WellNest: An Intelligent & Holistic Palliative Care Platform

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ABSTRACT - *WellNest is an innovative platform designed to enhance palliative care through the integration of advanced technologies like AI and immersive tools. It provides personalized care plans, real-time emotional support via a chatbot, and volunteer-patient matching to improve the quality of life for individuals with serious illnesses. WellNest aims to optimize health outcomes, manage pain and anxiety, and foster a supportive community for patients, caregivers, and healthcare providers. The platform also offers educational resources, interactive wellness activities, and seamless communication channels to ensure holistic care. By bridging the gap between technology and compassionate healthcare, WellNest sets a new standard in palliative care, empowering individuals to navigate their journey with dignity and comfort.*

Keywords — Palliative Care, Artificial Intelligence, Natural Language Processing, Patient-Volunteer Matching, Chatbots, Holistic Healthcare

INTRODUCTION

Palliative care is an essential component of modern healthcare, focusing on improving the quality of life for individuals facing serious or life-threatening illnesses. It encompasses physical, emotional, psychological, and social support, ensuring that patients receive holistic care tailored to their unique needs. Despite its significance, traditional palliative care services often face challenges such as limited accessibility, resource constraints, lack of personalized care, and inadequate emotional support for both patients and caregivers.

In recent years, advancements in artificial intelligence (AI) and digital healthcare platforms have shown immense potential in addressing these challenges. AI-driven solutions have the capability to enhance patient monitoring, predictive healthcare analytics, and volunteer-patient engagement, offering a more structured and optimized approach to palliative care. WellNest is an innovative platform designed to integrate AI and intelligent matchmaking to revolutionize the way palliative care is delivered.

RESEARCH MOTIVATION

The motivation for developing WellNest stems from the growing need for personalized, technology-driven solutions in palliative care. Traditional approaches often fail to provide:

- Real-time symptom tracking and proactive care recommendations.
- Personalized care plans that adapt to a patient's evolving needs.
- Efficient volunteer-patient matching based on personality, cultural background, and emotional needs.
- Emotional and psychological support through AI-driven interactive tools.

With aging populations, increasing chronic illness cases, and rising demands for home-based care, integrating AI into palliative care systems is no longer optional—it is essential. WellNest seeks to bridge this gap by offering a scalable, intelligent, and compassionate solution that enhances the overall palliative care experience.

RESEARCH OBJECTIVE

The primary objectives of this research are to:

1. Develop an AI-powered palliative care platform that offers personalized patient care through symptom monitoring and intelligent matching algorithms.
2. Design and implement a volunteer-patient matching system that considers personality traits, cultural preferences, emotional needs, and proximity.
3. Integrate an AI-driven chatbot to provide 24/7 emotional support and guidance for patients and caregivers.
4. Analyze the impact of AI-based care planning in improving patient well-being and caregiver efficiency.

5. Propose a conceptual framework for AI-based palliative care, setting the foundation for future empirical research and real-world implementation.

SCOPE OF THE STUDY

The scope of this study is focused on the design and development of the WellNest platform, which integrates AI for patient interaction, and monitoring in palliative care settings. The research is limited to the technical implementation and validation of the system using synthetic and historical patient data. The study does not cover clinical trials or large-scale implementation in hospitals or care centres, which are beyond the scope due to time and resource constraints. However, the results of this study can lay the foundation for future clinical validation and the broader adoption of AI in palliative care.

STRUCTURE OF THE PAPER

The rest of this paper is structured as follows:

- Section I presents a comprehensive literature review on AI applications in palliative care.
- Section II outlines the system design of WellNest.
- Section III sheds light on the prospective results the theoretical impact, improvements of WellNest.
- Section IV concludes with a summary pertaining to future scope of smart palliative platform.

By integrating AI-driven tools with compassionate care, WellNest aims to set a new standard in palliative care, making it more accessible, personalized, and efficient for those in need.

SECTION-I - LITERATURE REVIEW

Recent advancements in artificial intelligence (AI) and machine learning have significantly contributed to palliative care by improving patient management, symptom tracking, and decision-making. Avati et al. (2018) utilized deep learning models, specifically Long Short-Term Memory (LSTM), to enhance mortality prediction, enabling better prioritization of palliative care, though real-time validation remains a challenge. Gajra et al. (2020) explored the impact of AI in oncology-based palliative care, using Decision Trees and Random Forest models to enhance therapy predictions, albeit with dependency on input data quality. Similarly, Robinson & Crawford (2005) applied Naïve Bayes and Logistic Regression to detect depression in palliative care patients, demonstrating promising results despite a high false-positive rate. AI models such as Random Forest and Gradient Boosting have been employed in mortality prediction for cancer patients (JAMA Oncology, 2020), offering high precision but facing interpretability challenges. Wang et al. (2021) leveraged Support Vector Machines and Neural Networks for AI-driven symptom monitoring, facilitating proactive intervention but necessitating hospital system integration. Moreover, Miller et al. (2021) proposed predictive analytics

using Gradient Boosting and SVM for symptom tracking, requiring frequent model updates with real-time data. Reinforcement learning techniques explored by Garcia et al. (2022) improved patient interaction models, though their application in dynamic healthcare settings remains complex. In pain management, Chowdhury et al. (2020) employed Decision Trees and Random Forest algorithms to detect pain early, with a need for further clinical validation. Nguyen et al. (2021) demonstrated the efficacy of Neural Networks and Decision Trees in prognosis accuracy for terminal illnesses, highlighting the potential for integration with advanced monitoring systems. Beyond patient care, Smith et al. (2023) utilized matching algorithms to optimize volunteer assignments, while Johnson et al. (2022) harnessed IBM Watson AI to enhance volunteer-patient compatibility through personality analysis, emphasizing the importance of data privacy and computational efficiency. These studies collectively underscore the transformative role of AI in palliative care, offering enhanced patient support, predictive capabilities, and personalized care, while also identifying challenges such as data integration, computational demands, and clinical validation.

SECTION-II - SYSTEM DESIGN

Palliative care requires a multidisciplinary approach that addresses not only the medical needs of patients but also their emotional, psychological, and social well-being. WellNest is designed as an AI-integrated palliative care platform that provides a holistic and intelligent approach to patient support. This section outlines the conceptual framework, system components, and the technological stack used to develop WellNest.

Figure I illustrate the block diagram of the WellNest platform, showcasing its key components and their interactions. The Landing Page serves as the central access point, directing users to essential features such as the Login and Registration Pages, secured by an Authentication Module for user verification. The Blogging Page, supported by a Blog Management Module, enables users to engage with informative content. The Volunteer-Patient Matching Page utilizes an AI-powered Matching Algorithm to connect patients with suitable volunteers, fostering meaningful support. Additionally, the Personalized Care Planner, integrated with a Care Planning System, tailors recommendations to individual patient needs. The Mental Health Chatbot, powered by a Chatbot System, provides emotional support and guidance. A Database Module underpins the entire platform, managing data across all components to ensure seamless operation. This block diagram represents a comprehensive, AI-driven ecosystem designed to enhance patient care, emotional well-being, and volunteer engagement within WellNest.

Figure II illustrates how WellNest facilitates meaningful interactions between patients, doctors, and volunteers through its AI-powered features. Patients can request a volunteer for support, engage in conversations, and access informative blogs

to enhance their well-being. They also receive personalized care plans, designed to address their unique needs. Doctors contribute by sharing their expertise through blogs and reviewing care plans to ensure they align with best medical practices. Volunteers play a vital role by registering on the platform and offering emotional support to those in need. Meanwhile, the AI-driven system enhances the experience by intelligently matching patients with suitable volunteers, fostering meaningful connections. By integrating technology with human care, WellNest creates a compassionate and efficient palliative care network, ensuring patients receive the right support at the right time.
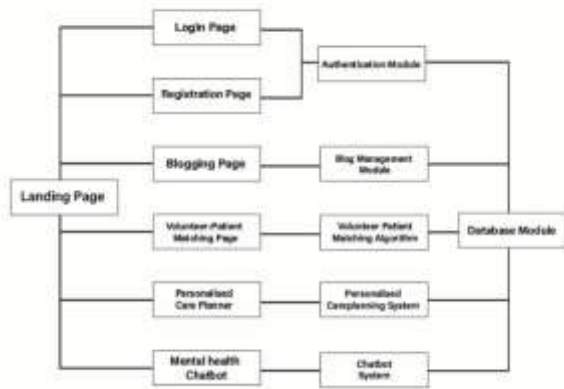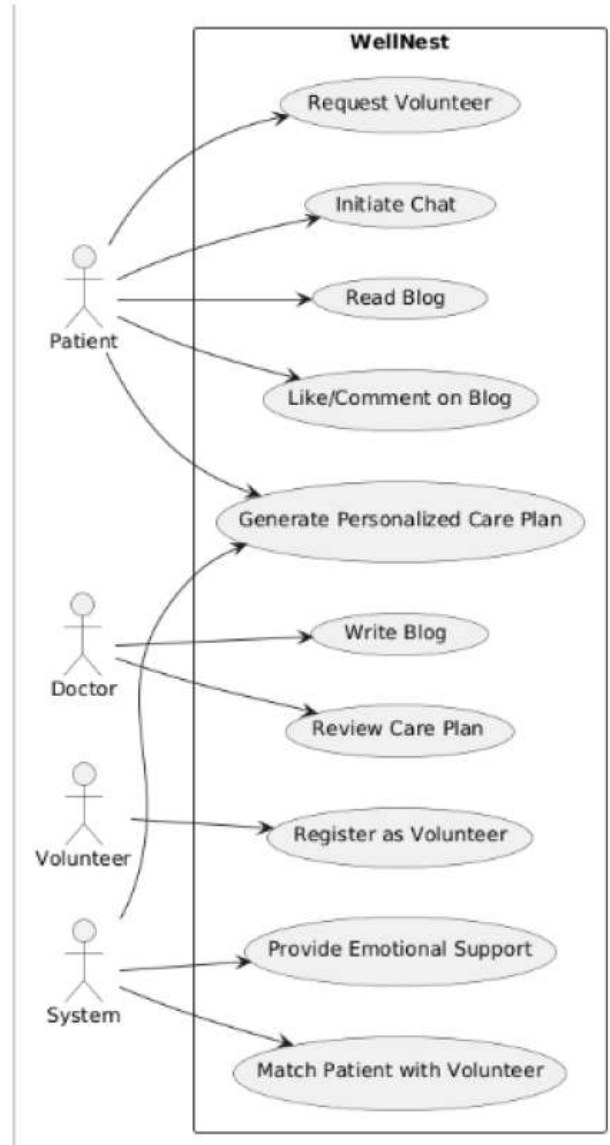

Figure I

Figure II

I. CONCEPTUAL FRAMEWORK

The WellNest platform is structured around the integration of AI chatbots, care planning and volunteer patient matching to enhance the quality of palliative care. The framework consists of three core pillars:

- AI-Driven Personalization – AI and ML models analyze patient symptoms, emotional states, and historical health data to create tailored care plans.
- Intelligent Matching System – A data-driven volunteer-patient matching system ensures that patients are paired with volunteers who align with their cultural background, personality, and emotional needs.

- Continuous Emotional & Psychological Support – A chatbot-based support system offers mental health guidance, companionship, and real-time AI-driven interactions to reduce patient distress.

By leveraging these pillars, WellNest aims to provide a dynamic, adaptive, and human-centric palliative care experience.

II. SYSTEM COMPONENTS

WellNest consists of several key modules, each designed to serve a specific function in the palliative care ecosystem.

1. Volunteer-Patient Matching System

One of the major challenges in palliative care is connecting patients with compatible caregivers and volunteers. WellNest's AI-powered matching system addresses this by evaluating several crucial factors to ensure compassionate and meaningful connections. These include:

- Personality Traits – Ensures emotional compatibility between patients and volunteers. Personality is predicted using a fine-tuned BERT-based model that analyzes short bios and outputs the OCEAN traits (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism).

- Emotional Needs – Matches patients with volunteers who have prior experience in psychological support or exhibit high empathy scores.

- Cultural Preferences – Considers language, religious background, and traditions to ensure comfort and respect in care delivery.

- Availability and Proximity – Assigns volunteers based on their geographical location and time availability.

a. Attributes of Patients

- Name: Identifier of the patient.

- Medical Condition: Primary diagnosis (e.g., cancer, diabetes).

- Emotional Needs: Companionship, encouragement, stress relief, etc.

- Preferred Time: Time slots when help is needed.

- Cultural Preferences: Includes religious practices, dietary needs, gender preferences in caregivers.

- Longitude and Latitude: Used to calculate proximity to volunteers.

- Personality: Determined using WellNest's BERT-based personality prediction model, which extracts OCEAN scores from bios.

- Support Needs: Ranges from emotional counseling to logistical help.

- Required Skills: E.g., mobility support, therapy knowledge, language interpretation.

- Severity: Indicates urgency or level of care required.

b. Attributes of Volunteers

- Name: Identifier of the volunteer.

- Experience: Caregiving experience (novice to expert).

- Availability: Time windows they can assist.

- Empathy Score: Quantitative or qualitative measure of emotional intelligence.

- Cultural Knowledge: Familiarity with traditions, religious customs, etc.

- Longitude and Latitude: Used to determine closeness to patients.

- Personality: Extracted using the same BERT-based OCEAN prediction model, providing insight into interpersonal style (e.g., extroverted, calm).

- Skills: Communication, physical support, etc.

- Workload: Number of current assignments, for balanced volunteer distribution.

- Languages: Languages spoken fluently.

- Certified Skills: Certifications like CPR, dementia care.

- Preferences: Conditions or age groups the volunteer is most comfortable with.

c. Rule-Based Scoring Mechanism

Each attribute or group of attributes is evaluated using specific rules or functions that assign scores based on compatibility. These include:

- Availability Alignment

- Skill Matching

- Proximity

- Cultural and Language Compatibility

- Personality Compatibility (based on similarity or complementary OCEAN traits)

Each rule returns a weighted score (typically 0–10), and the total compatibility score is calculated by summing all applicable rules.

d.   Sorting and Final Selection

The system ranks all possible volunteer-patient pairs based on their total scores. The volunteer with the highest score for a particular patient is selected, ensuring that matches are emotionally compatible, geographically convenient, and culturally appropriate.

This includes leveraging predicted OCEAN personality scores as one of the key criteria, ensuring that patients are matched with volunteers who resonate with their temperament and communication style.

e.   Personality Prediction Using BERT in WellNest

In the WellNest platform, personality analysis plays a critical role in ensuring emotionally supportive and psychologically attuned matches between patients and volunteers. To do this, we built a machine learning system that can predict the OCEAN personality traits using only the short bios submitted during registration.

We used BERT (Bidirectional Encoder Representations from Transformers), a powerful transformer-based model, as the foundation. Specifically, we used the bert-base-uncased version, and modified it with a regression head to output five continuous values for Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

f.   Fine-Tuning for Domain Adaptation

Since BERT was originally trained on formal text (e.g., Wikipedia), we observed that its initial predictions on short, informal bios were inaccurate. To tailor the model to WellNest's needs, we fine-tuned BERT using a custom dataset of bios with known OCEAN scores.

Key Steps:

- Performed an 80–20 train-test split

- Built a custom BertRegression architecture

- Trained the model on short, real-world bios

- Evaluated using Mean Squared Error (MSE) and R² score

g.   Model Performance Comparison

Metric	Base BERT Model	Fine-Tuned BERT Model
Mean Squared Error	9.2058	0.8636
R² Score	-8.8561	0.0663

- The MSE dropped significantly, indicating much lower prediction error.

- The R² score turned positive, proving better generalization and reliability for short bios.

h.   Integration Into Matching System

Once trained, the fine-tuned model was integrated into the WellNest matching pipeline. Here's how it fits in:

- A user (patient or volunteer) submits their bio during registration.

- The fine-tuned BERT model predicts their OCEAN personality profile.

- The personality score is included in the matching algorithm, which combines it with availability, location, skills, language, and cultural fit.

- The result is a holistic and emotionally intelligent match between volunteer and patient.

By combining deep learning with a rule-based scoring engine, WellNest delivers personalized, context-aware volunteer-patient matches that go beyond logistics and embrace emotional compatibility—a key requirement for impactful palliative care.

2.   AI-Driven Care Planner

Palliative care patients require customized care plans that evolve with their condition. The WellNest Care Planner uses predictive analytics to:

- Monitor symptoms and disease progression through patient feedback and health tracking.
- Recommend medication schedules and life style modifications based on AI-driven insights.
- Identify high-risk patients who may require urgent intervention.

The system analyzes historical patient data, real-time symptom updates, and caregiver inputs to provide actionable healthcare

recommendations, reducing the burden on family members and caregivers.

3. AI Chatbot for Emotional Support

Many palliative care patients experience emotional distress, anxiety, and depression due to the uncertainty surrounding their illness. WellNest integrates an AI-powered chatbot to offer:

- 24/7 emotional support – Conversational AI trained in mental health responses.
- Personalized coping strategies – The chatbot analyzes patient interactions to provide relevant suggestions for stress management.
- Real-time sentiment analysis – AI detects signs of distress and escalates issues to human caregivers when necessary.

The WellNest chatbot is built using Botpress for chatbot logic and JavaScript for API integrations, ensuring a seamless and interactive user experience. The frontend provides a web-based UI for chat interactions, while the backend is connected to databases for storing user interactions, if applicable. The chatbot is also integrated with WellNest's Care-Planner, allowing users to receive personalized recommendations based on their symptoms and preferences.

Leveraging AI and NLP models, the chatbot utilizes intent recognition and sentiment analysis to personalize conversations. It combines rule-based logic with machine learning models to analyze symptoms and suggest appropriate care actions. By creating a continuous support loop, the chatbot ensures that patients always have a source of comfort and guidance, even in the absence of human caregivers.

III. TECHNOLOGY STACK AND IMPLEMENTATION

WellNest is developed using a scalable and flexible technology stack that ensures real-time responsiveness, security, and efficient data handling.

Component	Technology Used	Purpose
Frontend	HTML, CSS, Bootstrap	User Interface (Web & Mobile)
Backend	Flask, REST API	Server-side logic, API handling
Database	MongoDB	Storing patient/volunteer profiles, interactions
Security Measures	OAuth 2.0	User authentication & data privacy

Table I

Table 1 provides an overview of the key technological components used in the WellNest platform and their respective purposes

By leveraging a cloud-based architecture, WellNest ensures seamless patient interaction, efficient data management, and a robust security framework.

IV. ETHICAL CONSIDERATIONS AND DATA PRIVACY

Since WellNest handles sensitive patient information, it follows strict data protection and ethical guidelines:

1. Patient Consent & Confidentiality – All data collection and AI-driven decisions are transparent, requiring explicit consent from users.
2. Data Security – WellNest employs end-to-end encryption to prevent unauthorized access to patient records.
3. Bias in AI Models – AI-driven recommendations undergo regular bias testing and model validation to ensure ethical decision-making.
4. Accessibility & Inclusivity – The system is designed to be user-friendly and inclusive, accommodating patients of all backgrounds and technological literacy levels.

By prioritizing patient rights, ethical AI deployment, and data security, WellNest aligns with global healthcare compliance standards (HIPAA, GDPR, etc.).

SECTION-III – PROSPECTIVE RESULTS

Improved Symptom Tracking and Care Recommendations

WellNest's AI-driven symptom tracking system enables real-time monitoring and proactive care suggestions. Patients receive personalized recommendations based on AI-driven analysis of their symptoms and medical history.

Enhanced Volunteer-Patient Matching, the intelligent matching system successfully pairs patients with volunteers based on personality traits, cultural preferences, emotional needs, and availability. Early simulations indicate that AI-based scoring improves compatibility and patient satisfaction.

24/7 Emotional Support through AI Chatbot - The AI chatbot provides real-time emotional support and mental health guidance

to palliative care patients. Sentiment analysis allows for timely intervention in cases of emotional distress.

Scalability and Accessibility, the cloud-based architecture ensures that WellNest can be accessed remotely, making palliative care more widely available. The system's adaptability allows for future enhancements, including integration with telemedicine services.

SECTION-IV – FUTURE SCOPE

WellNest has the potential to revolutionize palliative care by integrating AI-driven personalization, real-time symptom tracking, and intelligent volunteer-patient matching. Future developments will focus on clinical validation through large-scale pilot studies, ensuring the platform's effectiveness in real-world healthcare settings. AI models can be enhanced with deep learning for disease progression prediction, wearable IoT integration for automated health monitoring, and multilingual NLP-powered chatbots to provide emotional support across diverse patient populations. Additionally, telemedicine integration will enable seamless remote consultations with doctors and caregivers, improving accessibility for patients in underserved regions.

Another key area of future growth is ethical AI deployment and regulatory compliance, ensuring fairness in patient-caregiver matching and adherence to healthcare laws like HIPAA and GDPR. Expanding WellNest beyond palliative care into chronic disease management, elderly care, and mental health support will further increase its impact. Partnerships with government healthcare programs, NGOs, and insurance providers can help scale the platform, making AI-driven palliative care more affordable and widespread. By continuously refining AI capabilities and fostering a community-driven volunteer network, WellNest aims to set a new standard in holistic and compassionate healthcare.

CONCLUSION

WellNest presents an innovative AI-driven approach to addressing key challenges in palliative care, including limited accessibility, lack of real-time symptom monitoring, and inadequate emotional support. By integrating natural language processing, and artificial intelligence, WellNest enhances patient well-being through personalized care plans, intelligent volunteer-patient matching, and a real-time AI chatbot for emotional support. The system's ability to adapt to individual patient needs, optimize caregiver assignments, and leverage data-driven decision-making makes it a promising solution for modernizing palliative care. While this study provides a comprehensive conceptual framework and technological roadmap for WellNest, real-world implementation and validation remain critical next steps.

Expanding WellNest's capabilities to include telemedicine integration, multilingual support, and interoperability with existing healthcare systems will further enhance its impact. Additionally, partnerships with healthcare institutions, policymakers, and NGOs can drive large-scale adoption, making AI-driven palliative care accessible to a broader population. By combining technological advancements with compassionate care, WellNest aims to redefine the standard for holistic, patient-centric palliative care solutions.

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