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WellNest – AI Driven Elder Care System

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Abstract **- The growing number of older adults has made it essential to develop intelligent systems that support their health, safety, and independence. Most elderly care solutions are scattered—they focus on just one thing, like spotting falls or sending medication reminders, instead of bringing everything together. This paper introduces WellNest, an AI-powered elder care system that pulls all these features into one connected platform. WellNest combines real-time fall detection and activity monitoring using computer vision, built on MediaPipe and OpenCV, and adds GPS location tracking for outdoor safety. A Kotlin-based mobile app makes it easy for elders and caregivers to interact, while a backend running on .NET Core keeps data safe and handles everything behind the scenes. For extra support, WellNest manages prescriptions and automatically sends out notifications—either through Firebase Cloud Messaging or email if there's an emergency. Caregivers get a single dashboard for real-time updates, enabling quick responses and better decisions. Tests show that WellNest reliably spots unusual behavior and delivers alerts promptly in different scenarios. With this setup, the system boosts safety, speeds up emergency response, and helps older adults stay independent.**

Keywords-- **Elder care, Artificial Intelligence, Fall detection, Activity monitoring, GPS tracking, Mobile application, Firebase Cloud Messaging.**

I. INTRODUCTION

The rapid growth of the elderly population has created a significant demand for systems that can effectively support their health, safety, and day-to-day living. As life expectancy continues to increase, a large number of older adults are choosing to live independently. While this promotes dignity and self-reliance, it also introduces several risks, including falls, prolonged inactivity, missed medications, and delayed medical attention. These issues, when not addressed in time, can lead to severe health complications and even life-threatening situations. Traditional caregiving approaches and existing assistive technologies provide only partial solutions, often lacking continuous monitoring and the ability to respond quickly in emergency scenarios.

In recent years, advancements in technologies such as Artificial Intelligence (AI), computer vision, and mobile computing have paved the way for the development of smarter and more efficient healthcare systems. These technologies enable real-time data processing, automated decision-making, and improved communication between users and caregivers.

Despite these advancements, most existing solutions are designed to address specific problems in isolation. This fragmented approach limits their overall effectiveness, as it fails to provide a comprehensive understanding of an individual's condition and environment.

To address these limitations, this paper introduces WellNest, an AI-powered elder care system designed to provide a unified and intelligent solution for continuous monitoring and assistance. The system integrates multiple functionalities, including activity monitoring using computer vision techniques, location tracking through GPS, and a mobile-based interface that facilitates seamless interaction between elderly users and caregivers. By leveraging frameworks such as MediaPipe and OpenCV, the system is capable of analyzing real-time movements and detecting abnormal events such as falls and inactivity. Overall, WellNest aims to enhance the safety, independence, and quality of life of elderly individuals while simultaneously reducing the burden on caregivers.

II. LITERATURE SURVEY

Recent breakthroughs in Artificial Intelligence (AI), Internet of Things (IoT), and mobile technology have reshaped elderly care systems in remarkable ways. As the global population ages, demand has surged for intelligent solutions that can deliver continuous monitoring, timely assistance, and a better quality of life for older adults.

AIoT-based solutions, which merge artificial intelligence with IoT devices, now stand out as a powerful answer for real-time monitoring and analysis. Qian and colleagues conducted an in-depth study of AIoT in elderly care, concentrating on assisted living and healthcare monitoring. They show that sensor, camera, and wearable device data—when analyzed through machine learning—can detect falls, recognize activities, and monitor health. These advances promote both safety and independence, but concerns about privacy, heavy power use, and complexities of deploying these systems at scale still loom large [1].

Smart homes for elderly care have gotten a lot of attention too. Shi and colleagues studied the impact of AI-driven smart home technology on elderly well-being, classifying solutions by health monitoring, safety, and psychological support. These systems rely on IoT sensors, deep learning, and automation. Still, device compatibility, data security, and significant implementation costs continue to stand in the way of broader adoption [2].

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Machine learning has become a common tool for predicting health problems and understanding behavior in older adults. Models like Artificial Neural Networks, Support Vector Machines, Random Forest, and XGBoost have proven they can predict health status and detect risk factors with notable accuracy [3].

Mobile-based elder care apps open up new ways for seniors to communicate, track their health, and call for help in emergencies. Studies find that mobile health (mHealth) boosts accessibility and can cut healthcare costs, but they often rely on users to input data manually and don't offer much in the way of automated monitoring [4][8]. Researchers are also looking to AI for emotional support, hoping to ease loneliness and support mental health for seniors, though ethical issues such as privacy and data security remain concerns [5][6]. Most current systems focus on one area at a time instead of delivering a fully unified experience [7][11][12].

To address these gaps, the proposed WellNest system brings together AI-powered activity monitoring, GPS location tracking, prescription management, and real-time alerts, all in one platform. By integrating these elements, WellNest delivers a comprehensive, scalable solution that boosts safety, efficiency, and the overall quality of life for elderly individuals.

III. METHODOLOGY

The proposed WellNest system follows a structured approach to provide comprehensive monitoring and assistance for elderly individuals. It integrates Artificial Intelligence, mobile computing, and cloud-based services to ensure real-time tracking, activity analysis, and alert generation. The system is designed as a multi-module architecture where each module performs a specific function while working cohesively to deliver an efficient and reliable solution.

A. System Architecture

The overall architecture of the WellNest system consists of five major modules: User Interaction Module, Monitoring Module, Location Tracking Module, Dashboard Module, and Notification Module. These modules are interconnected through a centralized backend system that manages data processing, storage, and communication. The system begins with data acquisition through camera input and mobile sensors. The collected data is processed using AI-based algorithms to detect activities and abnormalities. Caregivers access this information through a mobile application, which provides real-time updates and alerts.

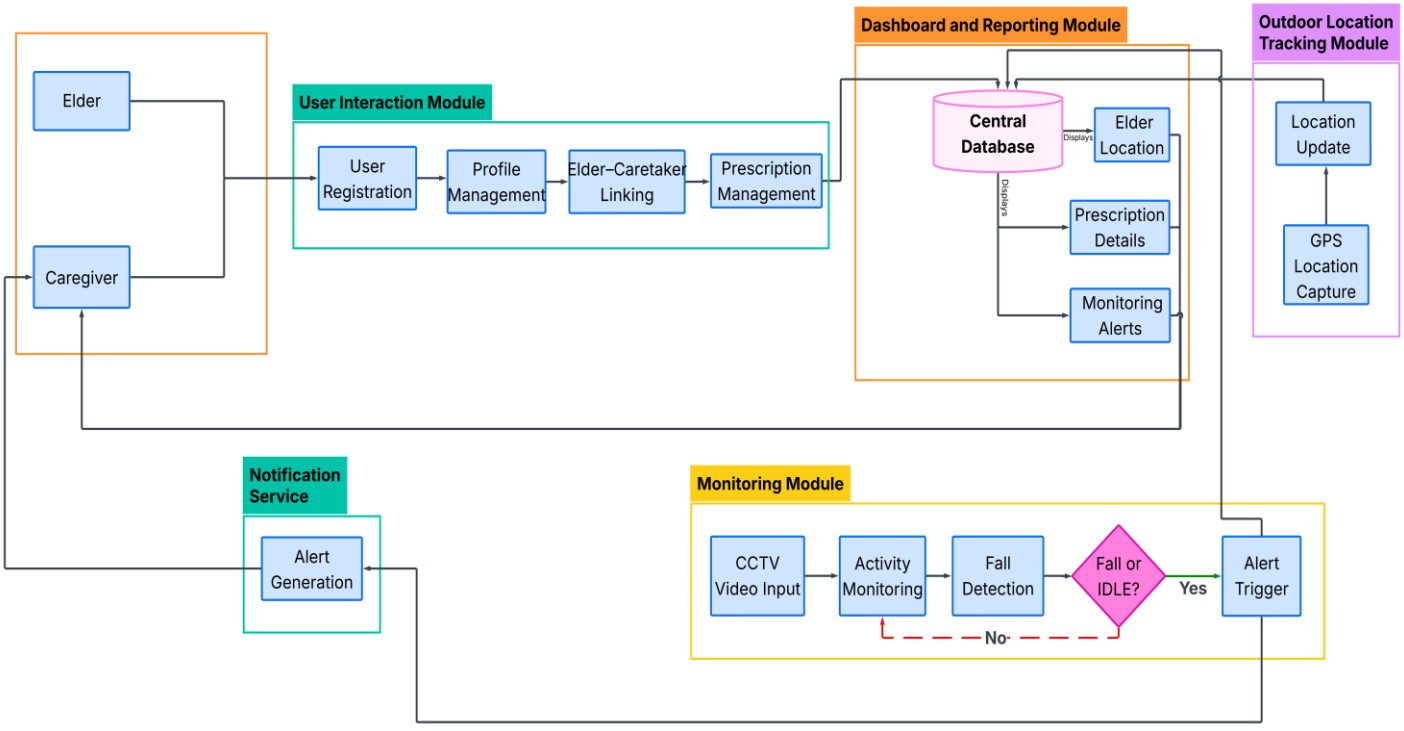

Fig -1: System Architecture

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B. User Interaction Module

The User Interaction Module facilitates communication between elderly users and caregivers. It includes functionalities such as user registration, authentication, and profile management. The module allows caregivers to link with elderly users, enabling seamless monitoring and data sharing. The mobile interface is designed to be simple and user-friendly, ensuring accessibility for both elderly individuals and caregivers.

C. Monitoring Module

The Monitoring Module is responsible for tracking the physical activities of the elderly using computer vision techniques. It utilizes camera input to continuously observe the user's movements. The system employs MediaPipe and OpenCV to analyze posture and motion in real time. Based on the analysis, the system can detect critical events such as falls and prolonged inactivity. Fall detection is achieved by analyzing body posture and sudden changes in position, while inactivity monitoring identifies unusual periods of no movement. When such events are detected, the system triggers alerts to notify caregivers.

D. Location Tracking Module

The Location Tracking Module provides real-time tracking of the elderly user's geographical location using GPS technology. This feature is particularly useful in outdoor environments where monitoring through cameras is not possible. The location data is continuously updated and made accessible to caregivers through the mobile application. In case of emergencies or unusual movement patterns, the system can quickly identify the user's location and send alerts, ensuring the safety of the elderly in both indoor and outdoor scenarios.

E. Dashboard Module

The Dashboard Module provides a centralized interface for caregivers to monitor all activities and system data. It displays information such as activity logs, fall detection events, location history, and alerts. The dashboard is designed to present data in a clear and organized manner, enabling caregivers to quickly assess the situation and take necessary actions. This module also supports data visualization and report generation, which helps in analyzing long-term patterns in the user's behavior and health.

F. Notification Module

The Notification Module is responsible for delivering alerts and updates to caregivers in real time. It integrates Firebase Cloud Messaging (FCM) and email services to ensure reliable communication. When a fall, inactivity, or emergency situation is detected, the system immediately sends notifications to the caregiver's device, enabling timely intervention and reducing the risk of serious consequences.

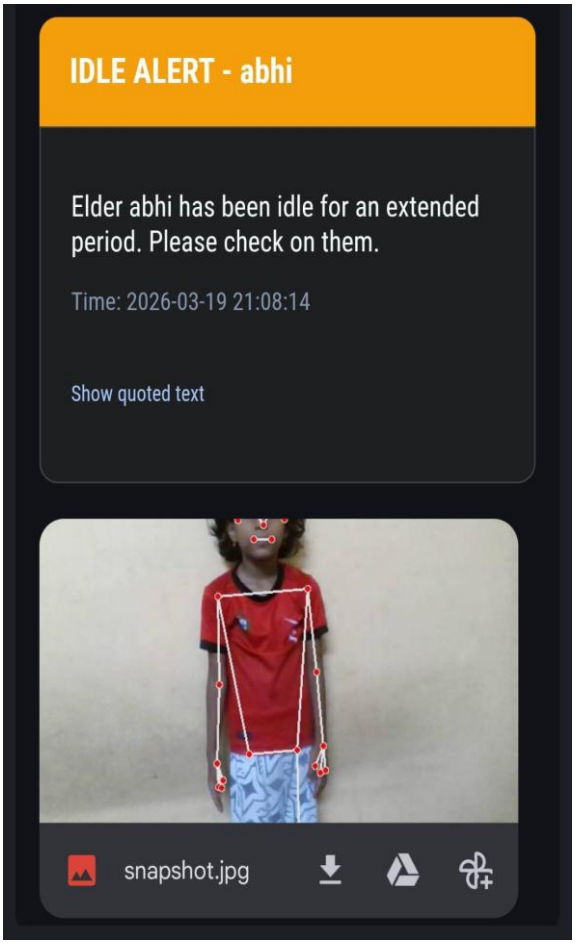

Fig -2: Idle Alert via Mail

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Fig -3: Fall Alert via Mail

IV. Implementation And Results

The implementation of the WellNest system integrates hardware, software, and communication technologies to ensure real-time monitoring and assistance for elderly individuals.

A. Hardware Implementation

A camera device is used to continuously capture video input of the elderly individual. The hardware setup is simple, cost-effective, and suitable for indoor monitoring. Captured video data is transmitted to the processing unit for analysis. The system ensures low latency to enable real-time detection of critical events.

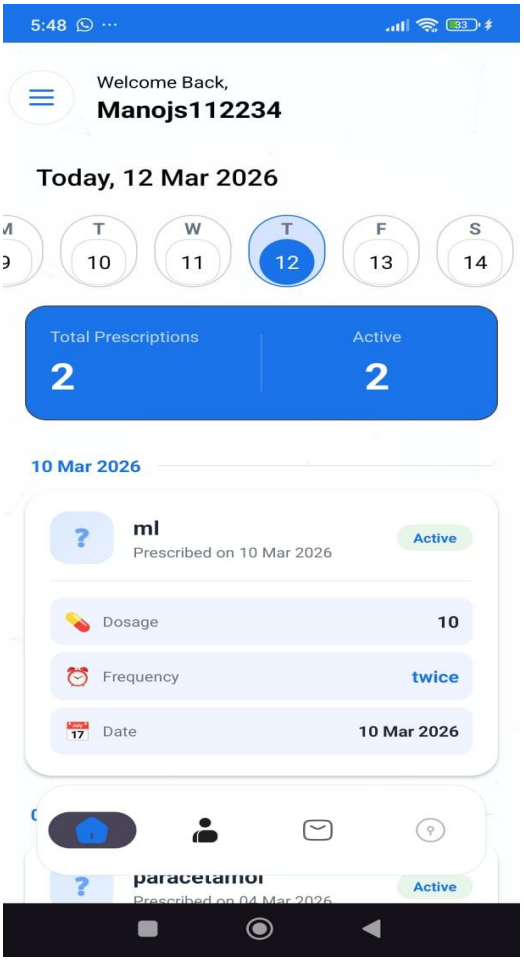

Fig -4: Mobile Application Interface

B. Software Implementation

Activity Detection: Implemented using OpenCV and MediaPipe frameworks. Processes video frames to analyze body posture and movement. Detects events such as falls and prolonged inactivity. Converts detection results into alerts.

Mobile Application: Developed using Kotlin for Android devices. Provides real-time monitoring interface for caregivers. Displays alerts, activity logs, and location data. Enables communication between caregiver and elderly user.

Backend System: Developed using .NET Core. Handles data processing, storage, and communication. Ensures secure data management. Integrates notification services.

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C. System Workflow

The system workflow involves: (1) Capture video input using camera, (2) Process frames using AI-based algorithms, (3) Detect activities and abnormal events, (4) Generate alerts for critical situations, (5) Send notifications to caregiver via mobile application.

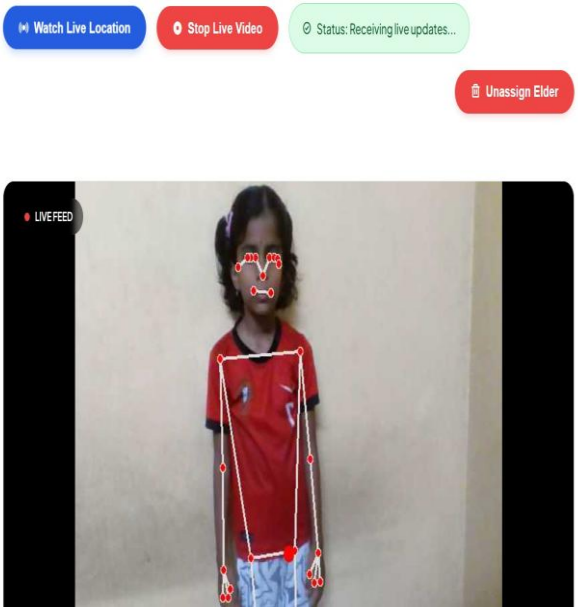

Fig -5: Live Monitoring

D. System Testing and Evaluation

System was tested under different scenarios such as normal activity, falls, and inactivity. It was evaluated based on detection accuracy and response time, demonstrating reliable performance in identifying critical events. Alerts were delivered with minimal delay and the system ensured stability under continuous operation.

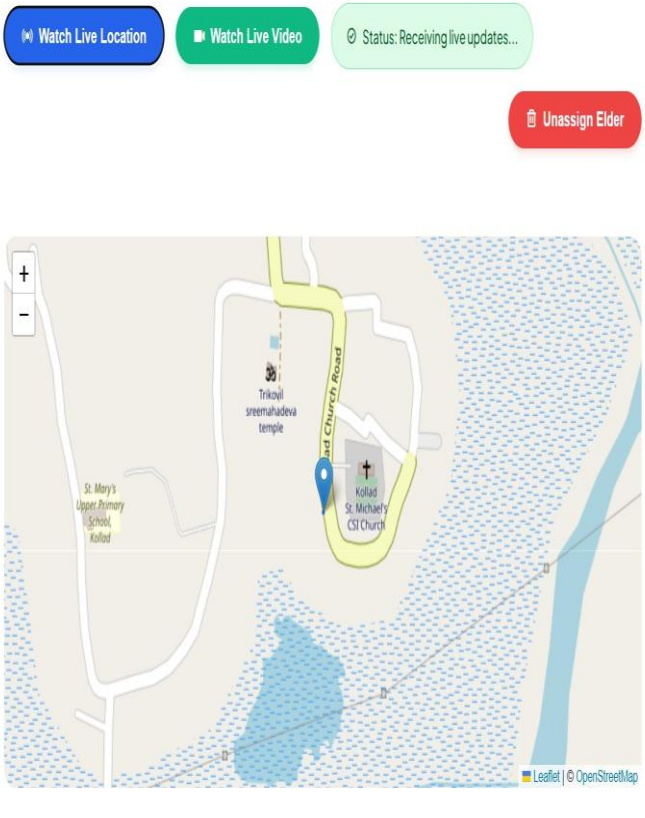

Fig -6: Location Tracking

V. CONCLUSION

The WellNest system offers a thoughtful, well-rounded approach to elderly care by bringing together artificial intelligence, mobile technology, and real-time monitoring into one coherent package. It tackles pressing issues head-on—fall detection, inactivity monitoring, and location tracking—all through a single, easy-to-use platform.

By tapping into tools like MediaPipe and OpenCV for computer vision, plus a mobile app backed by a .NET server, WellNest keeps tabs on users nonstop and keeps communication lines open between older adults and their caregivers.

The results show that WellNest reliably spots major incidents—like falls or extended inactivity—and gets alerts out to caregivers fast. Extra features such as prescription tracking and instant notifications make daily life easier and add a layer of practicality for both users and caregivers. WellNest does not just make life safer for elderly individuals; it gives them more independence and relieves pressure on caregivers. Down the line, adding more advanced machine learning, supporting wearables, and boosting system scalability could open WellNest up to support even larger communities, making elderly care smarter and more accessible for everyone involved.

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