Leveraging Virtual Reality and AI for Healthcare: Personalized Diet Analytics and Mental Health Support During the COVID-19 Pandemic*

Amina Khaja
Department of Information Science
University Of North Texas
Texas, United States
aminakhaja@my.unt.edu

Kavya Parvathapuram
Department of Information Science
University Of North Texas
Texas, United States
kavyaparvathapuram@my.unt.edu

Vinay Daram
Department of Information Science
University Of North Texas
Texas, United States
vinaydaram@my.unt.edu

***Abstract*—The COVID-19 pandemic had a significant impact on global health, highlighting the critical role that diet plays in promoting healing, increasing immunity, and controlling general health. One of the most important strategies for preventing and healing from the virus's physical and psychological effects is proper nutrition. This initiative uses cutting-edge technology, like as virtual reality(VR), artificial intelligence (AI), and data analytics, to offer creative answers to dietary and mental health issues that have been made worse by the pandemic.The COVID-19 Healthy Diet Dataset, a thorough compendium of worldwide dietary trends, food supplymeasurements, and health indicators like obesity and death rates, is at the heart of the research. The study establishes the foundation forpractical insights into the function of nutrition in managing COVID-19 by examining these datasets to find associations between dietary practices and health outcomes.The project also includes an AI-powered personalized diet plan generator that can adjust nutritional recommendations based on a person's health, food preferences, and cultural background. As user conditions improve, this program adjusts dynamically to provide continuously optimal diet regimens based on changing recovery data.The system incorporates a virtual reality (VR) assistant to further improve the user experience. Pre-surgery preparation, guided exercises, mental health support, and intensive educational and therapeutic encounters are all provided by this assistant. The initiative tackles physical and mental health issues by combining data analytics, AI, and VR, providing a comprehensive approach to medical assistance. In addition to offering insightful information about worldwide dietary trends during the pandemic, the tools and methodology created by this research show how cutting-edge technologies may be used to create individualized healthcare solutions. These developments aid in lowering healthcare costs, enhancing recovery results, and getting ready for upcoming public health emergencies. This study lays the groundwork for revolutionary methods of incorporating AI and VR into data-driven, individualized healthcare**

I. Introduction

The COVID-19 epidemic disrupted global health systems and highlighted the critical role that nutrition and mental health play in prevention and recovery. Nutrition plays a major role in immune response and recovery rates, while loneliness and stress often have an impact on mental health. To tackle these issues, this study integrates virtual reality (VR), artificial intelligence (AI), and data analytics. The project creates AI-driven customized diet regimens based on user conditions, preferences, and cultural factors using a large dataset of worldwide food trends and COVID-19 criteria. As user health improves, these strategies adjust dynamically to maintain their relevance. In addition, a virtual reality assistant offers therapeutic and educational experiences that are immersive and promote improved comprehension and adherence to recovery regimens. When combined, these developments provide a comprehensive strategy to healthcare that enhances results and fortitude in the face of international health emergencies.

II. Statement of Problem

Creating personalized COVID-19 diet plans presents several challenges:

1) Data Quality:: Gaining access to a variety of excellent datasets that represent nutritional and health issues around the world.

2) Contextual Understanding:: Addressing dietary constraints, cultural sensitivity, and medical problems in suggestions.

3) Dynamic Adaptation:: Ensuring that plans adapt to changing user circumstances.

4) Ethical Responsibility: : Giving prudent, safe, and accurate dietary guidance.

5) Accessibility:: Enhancing compliance by involving people with user-friendly tools such as the VR assistant.

In order to address these problems, this project combines AI and VR to create a flexible healthcare application that provides individualized meal plans to aid in COVID-19 recovery and foster long-term wellbeing.

III. Review of Literature

The significance of nutrition for general health was brought to light by the COVID-19 pandemic. Research indicates that

healthy eating improves mental health, speeds up recovery, and fortifies immunological responses. By taking into account variables like age, health, and cultural dietary customs, AI-driven diet recommendations have demonstrated efficacy in providing individualized nutrition programs. For each patient's unique healthcare demands, these systems provide scalable, precise, and flexible solutions.

Simultaneously, virtual reality (VR) has shown great potential in the medical domain, particularly for patient education, training, and therapy. VR's immersive qualities make it a valuable tool for treating both physical and mental health conditions, as they enhance patient participation, comprehension, and treatment program adherence.

A complete approach to addressing the dietary and mental health components of recovery can be developed by combining AI and VR. But obstacles like data biases, moral dilemmas, and accessibility problems need to be resolved. Maximizing the potential of these technologies requires ensuring data integrity, developing recommendations that are sensitive to cultural differences, and ensuring that VR is accessible to a wide range of people.

Building on these discoveries, our study combines AI and VR to provide creative, individualized healthcare solutions for COVID-19 recovery while resolving the issues raised by previous studies.

IV. Objectives of the Study

A. Analyze the Relationship Between Global Food Supply Statistics and Health Outcomes During the Pandemic:

The purpose of this study is to investigate the relationship between health outcomes during the COVID-19 pandemic and changes in global food supply variables, including calorie intake, fat, protein supply, and food availability. The study finds trends and connections between dietary practices and important health metrics like recovery rates, mortality, and general health resilience by looking at data at the national level. This analysis offers insightful information about how nutrition might help manage health issues related to pandemics.

B. Develop a Personalized Diet Plan Generator Using User-Specific Inputs and Food Supply Metrics:

The goal of the project is to develop an AI-powered platform that can produce customized nutritional advice. Individual user inputs such as age, food preferences, exercise levels, recovery objectives, and health issues are taken into account by this generator. To make sure the suggestions are realistic and in line with local food availability, it also incorporates data on the food supply. As users' circumstances improve, the application dynamically modifies the diet programs to maintain effective and individualized nutritional support.

C. Implement a VR Assistant for Therapy and Patient Support:

Incorporating virtual reality (VR) technology improves user engagement and offers comprehensive healthcare support. The VR assistant functions as an interactive platform that provides patient instruction on nutritional practices, therapy for mental health issues including stress and anxiety, and immersive experiences that enhance the appeal of rehabilitation. The VR assistant tackles the mental and physical facets of health recovery by fusing therapeutic interventions with education.

D. Establish Correlations Between Dietary Patterns and Health Metrics Like Mortality and Obesity Rates:

The study looks into how food habits relate to important health indicators including COVID-19 mortality and obesity rates. By examining these relationships, the study emphasizes how nutrition affects illness outcomes and how crucial dietary changes are to enhancing health resilience. In addition to providing information for the customized diet plan generator, this goal supports more comprehensive public health plans for pandemic response and recovery.

By tackling physical and mental health issues with immersive technology and customized diet, the project aims to develop an integrated, data-driven system that improves recovery results.

V. Data Collection

A. Research Design

Our Covid-19 diet plan, which takes into account the patient's inputs including food and medical history, defines our issue statement. Additionally, this program is an improvement to Covid Coach, an already-existing mental health application. These are our project's main constituents:

- The datasets containing all of the country names and values, along with the list of values, make up the CSV (comma-separated values) dataset. Additionally, possible insights are handled graphically and the values have been cleansed. Additionally, machine learning and the provided models will be used to handle the dataset.When the model is complete, we will test it on actual patients and get input from their cases. The effectiveness of the diet plan will then be confirmed, and we will utilize our model to track the effects on the patient's physical and mental health. We will see how the suggestions our model makes improve their well-being.Integrated VR, AR and Open-AI.All things considered, COVID-19 had a major effect on the world. By improving an LLM, we intend to offer trustworthy COVID-19 diet regimens that take into account dietary restrictions, virtual reality, and health concerns. We intend to use LLM and fine-tuning

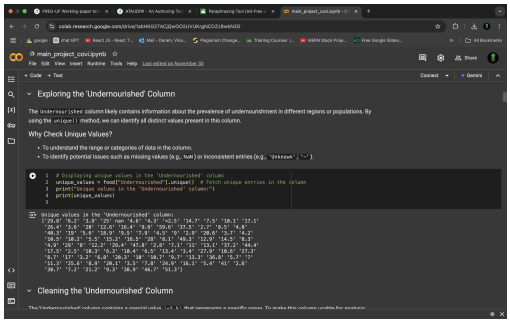

Fig. 1. Exploring the 'Undernourished' Column

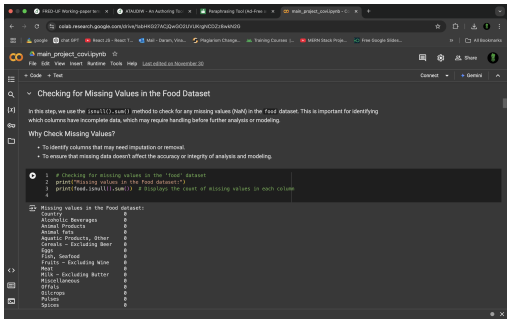

Fig. 2. Checking for Missing Values in the Food Dataset

in our Covid Coach continuing to further enhance our approach and help people who want to see a quicker improvement in their symptoms.

B. Dataset

The dataset used in this investigation came from Kaggle. As Countries from all over the world provided the data. It also includes "information on nutrition values, obesity, undernourished percentages, and different food group supply quantities" (Ren, 2020). The number of deaths and cases following positive COVID-19 tests is also included in the dataset. The information was obtained from the Food and Agricultural Association of the United Nations, the Population Bureau, choosemyplate.gov, and the Johns Hopkins Center for Systems Science and Engineering (Ren, 2020). Together, the metrics can be used to ascertain the connection between diets and COVID-19 cases, which will help us refine our model. This approach ensures that the LLM can effectively provide food plans to COVID-19 patients. The following datasets:

- **FatSupplyQuantityData:**
- **FoodSupplyQuantitykgData:**
- **FoodSupplykcalData:**
- **ProteinSupplyQuantityData:**

VI. Exploratory Data Analysis

Additionally, we needed to process and clean these datasets before beginning our work utilizing them. We made use of

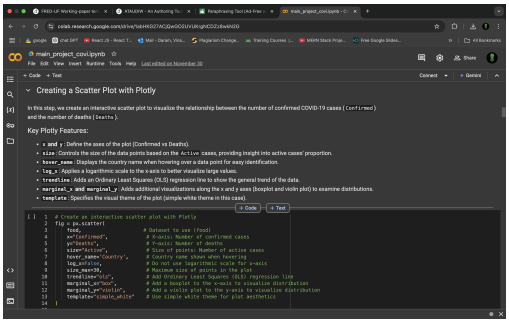

Fig. 3. Creating a Scatter Plot with Plotly

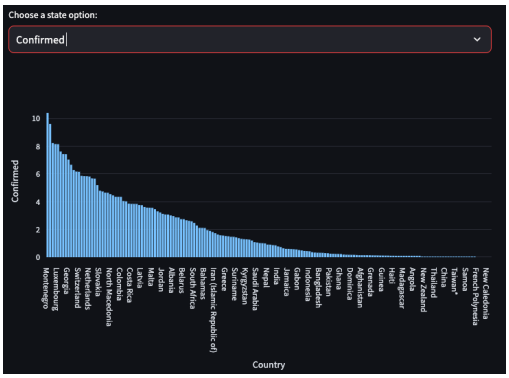

Fig. 4. Confirmed Covid Cases by Country

KNN inputer through python to estimate values based on similarity between data points to ensure consistency without any sort of bias that could occur otherwise. Similarly, when working on cleaning this dataset, we also removed any empty or null values in this process as well. This procedure helped to ensure and handle our large datasets, enabling the ability to process our data successfully to prepare for the next steps.

Above displayed images in figures 1-3 can be found showing some of the methods we used to implement this process.

- Figure 1: Explores any unique or odd values in our dataset that need to be handled
- Figure 2: Portrays the process used to check for any missing or null values in our datasets
- Figure 3: Reveals the process of creating a scatter plot with plotly to display some of our scatter plot visualizations

VII. Data Analytics

A. Covid Cases by Country:

As seen above in Figure 1, we created some visualizations to help our users better visualize our dataset. Similarly, these info-graphics help to better understand the metrics and correlations between global food supply statistics and Covid-19 health impacts. Likewise, it also showcases different food groups and categorizes them by country to help recognize

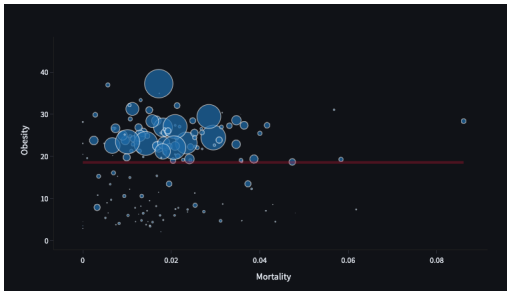

Fig. 5. Obesity vs Covid Mortality Rate

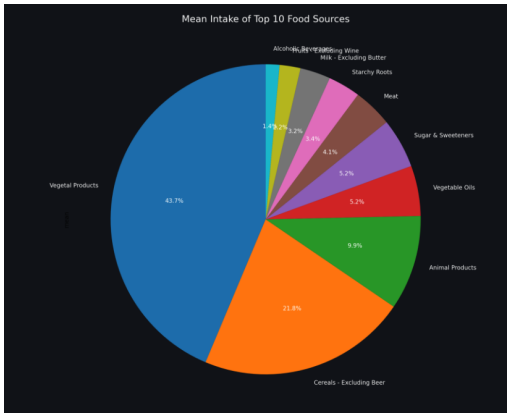

Fig. 6. Mean Intake of Top 10 Food Sources

different trends in diets, health, impacts, as well as any notable relationships.

From the drop down below where it states ”Choose a state option:” the user is able to filter the data to display results from confirmed Covid cases, number of deaths as a result of Covid by country, active number of cases by country, and the Covid mortality rate by country. The ability to filter the bar graph by the desired results the user is looking for, plays a huge role in depiction of improved understanding of what countries are more likely to suffer from covid complications and what role each country may play. Additionally, this interactive visualization helps users to explore the data dynamically making patterns and insights more accessible.

B. Obesity and Covid Mortality Rate by Country:

Furthermore, the next visualization revealed in Figure 2 displays the correlation between obesity and Covid mortality rate by country. Each bubble represents the intensity of the concentration with respective population taken into consideration.

Top 10 Food Sources:
Lastly, in the final visualization shown in Figure 3, this graphic showcases a pie chart with the mean intake of the top 10 food sources and which foods are most likely to be

Fig. 7. VR Interface with games, diet plan generation and mental health quiz

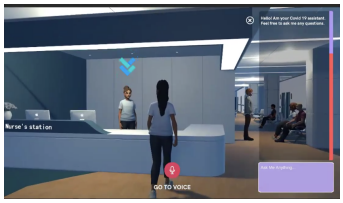

Fig. 8. Open-AI Integration with VR-TTS/STT

consumed. From these visualizations, we can notice a trend that obesity and poor diet can lead to higher Covid mortality rates. In addition, diet plays a huge role, as commonly those affected negatively with Covid symptoms often have poor diets and are not recieving the nutrients they need to properly overcome the illness. As a result, we hope to overcome this issue by our program prescribing what foods the patient is lacking in order to avoid experiencing more symptoms.

VIII. VR Integration

Virtual reality (VR) can easily be enhanced with advanced text-to-speech (TTS) and speech-to-text (STT) capabilities by combining it with OpenAI and Amazon Polly. This method uses the virtual reality environment as a platform for engaging user experiences by recording and analyzing spoken inputs in real time. Programs such as Amazon Transcribe or OpenAI Whisper can translate human speech into text, which allows the machine to understand and interpret commands or questions. After receiving the researched text, OpenAI GPT-3.5 generates intelligent, contextually aware responses. After Amazon Polly converts these remarks back into natural-sounding audio, the user receives spoken feedback in the virtual reality experience.
The VR interface, which enables realistic interaction with dashboards, virtual assistants, and other aspects, is built using platforms like as Unity or Unreal Engine. Voice input is captured by the VR headset’s microphone, and smooth interaction is ensured by real-time data processing. For example, OpenAI GPT-3.5 is able to understand the user’s question and employ realistic speech production from Amazon Polly to produce dynamic, audible responses. The integration is further enhanced by visual components, such as displaying the AI-generated text in the virtual environment.

Applications such as virtual assistants in virtual reality, immersive learning settings, or interactive gaming experiences that let users speak naturally with characters or systems

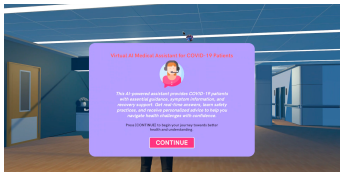

Fig. 9. VR Interface

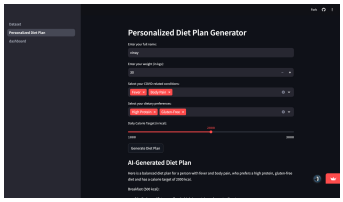

Fig. 10. Streamlit Interface

are made possible by this configuration. AWS cloud infrastructure, which guarantees scalability, low latency, and high availability, supports Polly and Transcribe. By utilizing secure API endpoints and cutting down on processing time through local caching or hybrid deployments, privacy and performance issues are resolved. This cutting-edge platform for immersive, interactive, and customized virtual experiences is made possible by the creative fusion of virtual reality, OpenAI, and Amazon Polly.

IX. Data Visualization and Results Report

For the final implementation phase of our project, we utilized a Virtual Reality simulator for our patients to dynamically be able to ask an AI assistant for questions on Covid-19 symptoms they may be experiencing. This simulator was created using assets from the Unity Asset store. Moreover, these assets consisted of our character models, hospital environment, landscape, and other figures used in our VR simulation. We were able to download these artifacts, as well as animations to make sure these objects or characters animate accordingly. For example, ensuring our character model walks, talks, and stands with dimensions taken into consideration, and then we imported these assets into our unity project. After designing, we added animations of walking and/or jumping into our humanoid characters created in the canvas. This provided the set up of our virtual simulator, and then we were ready to incorporate our dataset and AI integration into it.

In addition, we included use of voice inputted speech into our model as well. We made use of Amazon Polly to integrate speech to text within our VR model, in order to accomodate to any potential disabilities that prevent patients from being able to make use of text.

X. Conclusion

COVID-19 had a major impact on the world.The project successfully blends AI, VR, and data analytics to provide

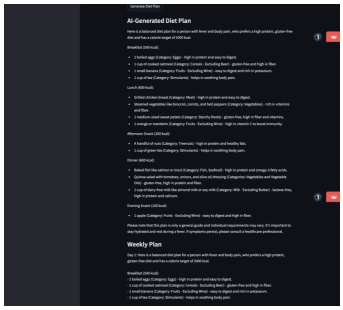

Fig. 11. Diet Plan Generation

useful insights and healthcare solutions during the COVID-19 pandemic. Important subjects including nutrition, mental health, and professional training are covered by the diet plan generator and VR AI assistant. Future studies might enhance the virtual reality experience and expand its application to cover other medical conditions.

XI. Future Studies

In future studies, there are a couple of features we would like to implement into our existing project. We would like to focus on further improving our fine-tuning techniques. In doing so, we would be able to improve our AI driven personalizations and enhance the model to provide for more personalized recommendations to patients. Similarly, we would like to improve our virtual reality engagement to provide users with the best quality experience and user interface, for smooth usability and enhanced practice. Lastly, in future studies, we hope to broaden and expand our data to include more datasets. Incorporating this change, will allow for better recommendations and more personalized suggestions from our AI assistant. As a whole, we were able to provide patients with a virtual reality artificial intelligence assistant that is able to provide recommendations for diet plans based on preexisting Covid symptoms or medical conditions, as well as any dietary preferences.

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