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A Meta-Analysis of Artificial Intelligence Applications for Tracking COVID-19: The Case of the U.A.E.

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Abstract

Coronavirus disease (COVID-19) is an infectious respiratory disease that was first found in Wuhan, China, on December 31, 2019. It is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of November 10, 2020, more than fifty million cases have been confirmed, and more than one million deaths have been reported globally. This situation has created a serious challenge for all countries to institute a variety of control measures to track and slow down the spread of the virus and prevent the increasing number of deaths. In recent years, there has been an ongoing interest in using Artificial Intelligence (A.I.) in healthcare to create new treatments and detecting diseases. The objective of this study is to analyze the application and the impact of A.I. on the breakout of COVID-19 and discuss the contribution of A.I. to the fight against the pandemic based on the most recent applications used in the United Arab Emirates, including Dubai Police Movement Restriction Monitoring System, Taxis Preventive Measures Compliance System, Mobile App "Wai-Eye," Smart Helmets, Virtual Doctor, and The Department of Health – Abu Dhabi (DoH) Remote Healthcare App. The method used in this study is based on a meta-analysis of recent COVID-19 studies from various databases such as ScienceDirect, Sage Journals, SpringerLink, ResearchGate, Emerald Open Research, and IEEE Xplore. The COVID-19 data was based on Johns Hopkins University Center for Systems Science and Engineering (JHU CCSE). Results showed that A.I. applications provided the necessary prevention of the spread of COVID-19, assisted in monitoring restrictions and preventive measures violations, and provided remote healthcare, which directly impacted the number of hospital visits amidst the lockdown. The study concluded that A.I. has proved to be effective in supporting governments in fighting the pandemic.

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1. Introduction

COVID-19 is a virus from the coronavirus family that causes viral pneumonia and has first been seen in humans in December 2019. The virus was confirmed to be transmitted through human-to-human contact on January 20, 2020, and was later announced as a pandemic in March 2020 by the World Health Organization [1]. As the

pandemic was declared, countries quickly started adding social distancing measures and announcing lockdowns on citizens to control the spread as much as possible. In the United Arab Emirates and many neighboring countries, education became online, and curfews started, later a complete lockdown was announced. National and international flights were also canceled beginning in March. COVID-19 affected as many as 215 countries with 41,375,017 confirmed cases and 1,133,803 deaths as of October 20, 2020. A similar tragedy hit the world in 1918, when the Spanish flu was recorded as a pandemic, lasting from 1918-1920 with similar intensity to COVID-19. However, due to the richness of technology, innovation, and precautions in the modern-day, it will be easier and faster to manage and suppress the virus than a century ago.

The concept of Artificial Intelligence (A.I.) was introduced as early as the 1950s by Alan Turing [2]. Five years later, the first Artificial Intelligence program was created (DARPA sponsored summer conference at Dartmouth College), where an open-ended conversation started on teaching machines/computers how to think. Ever since then, the concept grew to what it is today. Artificial Intelligence is training or developing machines that perform tasks that require human intelligence like speech recognition, decision making, abstract thinking, and reasoning [3]. As COVID-19 cases started impacting people and economies, research and A.I. became tools to overcome the pandemic. The United Arab Emirates was one of the many countries that embraced A.I. and implemented a variety of solutions throughout the country. According to The National News of U.A.E [4], the introduction of artificial intelligence (A.I.) has played an essential role in managing and controlling the spreading of COVID-19. The usage of A.I. has helped in understanding the spreading of the virus, which as a result, has assisted in developing protective measures plans to contain the virus [5].

Artificial Intelligence heavily impacted the health sector in the U.A.E. It made it easier for the government to control the cases as much as possible as countless different solutions and applications were launched in 2020 to avoid miscommunication and unnecessary contact. In July 2020, the Ministry of Health and Prevention introduced the Diffractive Phase interferometry to detect COVID-19 [6]. According to Dr. Pramod Kumar, the research team leader studying the virus at QuantLase Labs, the equipment uses a CMOS detector enabling mass-scale screening with results made available in seconds. Another solution implemented by the U.A.E. government is a virtual doctor. The virtual doctor is a chatbot service that asks users questions about their travel history, whether the people they have been in contact with are sick, as well as asking about their symptoms. Based on their answers, the chatbot will connect him/her to a doctor. A.I. has not been limited to the healthcare sectors during the pandemic but has also positively affected other sectors of the country, such as education and transportation. For instance, in education, the U.A.E. government is planning to implement a digital learning platform powered by A.I. that will be implemented in all schools to support education during the pandemic [7]. Figure 1 shows the main purposes that A.I. applications that were used for amid the pandemic.

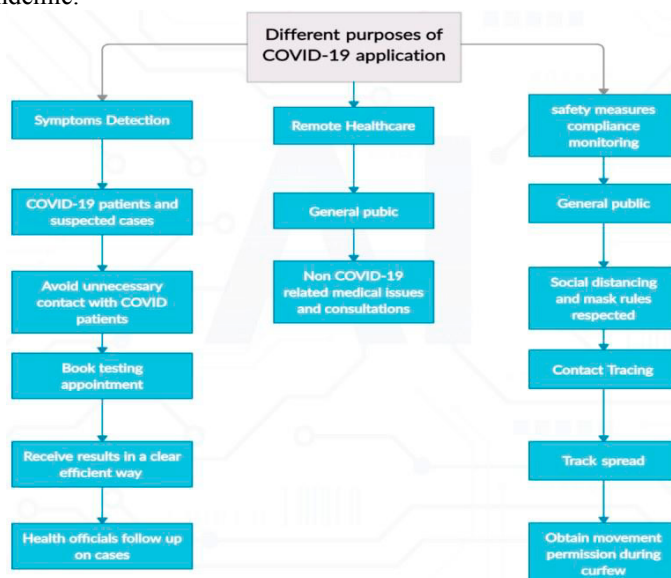


Fig. 1. The primary purpose of the COVID-19 applications built and released throughout the year 2020.

The graph in Figure 2 shows the distribution in the number of daily new cases, daily recovery cases, and cumulative cases. Overall, there is fluctuation in the number of daily new cases. Along with these distributions, we have added the A.I. technologies integrated into the U.A.E. between January 22 and October 31. The first A.I. app used was the Dubai Police A.I. to track if a person's trip was essential in this time of the pandemic, which was on April 06. The daily new cases, however, continued to increase gradually. As cases continued to rise, April 14 was the smart helmet start, which was a new artificial intelligence technology. The number of cases was still increasing and jumped to around 1000 daily new cases. On May 12, an A.I. virtual emergency doctor technique was introduced, then A.I. App used in a taxi cab, Wai-Eye for school compliance as shown in Figure 2. By investigating the number of daily new cases, we can observe that this number starts decreasing from May 21 to August, while the daily recovered cases were very low at the beginning of the pandemic, then, with the new prevention policy, this number increased or at least was at the same level as the daily new cases. However, despite the availability of 6 various devices to help control the spread, the U.A.E. recorded their highest number of cases on October 14 at 1,315.

This study explores and evaluates the effect of A.I. applications used to slow down and/or prevent the COVID-19 pandemic with emphasis on the most recent applications in the United Arab Emirates. The rest of the paper is organized as follows: section two presents a broad literature review and discussion of work relating to COVID-19 and A.I. Apps. Section three presents the proposed methodology and available data source for COVID-19. Section four presents the result and discussion and, finally, a conclusion is presented in section five.

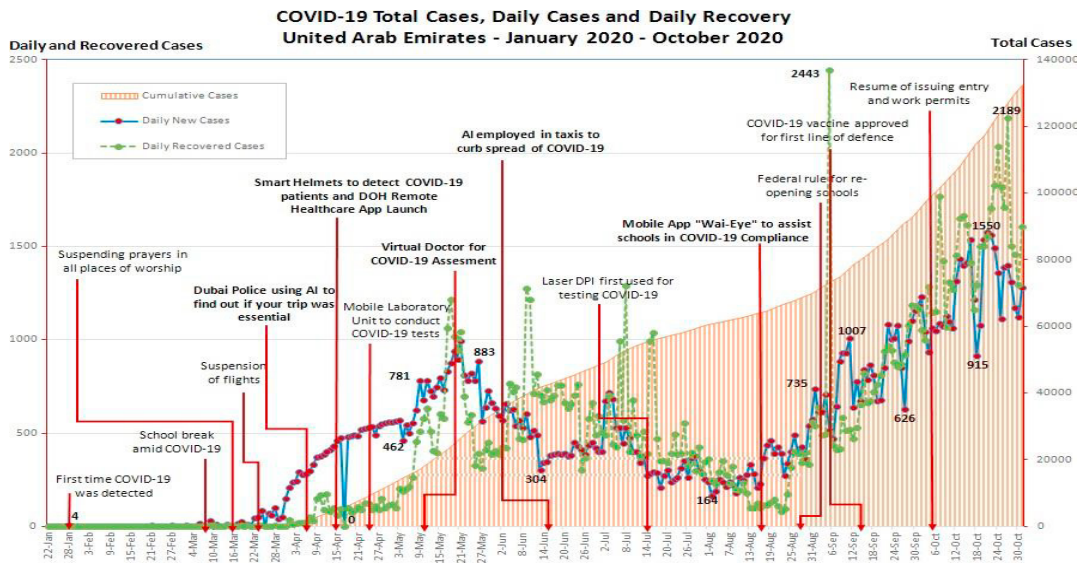


Fig. 2. Daily and cumulative COVID-19 cases in the United Arab Emirates (as of October 31, 2020).

2. State-of-the-Art Review

Recent research reported that A.I. is an effective tool in supporting the COVID-19 pandemic [8]. Simulated and computer-based intelligence is useful for improving treatment consistency by creating appropriate treatment regimens, counteraction methodologies, medication, and immunization advancement. Furthermore, A.I. is a powerful tool to distinguish early diseases due to coronavirus and providing appropriate medical check-ups [9]. A study by Jamshidi et al., (2020) illustrates AI-based platforms that accelerate the diagnosis and treatment of the COVID-19 disease. The key problems studied were geographical issues, high-risk people, and recognition and radiology. These conceptual structures help experts analyze massive datasets and help physicists train machines, set algorithms, or optimize the analyzed data for dealing with the virus with more speed and accuracy. Moreover, the study emphasizes that AI A.I.'s capabilities and the effectiveness of the tools used in this pandemic depend on the

knowledge and abilities of the scientists who code them. This implies that the A.I. used to fight the pandemic might not be utilized to its full potential, reflecting on the number of cases. The study concludes that A.I. is best used besides human physicians to obtain significant results. The research [10] mentioned many points in common with the above paper and emphasized that this new pandemic is on a spread, and urgent help is required. Artificial Intelligence (A.I.) is suggested to deliver the healthcare support needed for this cause. A.I. is considered a useful tool to play a role in fighting COVID-19.

The biggest challenge that scientists face in understanding and documenting the transmission of COVID-19 is the asymptomatic patients [11]. According to WHO, an asymptomatic laboratory-confirmed case is a person infected with COVID-19 who does not develop symptoms [1]. Asymptomatic patients spread the virus unknowingly, so how would the spread of COVID-19 be affected if they can be identified from their forced-cough through a cell phone? A study conducted at M.I.T. [12] created an A.I. model trained to detect a COVID-19 patient, especially asymptomatics, by a forced-cough cell phone recording. The model, called the M.I.T. Open Voice model, achieved exceptionally high results in sensitivity and specificity. The authors believed that A.I. techniques can provide large-scale, real-time, and free COVID-19 asymptomatic detection tools.

Nowadays, technology is at 'one's fingertips. It plays a great role in our personal and professional lives. As the new pandemic (covid-19) has spread its shadows worldwide, the U.K. government advised people to isolate themselves for their protection, especially those with underlying, chronic health conditions. As a result, face to face social interactions was temporarily suspended. The chance of social isolation and loneliness will increase. Here comes the role of virtual assistance (V.A.). Technology has provided various communication tools (e.g. Skype, Viber, Whatsapp) and social media platforms (e.g. Facebook, LinkedIn, Instagram), enabling individuals to interact with each other to compensate for the loss of physical interactions. While the future is still uncertain because of Covid-19, V.A.s has been used as a social weapon to maintain sanity during the chaos made by the Coronavirus pandemic. [13]

The wide-spreading of the COVID-19 pandemic resulted in increasing the demand for medical supplies. However, the pandemic quarantine rules and social distancing guidelines caused the manufacturing process, which requires high human involvement, to become increasingly challenging. Ramping up the production to achieve the required demands of the medical supplies can be achieved through introducing artificial intelligence systems (e.g. robots and automation systems), as explored in a study conducted by [14].

Many medical approaches have been made to diagnose COVID-19 disease. Medical imaging such as X-ray and computed tomography (C.T.) intertwined with recently emerging artificial Intelligence (A.I.) technologies are important to fight coronavirus. A.I. technologies strengthen the power of imaging tools and assist medical specialists. They play a significant role in automating the scanning procedure, getting the work done with minimal contact to patients, and providing more accurate results of infections in X-ray and C.T. images. Since the Reverse transcription-polymerase Chain Reaction (RT-PCR) test can be inadequate, A.I. imaging equipment such as X-ray and C.T. can be quite useful. However, bear in mind that imaging gives partial information about patients diagnosed with coronavirus. Therefore, it is important to combine both imaging data with clinical results and laboratory tests. To do that, we believe that A.I. can play a crucial part in fusing information from these multi-source data to provide the required results. [15] A proposed technique [16] implements deep-learning algorithms to detect COVID-19 pneumonia from digital chest X-rays automatically. Notably, the earlier the detection of pneumonia in a COVID-19 patient, the greater is the recovery rate. The authors believe that the diagnostic tool proposed is robust and can improve the precision and speed of screening of COVID-19 positive cases.

Telehealth is vital to deliver care during the lockdown. The spread of Covid-19 has highlighted the importance of telehealth significantly to reduce the risk of contamination caused by close interactions. For this approach to be effective, it should be routinely used as part of our health system. It has many advantages, including presenting more providers, facilities triage, support hospitals, and clinics that cannot meet demand and decrease the risk of contamination caused by face-to-face interaction. Telehealth application has some limitations since some consultations require physical examinations that may be difficult to perform remotely. Regardless, telehealth should become a mainstream component of our health system [17]. This paper as well introduced the significance of telemedicine. It mentions that medical practitioners are the most vulnerable category to be infected with COVID-19. The pandemic caused many frontline workers' death and caused harm to patients who regularly require doctor visits. Therefore, the world resorted to telemedicine. Medbot [18] is a conversational AI-powered chatbot for delivering Tele-Health after the pandemic. The application bridges the gap between the after-effects of the pandemic and the imbalance between the healthcare services currently available. The application is reliable in detecting common

diseases and suggesting advice. The problems and symptoms faced are delivered to the chatbot fully, and questions from the chatbot are well-answered.

Coronavirus is a dangerous disease that affects human lives globally. Prevention is the ideal solution to solve this problem until a vaccine is produced. Therefore, countries and governments rushed to create solutions that might help, such as smartphone applications. These applications' goal was to alert individuals exposed or close to an area where there are infected people. Besides, it helps the government to know new infection areas and limit the spread of the virus. These applications are of two types: contact tracing apps and location sharing apps. Among the countries that have implemented the idea of phone applications is Europe in its various regions, Bulgaria, Quarta, Cyprus, the Czech Republic, Austria, Denmark, Estonia, Finland, France, Germany, and many other countries [19]. This paper also mentioned the importance of smartphone applications in tracking people infected with the virus, and that it is an essential tool in combating the virus as it helps the authorities quickly identify infected people. It is worth noting that these applications have raised the concern of many researchers and data protection agencies regarding the privacy of the individual while using these apps [20].

3. Methodology

This study analyzes the relationship between A.I. technologies and the spread of COVID 19 in the U.A.E. For this purpose, the data used in the present study are compiled by the Johns Hopkins University Center for Systems Science and Engineering (JHU CCSE). The collected data is illustrated in figure 2 using Excel 2019. We based our review on various publication repositories such as Emerald Open Research, IEEE Xplore, ScienceDirect, SpringerLink, and Sage Journals, and searched using the terms "COVID-19", "artificial intelligence", "artificial intelligence and COVID-19", "A.I. and COVID-19", "A.I. applications", and "coronavirus 2019". We also referred to official websites for live updates of COVID-19. Table 1 summarizes the available data sources about COVID-19 ranging from numerical data of the cases, transmission and highlights information about the A.I. applications used amid the pandemic to control the breakout of COVID-19 in the U.A.E. Table 2 summarizes the available search engines for COVID-19.

Table 1. Available data sources used for COVID-19 and the A.I. applications used to combat COVID-19

Sources	Data Type	References
JHU CCSE	Web-based mapping global cases	https://data.humdata.org/dataset/novel-coronavirus-2019-ncov-cases .
Centers for Disease Control and Prevention	Transmission and spread of COVID-19	https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-
Global C.D.C.	Live updates on cases and deaths by country	https://www.worldometers.info/coronavirus/?#countries
UAE CDC	Daily updates on cases, recovery, and deaths	https://covid19.ncema.gov.ae/en
U.A.E. Ministry of Health and Prevention	COVID-19 cases, testing, and prevention in U.A.E.	https://www.moh.gov.ae/en/Pages/default.aspx
COVID-19 Research Explorer	Answers to questions based on COVID-19	https://covid19-research-explorer.appspot.com/
World Health Organization	Latest Scientific findings and knowledge on COVID-19	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov
Emerald Open Research	Latest scholarly articles on COVID-19 and A.I. tools used amid the pandemic	https://emeraldopenresearch.com/search?q=covid-19+and+AI
IEEE Xplore	Provides full text access to high quality papers from journals and conferences	https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=COVID-19%20and%20AI
ResearchGate	Access to COVID-19 research community	https://www.researchgate.net/community/COVID-19
Sage Journals	Scholarly articles on COVID-19	https://journals.sagepub.com/action/doSearch?filterOption=allJournal&AllField=COVID-19+and+AI
ScienceDirect	Elsevier's free health and medical research on the novel coronavirus (SARS-CoV-2) and COVID-	https://www.elsevier.com/connect/coronavirus-information-center?dgcid=_SD_banner

	19	
SpringerLink	Access to scientific documents from journal, books, and conferences	https://link.springer.com/search?query=covid-19+and+ai
OECD	The Organisation for Economic Co-operation and Development. Helps facilitate the use of AI throughout the COVID-19 crisis	https://www.oecd.org/coronavirus/policy-responses/using-artificial-intelligence-to-help-combat-covid-19-ae4c5c21/
PubMed	COVID-19 papers sorted most recent publication on COVID-19	https://pubmed.ncbi.nlm.nih.gov/

Table 2. Available search engines tools for COVID-19

Sources	Data Type	References
Google's COVID-19 Research Explorer	Allows users to ask questions such as 'What are the rapid molecular diagnostics for COVID-19?'	https://covid19-research-explorer.appspot.com/
LitCovid	One of the most comprehensive resources on COVID-19	https://www.ncbi.nlm.nih.gov/research/coronavirus/
COVIDScholar	COVID-19 literature search powered by advanced NLP algorithms.	https://covid scholar.org/
SPIKE-CORD	Focuses on retrieving papers and extracting information using a query language	https://www.researchgate.net/community/COVID-19
<i>iSearch</i> COVID-19 Portfolio	National Institutes of health source for publications on COVID-19 and SARS-CoV2	https://icite.od.nih.gov/covid19/search/
Researcher Life	An AI-powered site offering access to the latest research and information on COVID-19. It also has the option for researchers across disciplines to collaborate.	https://covid19.researcher.life/

4. Results and Discussion

Studies have shown that A.I. applications have helped in controlling the breakout of COVID-19 [10]. In the U.A.E., A.I. was used to assist the police and taxis in identifying and tracking violations during the lockdown [21]. Furthermore, A.I. mobile applications were used to provide remote healthcare for members of the community in the comfort of their homes [18][17][22][23]. Various A.I. technologies were implemented to support the functions of each application. The applications have three main purposes: COVID-19 safety measures compliance monitoring, symptom detection, and remote healthcare. Table 3 shows a summary of the significant A.I. functions used by the U.A.E. during the pandemic.

Table 3: Prominent A.I. functions found across U.A.E. during COVID-19 lockdown

Applications	Main AI techniques	Purposes	References
Dubai Police Movement Restriction Monitoring	License Plate Recognition	The system determines if the 'individual's trip is necessary and identifies if the individual is an essential worker or not.	[21]
Taxis Preventive Measures Compliance System	Computer vision and machine learning algorithms	The technologies determine if the driver and the passenger are following preventive measures like wearing the face mask correctly and maintaining a safe physical distance.	[24]
Mobile App "Wai-Eye"	Facial recognition, G.P.S. tracking	The application enhances current CCTV systems to control preventive measures compliance.	[25]
Smart Helmets	Thermal screening, Facial recognition	The smart helmet is supplied with a thermal camera to detect temperatures from a safe distance. It can recognize faces, car plates, and decision-making services for the patrols.	[26]
Virtual Doctor	NLP	A chatbot that asks questions and gives a general medical assessment based on the answers of the patient.	[22]

DOH Remote Healthcare App	N.L.P.	The Remote Health Care App provides various medical services for patients in the comfort of their homes.	[23]
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4.1. Dubai Police Movement Restriction Monitoring System

During the lockdown, movement restrictions were enforced to ensure individuals only left their homes for valid reasons. To assist in this task, the Dubai police used AI A.I. to help decide if the moving vehicle is following restrictions or not and must be fined [21]. The system has a radar that detects car license plates of moving cars. The Dubai police system processes each plate number and checks if it belongs to someone who works in a vital sector or not. In the former case, the individuals are recognized by the A.I. and are exempted from the fine. However, in the latter case, the system checks if the person has a permit or not. If they have a permit, no fine would be issued. If they do not have a permit, the system tracks the path and checks if they went out for an unnecessary matter or essential purposes. The system will automatically find a person who did not follow the restrictions. This system simplified the process of sterilizing the emirate and reduced the time taken to sterilize an area.

4.2. Taxis Preventive Measures Compliance System

According to the Centers for Disease Control and Prevention [27], COVID-19 spreads mainly through close contact between people. However, compliance with safety measures such as face masks and social distancing has proven to be an effective method to slow the spread. 'Dubai's Roads and Transport Authority, R.T.A., implemented A.I. in taxis to detect and report violations of COVID-19 preventive measures [24]. The system uses technologies such as computer vision and machine learning algorithms. It is based on a video analysis feature that scans humans' faces and verifies if the mask is worn correctly and the distance between the driver and the passenger follows the rules. The main purpose of the system is to promote and ensure that public transportation is safe for everyone.

4.3. Mobile App "Wai-Eye."

Education was among the first sectors affected by the COVID-19. Until today, most educational institutes are using distance learning and virtual classes. However, physically attending classes is indispensable, and it must be well accommodated. A UAE local mobile application was introduced to help schools in compliance with COVID-19 preventive measures. Mobile app ""Wai-eye"" generates real-time data by enhancing CCTV to maintain control over school entrance, transportation, and social distancing [25]. The application also solves the issue of taking attendance manually or by fingerprints by using facial recognition to automatically recognize the student. Moreover, the system facilitates bus transportation by giving parents an estimated time of arrival with G.P.S. tracking. The system was to be used by September 2020 for reopening schools.

4.4. Smart Helmets

One of the most known symptoms of COVID-19 is the increase in temperature. As a result, Dubai has implemented smart helmets that scan a crowd and detect individuals with high temperatures from a safe distance using thermal cameras [26]. The helmet works efficiently in different climate conditions and has a night vision mode. The helmet is also equipped with facial recognition, a car plate reader, and a Q.R. reader. Also, the helmet facilitates the decision-making process of the police by generating quick reports electronically. The smart helmet is an impressive implementation of A.I. in the U.A.E. and has helped in strengthening the level of following preventive measures among the community members.

4.5. Virtual Doctor and DOH Remote Healthcare

As a result of the pandemic and fewer face-to-face meetings, remote healthcare was found to be an effective method for doctors to provide assessments and advice to patients. A virtual Doctor is a chatbot that provides medical assessments by asking a series of questions [22]. The assessment is based on the answers fed to it by the user. The service also offers various specialties such as pediatrics, internal medicine, pharmacy, nursing, mental health

support, and much more. It also provides nationwide home delivery for patients who need regular monthly drug prescriptions.

Furthermore, the U.A.E. department of health, DOH, has launched the DOH Remote Healthcare Platform to encourage staying at home and receiving safe medical services [23]. The system offers several services such as booking appointments, remote consultations, delivering medical prescriptions, and an AI-based tool for examining 'patients' symptoms. Both systems are based on Natural Language Processing (N.L.P.) techniques. These services aim to decrease the visits to hospitals, which helps control the curb of COVID-19.

4.6. Comparison between KSA and UAE COVID-19 applications

Table 4 displays the main COVID-19 applications developed in the Arab world. There are several similarities between K.S.A. and U.A.E. in terms of the applications used amid the pandemic. Regarding testing channels, U.A.E. launched the ALHOSN UAE app to receive the ALHOSN UAE app to receive test results and detect proximity to infected people [28]. ALHOSN app combines the benefits of multiple applications in one portal and guarantees users' privacy through A.I. Similarly, K.S.A. has Tabaud and Tetamman applications for contact tracing and receiving test results, respectively. The applications gather the infected people's data while sustaining a high degree of privacy [29][30]. Furthermore, in terms of an all-purpose health application, both K.S.A. and U.A.E. have HESN, and DOH Remote Healthcare applications provide medical services such as medical history, booking appointments, and much more. However, HESN is more focused on assisting health professionals while its counterpart is for the community members [31]. At last, for remote or virtual healthcare, K.S.A. has Seha for medical consultations and Mawid for booking appointments. These services can be found 'U.A.E.'s virtual doctor and DOH remote healthcare. Based on our research, U.A.E. incorporated a larger number of A.I. services, such as the smart helmet, taxi preventive measures system, and Dubai monitoring system for movement restriction in its journey in fighting COVID-19.

Table 4. Overview of COVID-19 in the Arab World

Country	Name of the application	Main Functionality	Origin	References
Bahrain	BeAware Bahrain	Quarantine enforcement	Governmental	https://healthalert.gov.bh/en/category/beaware-bahrain-app
Jordan	AMAN	Contact Tracing	Governmental	https://amanapp.jo/en
Kuwait	Shlonik	Self-diagnosis	Governmental	http://www.arabtimesonline.com/news/application-to-track-expats-and-kuwaitis/
Morocco	Wiqaytna	Contact Tracing	Governmental	https://www.wiqaytna.ma/
Qatar	Ehteraz	Information	Governmental	https://www.qatarday.com/blog/information/everything-you-want-to-know-about-ehteraz-app/73632
Saudi Arabia	Tawakkalna (Covid-19 KSA)	Quarantine enforcement	Private	https://ta.sdaia.gov.sa/en/index
Saudi Arabia	Tabaud(Covid-19 KSA)	Contact Tracing	Private	https://tabaud.sdaia.gov.sa/IndexEn

5. Conclusion

The present study showed that Artificial Intelligence (A.I.) is useful in treating infected patients with COVID-19 and ensuring that they are adequately monitored. In the U.A.E., A.I. plays a significant role in helping the government deal with the pandemic, whether directly in the health sector in testing centers and hospitals or indirectly through transportation education. Artificial Intelligence might not have stopped the growth of new cases or decreased cases significantly, but it has made processes smoother and faster for citizens, health officials, and the government. It provided the country with data and made it easier to monitor, understand, and predict upcoming issues or problems. Artificial Intelligence will continue aiding humans in many various aspects of life and has come to show its importance during the COVID-19 pandemic as people depended on technology to help. A.I. is still at the "Artificial Narrow Intelligence" stage; the surface of A.I. has just been scratched and has a long journey of research

and innovation looking forward as we continue to see its impact on humans' daily lives.

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