard[14] [23] [24].

In addition, data collected through remote monitoring is instantly stored in a secure database using meta-data tags and unique IDs[25]. How to respond to epidemics like COVID-19 is being put in jeopardy by COVID-19. Our digital civilization has paved the way for new forms of "digital health," and now it's time for them to show off and flourish. Face-to-face visits are no longer required for health care, and telemedicine is poised to take advantage of this newfound freedom. There are three basic types of telemedicine: remote monitoring, telemedicine through the Internet, and telemedicine via the telephone or the Internet[26].

In this paper, academics from several fields of internet technology conducted a comprehensive study of the most recent, successful ways during the last four years. Details of each technique, such as algorithms and methods, datasets, and findings, are frequently explained. Having also accurately identified the most typical approaches and methods.

The organization of the remaining paper is as follows: Section 2 contains the from Design and Implement a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data, benefits, and drawbacks; Section 3 gives a related work on from Design and Implement a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data; Section 4 comparison and from Design and Implement a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data, and the last section concludes the research work.

## **2. BACKGROUND THEORY**

Since its discovery in Wuhan, China, in December 2019, the 2019-coronavirus has grown to be a significant global health issue. Since the end of 2019, COVID-19 has been a menace to the earth[27]. The COVID-19 pandemic is expected to be carefully fought across the world until an effective vaccine is discovered. The common cold and the coronavirus both have mild symptoms. On the other side, COVID-

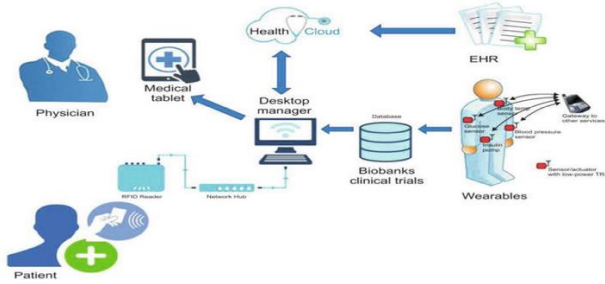
19 may cause serious illness in certain people, particularly the elderly and those with serious underlying medical conditions[28] [17].

### **2.1 Coronavirus Disease 2019- COVID-19.**

The World Health Organization (WHO) declared the latest coronavirus outbreak a pandemic. Since its initial outbreak in Wuhan, China, in late 2019, the coronavirus infection 2019-COVID-19, caused by the newly identified SARS-CoV-2 coronavirus, has rapidly spread worldwide. On March 11, 2020, There is currently no licensed medicine for this virus that mainly targets it. Thus researchers are looking to reposition/repurpose existing drugs to develop new ones that might be used to treat the disease[21] [29][20][31]. A novel approach has been developed to reduce the danger of not recognizing people or groups that cause cross-infection[32] [2] [33]. It is hoped that the suggested intelligent system would help healthcare staff uncover early the COVID-19 asymptomatic patient's "pull thinking," which is characterized by selective screening via more concentrated observations that lead to categorization, coding, and stratification[34]. Because of its ability to increase the chances of healthcare workers and public health officials to reduce or manage or control the potential hazards of asymptomatic patients, the suggested system has intelligence[17] [28] [35] as shown in figure ( 1).

### **2.2 Internet of Things using coved 19**

The Internet of Things, often known as IoT, is an innovative technology that connects digital devices all around us, allowing Machine to Machine (M2M) communication between digital devices worldwide, owing to the technological advancements in the 21st



**Figure 1. An IoT-enabled medical setting's typical organizational structure [17].**

century [36] [37] [38] [39]. Many businesses have benefited from the Internet of Things (IoT) in the 21st century, from manufacturing to wearable consumer gadgets to asset management. There are now estimates that the IoT industry will be valued at \$243 billion in 2021. A typical IoT system consists of various functional components specializing in collecting, transmitting, analyzing, and storing data. Sensors from a range of IoT devices collect data regularly. Cloud storage is used to store and analyze data after data gathering, which is then utilized to make choices[17] [40] as shown in figure (2).

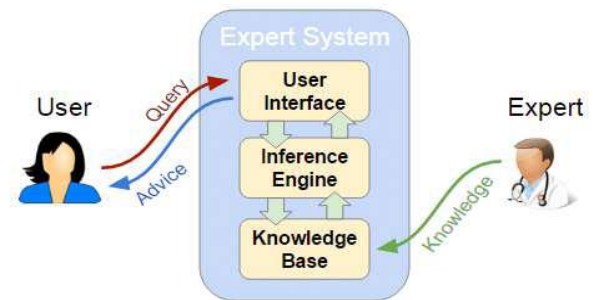


**Figure 2. The IoT architecture [17].**

### 2.3 Knowledge Representation

The primary sources of knowledge for this expert system are medical and coronavirus disease-specific websites. The information obtained has resulted in the creation of a knowledge database[41] [42] [6]. Currently, the expert system can detect coronavirus symptoms on a daily basis. An expert system is a computer program that mimics or behaves like, a human expert in all aspects of decision-making. The knowledge base is one of its most important components; it may be obtained through books,

periodicals, knowledgeable people, and other sources. The knowledge base is completed by the inference engine. Figure (3) displays the main components [2] [43] [44]. The lack of information in the middle of the COVID-19 epidemic causes stress, worry, and confusion. Knowledge is the most important resource available for educated individuals and knowledge-based societies to tackle new challenges and obligations. The ideals, leadership, and excellence that underpin a knowledge society and mutual respect are the bedrock of this society[45].

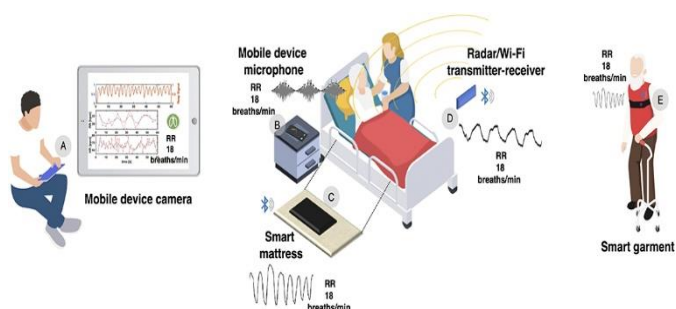


**Figure 3: Displays the main components of expert system [2].**

### 2.4 Monitoring System.

If an infected patient is isolated, may track their asymptomatic health situation in our suggested system. After quarantining the patient, their health must be monitored regularly. Doctors now have to visit patients in person for even routine checkups, but with our technology, they could remotely use IoT-based sensors to keep track of their patients' health. People in quarantine often have their temperature, blood pressure, and pulse monitored by physicians. Sensors may be used to keep an eye on this without any interaction. The temperature sensor monitors the patient's temperature, a blood pressure sensor monitors the patient's blood pressure, and a heartbeat sensor monitors the patient's cardiac rate as necessary[46] [49] . All the collected data will be transferred to physicians or healthcare experts through mobile or laptop using a GSM or Wi-Fi module to regularly check the patient's health state and give treatment. They will the asymptomatic patients'

recommended monitoring design[48] [49] as shown in figure (4).



**Figure 4: Technological Solutions For Remote Respiratory Rate Monitoring [49]**

### 3. RELATED WORKS

A Review Comparison Between a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data in this section, will study some of its utilization and how it has performed under different implementations and approaches.

Martínez-García et al.[50] Suggested The SARS-CoV-2-caused COVID-19 pandemic, which spread swiftly and had disastrous consequences, has generated a worldwide public health disaster. 1, 2, and 3 To combat this illness, which has epidemiological, clinical, and prognostic aspects that are now being studied, changes in care delivery, such as substituting specialist face-to-face consultations with remote consultations, are required. To evaluate whether telemedicine combined with tele monitoring is a therapeutically beneficial and safe technique to monitor COVID-19 patients. It shows that telemedicine combined with at-home tele monitoring may provide clinically useful and secure monitoring of COVID-19 high-risk patients when used proactively.

Shrestha et al.[51] Explained that COVID-19 is a pandemic that appeared quickly and spread over the globe. Nursing students are the cornerstone of the nursing profession, and they play a critical role in preventing disease transmission in society. The purpose of this study was to look into knowledge. Assess COVID-19 knowledge, practice, and anxiety among Nepalese nursing students and the relationship between stress and knowledge and practice.

According to the findings, half of the respondents had appropriate knowledge and excellent COVID-19 prevention procedures. And just a few people had mild to severe anxiety.

Shinwari et al.[52] Suggested Some allopathic medications (for example, chloroquine, lopinavir, oseltamivir, and remdesivir) used for other conditions, such as Malaria, have shown promising results in Corona. Some phytochemicals inhibit virus attachment to the host cell by targeting the viral envelope or membrane proteins. Plant extracts and active chemicals generated from plants have different antiviral mechanisms against other viruses. Phytochemicals may denature viral enzymes necessary for viral genome replication and assembly have compiled a list of medical plants having antiviral characteristics; nevertheless, new medicinal plants with antiviral qualities must be discovered as soon as possible.

N.V. et al.[48] Explained In this research suggested a technique for detecting and monitoring the asymptomatic patient to identify infected asymptomatic patients and monitor their health states after isolating them using IoT devices. Suggest the notion of employing IoT-based sensors to identify and monitor asymptomatic patients. Using IoT Devices, the system recognizes the asymptomatic patient to save their life and break the chain.

Masum et al.[53, p. 19] Explained This study offers an efficient question answering system that automatically evaluates hundreds of articles to create lengthy text replies (sections/paragraphs) in response to medical communities' inquiries. Provide an actionable knowledge extraction system that pulls important information from sections/paragraphs associated with a certain query automatically. Query expansion, data preparation, and vector space models were all examined early on in the study. The surprising results of a query for the incubation time are shown.

Mufid et al.[54] Suggestion We seek to create a mobile

app to assist users to recognize COVID-19 risk signals using an expert system rule-based strategy while doing this research. The COVID-19 data will thereafter be made accessible to the general public in Indonesia. Based on data acquired using online scraping methods, use an expert system to estimate the risk of contracting COVID-19 and offer information on the mitigation and development of COVID-19 cases in Indonesia. Testing for this application provided a satisfaction rate of 95.12%, and testing for the validation of the expert system's outputs using multiple test scenarios to achieve results compatible with the rules engine and knowledge base placed into the expert system was also successful.

Bhagavathula et al.[55] Explained As the worldwide danger of COVID-19 emerges, improving HCW understanding and perspectives is vital. More research is needed to reach HCWs worldwide, and educational interventions are critically needed. Examine HCWs' understanding and views of COVID-19. The research discovered a considerable information gap, low knowledge levels, and disparities in COVID-19 perceptions among our study participants.

Annis et al.[49] Suggested This effort delivers a safe and enjoyable experience for patients while lowering COVID-19 exposure and in-person healthcare use. Remote patient monitoring seems to be a viable option for managing COVID-19 symptoms at home. Analyze early lessons from a remote patient monitoring engagement and education technology solution for patients with indications of coronavirus disease 2019 (COVID-19).

Gordon et al.[46]According to a study conducted by researchers at the University of British Columbia in Canada, the Remote Patient Monitoring Program (RPM) lowers readmissions for patients with COVID-19. After being released from the hospital, it provides expandable remote monitoring capabilities. Post discharge monitoring was connected to a decreased risk of ED or hospital readmission, and it offered a

scalable strategy for monitoring patients at home. Provide a system for monitoring patients in their homes and reducing hospital visits. According to the findings, RPM lowers readmissions for COVID-19 patients and offers scalable remote monitoring capabilities after release.

Jeong et al[25] Explained The patient's house is constantly monitored by the medical staff, providing hope for recovery. This benefit is now being tested in clinical studies. They were accurately identifying the factors that are directly connected to the condition. Prediction algorithms that can be used for a wide range of populations will lead to a greater emphasis on data

interoperability and sharing. Machine learning approaches for identifying COVID-19 infections in the asymptomatic will benefit significantly from the findings of the molecular testing, as digital will biomes for predicting recovery tailored to the health condition of patients and guidance for employees returning to their employment safely.

Through this research, the latest 10 research were reviewed, and the important points which are (objectives, Results and Used Technology) were extracted, as shown in the following table1.

**Table 1: Summary of Literature review related to Comparison Between a Knowledge-Based System for COVID-19 using Compressed Internet of Things Data.**

| Reference                        | Objective                                                                                                                                       | Results                                                                                                                                                                              | Technology Used                    |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Martínez-García et al., 2020[50] | To see whether telemedicine paired with tele monitoring may be used to monitor COVID-19 patients in a therapeutic and safe way.                 | It demonstrates that telemedicine with at-home tele monitoring enables clinically relevant and safe monitoring of COVID-19 high-risk patients when utilized proactively.             | Telemedicine and telecommunication |
| Shrestha et al., 2021[51]        | Measure COVID-19 knowledge, practice, and anxiety among Nepalese nursing students, and look for a link between stress, knowledge, and training. | According to the survey findings, half of the respondents had enough knowledge and excellent preventative strategies for COVID-19. And just a few people had mild to severe anxiety. | Google Form Survey conducted       |

|                               |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                         |                                                        |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Shinwari et al., 2020[52]     | Some phytochemicals target the viral envelope or membrane proteins, while others block the virus from adhering to the host cell. Plant extracts and active substances produced from plants have varied antiviral mechanisms against various viruses. Some phytochemicals denature viral enzymes needed for viral genome replication and assembly. | have summarized medicinal plants with anti-viral characteristics; nevertheless, new medicinal plants with anti-viral qualities.                                                                                                         | Herbal Medicine                                        | Jeong et al., 2020[25] | The development of generalizable prediction systems for varied populations will be accelerated by focusing on data interoperability and sharing. | As a result of molecular testing results, machine learning algorithms will be able to identify COVID-19 infections among those who have not yet shown any symptoms of illness and construct digital biomes of predicted recovery that are particular to a patient's health condition. | IoT Devices like sensors, etc.. |
| N.V. et al., 2020[48]         | Suggest the notion of employing IoT-based sensors to identify and monitor asymptomatic patients.                                                                                                                                                                                                                                                  | Using IoT Devices, the system recognizes the asymptomatic patient to save their life and break the chain.                                                                                                                               | IoT Devices like sensors, etc..                        |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
| Masum et al., 2020[50]        | Create an actionable knowledge extraction system that can extract relevant information in the form of sections/paragraphs linked to a certain query automatically.                                                                                                                                                                                | The results looked at natural language processing techniques including query expansion, data preparation, and vector space models early on. For the incubation phase, they present the preliminary findings of an example query answer. | Natural Language processing and Data Mining techniques |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
| Mufid et al., 2020[54]        | COVID-19 early detection services are available to assess the disease's risk. COVID-19 uses an expert system to offer information on the mitigation and development of COVID-19 instances based on web scraping technologies.                                                                                                                     | 95.12% of those who responded to the survey gave it a thumbs up. Several test scenarios were performed to better understand how the expert system's rules engine and knowledge base work together to create the results.                | Web Scraping and expert system using PHP               |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
| Bhagavathula et al., 2020[55] | Explore HCWs' knowledge and attitudes of COVID-19.                                                                                                                                                                                                                                                                                                | The research found a considerable information gap, low knowledge levels, and inconsistencies in COVID-19 perceptions among our study participants.                                                                                      | Survey conducted using social media and google form    |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
| Annis et al., 2020[49]        | Early results from remote patient monitoring engagement and education technology solutions for symptoms of coronavirus illness 2019 (COVID-19) are being assessed.                                                                                                                                                                                | For treating COVID-19 symptoms at home, remote patient monitoring seems to be a useful alternative.                                                                                                                                     | Web based application and new technology used          |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |
| Gordon et al., 2020[46]       | Provide a means for monitoring patients in their homes and reducing hospital use.                                                                                                                                                                                                                                                                 | As a result of the research, the RPM program reduces COVID-19 patients' readmissions and allows for scalable remote monitoring after they are released from the hospital.                                                               | Web based portal to answer patients questionnaire      |                        |                                                                                                                                                  |                                                                                                                                                                                                                                                                                       |                                 |

## 4.DISCUSSION

Through this research, the latest 10 research were reviewed, and the important points which are (objectives, Results and Used Technology) were extracted, as shown in the following table (1). There is still a long way to go before the general use of healthcare systems in the healthcare business is possible. Still, medical centers are contemplating using these systems to enhance patient care, minimize costs of medical treatment, and reduce healthcare workers' workloads. Present the most current understanding of the COVID-19 pandemic as the paper's cornerstone. Use the internet of things to create an affordable, authorized healthcare system that is easy to use and has an enormous capacity for data access. Material is compressed and coughed into a knowledge base for further analysis and storage of the data. This is accomplished by compressing the data sent from the sensors to the server using data compression algorithms, which eliminates redundancy and reduces storage space—building an online monitoring system to assist sick and isolated people who are at risk of contracting Covid-19, as well as providing vital information to medical personnel and eventually storing this information as a knowledge base to help doctors gain experience and understanding in dealing with this epidemic, using an IoT framework to improve the performance of biometrics systems processes. this paper [50] Telemedicine combined with at-home tele monitoring enables clinically relevant and safe monitoring of COVID-19 high-risk patients



when utilized proactively, a study has shown. This paper [48] IoT-based sensors could identify and monitor asymptomatic patients to break the chain of infection. This paper [54] Some people are happy with the results of 95.12 percent, but they want to know more about how the expert system works. The application uses an expert system to figure out how likely it is that you will get COVID-19. COVID-19 case mitigation and development in Indonesia is what it aims to cover in this report. This paper [49] and [46] Remote patient monitoring could be a viable option for treating coronavirus (COVID-19) symptoms at home. Remote patient monitoring has been found to reduce readmissions and offer scalable remote monitoring capabilities after hospital release. Early findings are being evaluated by the US National Institute of Allergy and Infectious Diseases. This paper [25] Molecular testing will be a great resource for people around the world who want to use machine learning to find COVID-19 infections in people who don't show any symptoms. The results of molecular testing will help set up digital biomes of expected recovery based on a patient's health. A guide for returning to work safely will also be given. After reading all these in the paper, four of them performed better than all of them. This paper is [50] [50] [54] [55] Those involved in the study were more appropriate to determine whether patients with COVID-19 can be safely and therapeutically monitored using telemedicine and tele monitoring. Develop a feasible data extraction system to automatically extract relevant data in the form of sections or paragraphs related to a given query. Early diagnosis of COVID-19 services is provided to identify disease risks. Based on online scrappy techniques, COVID-19 uses an expert system to provide information on the reduction and development of COVID-19 cases. Follow up on the information and opinions of health care workers about the coronavirus.

## 5.CONCLUSION

The most recent research was reviewed for this study, and the key points (objectives, Results, and Used Technology) were retrieved. Numerous publications based on IoT and the body of knowledge have been compared to address the Covid-19 challenge. Researchers may use a wealth of information in the medical literature on coronavirus to address specific issues. Health care providers' policies might be improved by quickly reviewing and getting exact data regarding coronavirus from various published research and the giant fight against infectious disease and creating a system for the automated collection of relevant information from sections/paragraphs linked to a specific topic for actionable knowledge extraction. The framework uses the best natural language processing tools to make models. Also, the architecture has a similarity network based on articles that give a wider view of a certain question. On the other hand, one relevant article and other information on the subject will help healthcare providers learn more about what they are doing.

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