SmrutiPankha: A Renewed Approach to Live with Alzheimer

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Abstract— Dementia, a broad category of neurodegenerative disorders, impacts millions globally, with Alzheimer's disease being a leading cause. The challenges associated with Alzheimer's Disease (AD) necessitate innovative solutions that can assist patients and reduces the burden on caregivers.

This research explores the use of IoT-based healthcare solutions, specifically wearable devices, to support Alzheimer's care. The wearables are designed to be adaptive and responsive to individual AD patient needs, helping to Assists the AD patients over symptoms such as frustration, repetition, and poor judgment. These technologies also offer caregivers valuable tools for better understanding and managing the condition, ultimately leading to more effective and personalized care strategies.

Key words: - IOT, Wearable devices, Alzheimer, Automated Assistance.

I. Research on Wearable technologies

Wearable technology has transformed health care, that it allows continuous monitoring in real time and offers some sort of support. Common wearables include smartwatches, fitness trackers, and smart eyewear; these all collect health data on movement, heart rate, and sleep patterns. Many connect via Bluetooth to mobile phones, thus allowing easy access for the patients and carers. Wearable technology is availed in Alzheimer's care, with some offering geo-fencing features, which prevent patients from leaving designated areas. Some of the gadgets use AI in detecting falls and sending out emergency notifications.

1. Wearables like smartwatches: These have integrated sensors for movement, heart rate, and even oxygen saturation. In the instance of patients with Alzheimer's disease or other conditions where wandering may be a potential factor, many smartwatches designed for the healthcare industry incorporate GPS tracking.[1].
2. Wearable Fitness Trackers: Devices from Fitbit and Garmin long overcooked stage of simple counting of steps. They greatly contribute to insight into physical health though daily activity tracking allows sleep analysis so that the patient can maintain healthy routine.[2].
3. Wearable ECG Monitors: Advanced wearables can provide real-time ECG readings to a patient with ease. Such devices are a necessity on the part of patients who have risks associated with the heart. Withing's and Apple, among other companies, have come up with devices that monitor heart health, sync with phones, and raise alerts for any form of anomaly to caregivers.[3].
4. Smart Glasses: Much more than pure entertainment, smart glasses can also provide AR overlays for those who have trouble remembering things. Such wearables might remind the patient what day it is, what needs to be done, and what is important to remember, or even help them recognize faces which they should know by utilizing facial recognition software integrated into the wearable.[1].

Wearable technology in general goes a long way in monitoring mobility, real-time communication, and integration of geo-fencing features for safety in Alzheimer's care. In the future, wearables may offer predictive analysis, identifying patterns in movements and actions of a patient to predict emergencies.

II. Proposed Solution: Action Tracking System for Alzheimer's Patients

The proposed action-tracking system would make use of AI with Computer Vision technology in order to offer real-time assistance tailored to the needs of the person affected. The solution would be designed to target all special needs arising from caring for the patients in general terms of daily activities monitoring and their safety while also reducing burdens on caregivers.

1. Real Time Action Tracking

It contains sensors, such as motion detectors and cameras that enable the wearable device to track the patient's physical activities and his location. It aids in

pattern recognition and might detect abnormal activities on account of gathering real-time data.
Motion Detection: Activity sensors are embedded in a wearable device and track activities such as walking, sitting, or lying down. This information contributes to the recognition of regular activities and the detection of deviations that may indicate a problem, such as a long period of inactivity or a fall.
Camera Integration: Computer vision can facilitate integrating a camera that captures the visual data of whatever the patient has around them, whether it is objects or people. This is very helpful in understanding what the patient is interacting with; it aids in recognizing familiar faces or objects.

2. AI-Powered Data Processing and Analysis

Once captured, the data is processed through the algorithms of AI and Machine Learning. The AI system learns daily patterns that a patient goes through in order to detect deviation and hence the onset of risk.
Pattern Recognition: the AI system identifies routine patterns such as when people eat, take walks, or rest. The machine learning models are specific to the behaviours which are exhibited from a patient; thus, it will be a very personalized system.
Anomaly Detection: The AI detects anomalies such as disorientation, wandering, or lack of mobility. If such issues are detected, the system prompts the patient directly or notifies the caregiver.

3. Action Prediction and Guidance

Based on the learned patterns, the system predicts subsequent actions of the patient and offers him timely guidance or intervention. For example, when the patient is about to leave the house or enter an unsafe area, the system triggers off an audio or visual alert.
Audio-Based Assistance: The device prompts through voice to guide the patient. For example, it detects when a patient approaches a door that is not in their routine and would say something like, "Please wait for assistance," or, "Time for your medication."
Contextual aid: The system would automatically adapt to the patient's environment. For example, if a patient is in or near the kitchen, it would make the inference that meal preparation could be being done and prompt the user to follow through on the routine and limit frustration from a memory lapse.

4. Geo-Fencing and Safety Alerts

The system is integrated with geo-fencing technology to establish virtual boundaries for safe areas, for the patients, such as the home or even a garden. GPS-based location monitoring triggers alerts if the patient moves out of the predetermined area.
Safety Boundary Alerts: In case a patient crosses the geo-fence, an automatic alert is sent to the caregivers with the location of the patient. Even voice instructions may route the patient back to the safe zone.
Notifications to Caregivers: Real-time notifications go directly to caregivers for any detected unsafe behavior, such as a fall or when the patient enters an unsafe area. The rationale is to prevent accidents or incidents of wandering-off commonly seen in Alzheimer's disease.

5. Data Privacy and Cloud Integration

The system is integrated with a cloud-based model to process data in a secure way from patients and remotely access that data from caregivers. The supporting cloud allows offline functionality that is, key functions like detection of movement and alerting abnormalities are allowed to run when there is no connection with the internet.
Cloud Security: All the information collected by the system from patients is directly encrypted while transmitting into the cloud, helping secure the regulations of protection of data. Offline Functionality: Data is stored locally in the system and syncs into the cloud upon connection. Data would therefore be able to be monitored at any time.

Diagrammatic representation

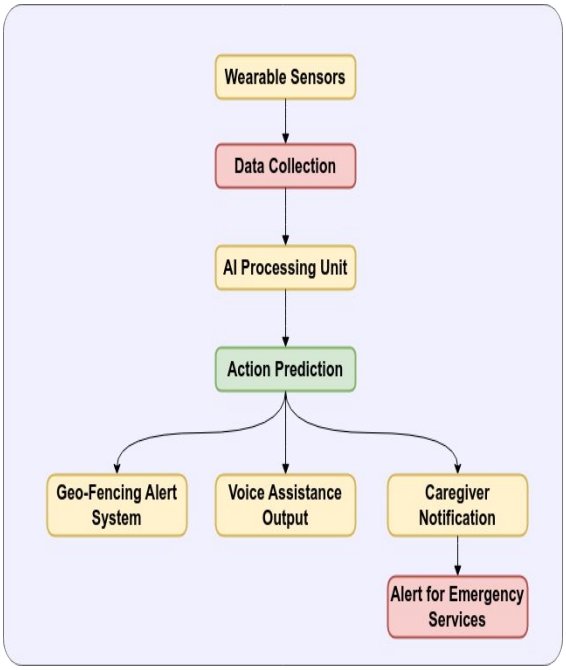

Fig. 1
(The architecture diagram captures how the system processes data and responds to various real-time inputs)

III. Explanation

Wearable sensors serve the purpose of data collection (Fig.1).

1. Wearable Sensors → Data Collection

   Wearable Sensors: In this context, a wearable device such as smart glasses, wristbands, or other types of sensors continuously acquires the subject's biometric signals, including heart rate, physical activities, location information based on GPS, and environmental conditions.

   Data Collection: The information collected by real-time sensors includes different elements, such as the patient's movement, physical condition, and current location. Later, this collected data is aggregated and fed into the system, where meaningful information is extracted through processing.

2. AI Processing Unit.

   AI Processing Unit: The gathered data is then sent further to the specified AI processing unit, where the extensive machine learning algorithms take over to elaborate on and classify the data arriving. During this process, state-of-the-art pattern recognition techniques will ascertain if the data depicts normal activities or an anomaly, which would be an indication of something wrong and leaving the stipulated areas or any longer periods than usual of inactivity that might need further investigation.

   This algorithm can also make use of previously trained models to understand different kinds of patterns. Hence, it could correct and adapt to the singular daily routine of the patient in due time.

3. AI Processing Unit→ Action Prediction.

   Action prediction: It will also try to predict what will happen next by the patient through the detailed analysis of the artificial intelligence. For instance, when the patient is standing right in front of the dining table, it will surely predict that the patient will eat dinner; if the patient is going across the space several times, this reflects that the patient is restive or may get irritated.

   Such a prediction is considered to hold particular importance because it plays a very vital role in ensuring that necessary interventions are instituted at the right time. This is important so that unsafe situations, such as incidents of wandering, could be averted.

4. Action Prediction → Geo-Fencing Alert System

   The Geo-fencing alert system is the most critical feature of this whole system. The system will monitor a patient's position in some unbroken areas of safety. If a patient happens to step out of such a zone-for instance, out of the house or out of the caregiving facility-the system is able to raise an alert on such status to the caregivers. That ensures that the patient cannot wander too far, hence reducing risks of getting lost.

5. Action Prediction → Voice Assistant Output

   Voice Assistant: The system features enhanced voice assistant capabilities to meet the needs of the patient. Through the energy harvested from the predicted user actions, the device may voice support for a user in practical instructions, timely reminders, or reassurance when one is in need. It would say something like, "Please go back to bed," or "It is time for your medication," as the system smoothest out the patient's path

   through every activity and ritual.

   This feature augments patient independence by empowering individuals to manage their activities of daily living autonomously, without the necessity for continuous supervision from a caregiver.

6. Action Prediction → Caregiver Notification.

   Caregiver Notification: At the moment the system detects some abnormal or potentially unsafe behaviour, such as prolonged periods of inactivity, departure from a designated safe zone, or signs of disorientation, it issues an immediate alert and sends it to the caregiver's device for notification. In this regard, the present invention keeps the caregiver constantly updated on the status of the patient at any given time; in this way, the present invention also enables caregivers to take all necessary intervention actions on time, where seen fit, to ensure safety and well-being of the concerned patient. These can be provided through mobile applications, SMS, or other alert mechanisms.

7. Caregiver Notification → Emergency Services Alert

   An incident of a fall, or any other critical situation, may automatically send an alert to the emergency

services. Instantaneous alerts would include all the information on the whereabouts and status of the patient so that the best and timely assistance can be afforded. In this relation, the important and basically vital step being followed is to ensure quick response in the emergency situation and helps reduce further potential injury to the patient under consideration.

Conclusion & Future scope

For those suffering from Alzheimer's disease, this system offers a customised real-time solution through the use of geo-fencing technology, integrated AI, and machine learning. This helps to monitor the activity of the patient and gives voice instructions to free up carers.

Using Machine Learning to improve disease detection Information gathered from wearables can be used to identify several health issues in addition to Alzheimer's disease symptoms. Through the observation of historical movement patterns, heart rate, and daily behaviours, the model can also be used to predict the likelihood of developing other illnesses like diabetes or cardiovascular disorders, hence broadening its range of applications.

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