Self-Surveillance of Alzheimer’s Patient Using KNN Machine Learning Algorithm

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Abstract: Alzheimer’s disease is a chronic neurodegenerative disease that usually starts slowly and gets worse over time. The most common early symptom of Alzheimer’s disease is difficulty in remembering recent events. To help the Alzheimer’s patient have an independent life we propose this Monitoring System. This system helps to keep track of the activities and motions of the Alzheimer’s patient. We use technologies such as IOT and ML to give the Alzheimer’s patients a sense of competence and ability to handle behavioural problems and take best decision thus thereby reducing the burden on caretakers.

Index Terms: Alzheimer’s, IOT, ML, KNN, assisted living, monitoring system.

I. INTRODUCTION
The Alzheimer’s disease is a progressive disorder that causes the brain cells to waste away (degenerate) and die. The early signs of the Alzheimer’s disease may be forgetting the recent events or conversations. Memory loss is the main symptom of Alzheimer’s disease. The signs of the disease are usually difficulty remembering recent events or conversations. As the disease progresses, a person with Alzheimer’s disease will develop severe memory impairment and lose the ability to carry out their everyday tasks. The current Alzheimer’s disease medications may temporarily improve symptoms or slow the rate of decline. The treatments can sometimes help people with Alzheimer’s disease maximize function and maintain independence for sometime. Different programs and services can help and support people with Alzheimer’s disease and their caregivers. Evidence suggests that changes in diet, exercise, sleep hours and habits — steps to reduce the risk of cardiovascular disease — may also lower your risk of developing Alzheimer’s disease and other disorders that cause dementia. Alzheimer’s patients and their families suffer and need technical tools that help them and benefit them in how to provide daily care to the patients and to live an independent Life. Based on the problems faced by Alzheimer’s patient, our project will use modern technology to help the caregivers to take care of Alzheimer’s patients in their initial stages and maintain the level of their functions in the best possible way. Our project which mainly depends on Internet of Things and Machine Learning Technologies will provide them the ability to live a free natural life themselves.

II. METHODOLOGY
KNN Machine Learning Algorithm:

- The k-nearest neighbours (KNN) algorithm is a simple, easy-to-implement supervised machine learning algorithm that can be used to solve both classification and regression problems.
- Here in our project we use the KNN algorithm for Classification. A classification problem will have a discrete value as its output.
- Here we are classifying into two classes namely, Activity done and Activity not done.
- The KNN algorithm assumes that similar things exist in its close proximity. In other words we can say that, similar things are near to each other.
- K-nearest neighbours (KNN) Algorithm is used to generate the Report.
- Sensor data is collected from the cloud and the KNN is used for classification.
- The data is assigned to the class which has the nearest neighbour’s, here we consider the time for the k value.
- And when the activity is done within 15mins, then the activity is considered to be done and it is considered as activity not done when the activity is not completed within 15min.

Fig 1: KNN Algorithm
III. PROPOSED WORK

Studies have found an association between lifelong involvement in mentally and socially stimulating activities and of Alzheimer’s disease. The new piece of technology is specifically designed for family members who do not live with their loved ones. This is a great option for long-distance caregivers wanting to ensure their loved one’s safety on a daily basis. In-home cameras are another great way to ensure your loved one’s safety from a distance. Keeping a camera focused on medication, or in the main room, can help you feel confident your loved one is taking medication and is active. This type of technology can also alert emergency personnel to ensure a safety of the patient through a mobile application. Finally, a Machine learning approach is used to generate a report on the routine activities which will be assessed by the medical personal.

The main objective of this project is to guide the caretaker to help the patients in their day to day activities.

- To create a smart ambience at Alzheimer Patients’ home by installing Sensors and Cameras.
- To monitor the patient’s routine by capturing his/her daily activities.
- To generate reports using KNN clustering algorithm based on the day to day routine on the Amazon Web Server.
- To develop a standalone application which receives the generated reports and will be evaluated by the doctor.
- To send notifications and real time alerts to family member through the mobile application if there is a need for attention.
- Additionally, a display panel and a buzzer would remind the patients about the activities such as medications or sleep timings.

The smart ambiance is created at Alzheimer Patients’ home by installing Smart Sensors, to monitor the activities of the Alzheimer’s patient and thus helps taking precautionary measures at the earliest. This system will assist in their activities of daily living and hence to promote independence and participation in routine activities. This project is based on monitoring of Alzheimer’s patients who require medical assistance and helps in taking immediate actions in smart way using internet of things.

IV. EXPERIMENTAL RESULTS

The end of the project has the smart monitoring system which consists of the sensors, microcontroller, camera, aws and the Wi-Fi module. These units communicate to act as a smart system to monitor the Alzheimer’s patient health with a desktop application. An android mobile application has been developed for the notification purpose in case of patient’s critical health condition.
Snapshot 1 depicts the login page. Here the user of the desktop application can login using username and password as the credentials. On successful validation the user is directed to the homepage of the desktop application and then proceeds to monitor the Alzheimer patient.

**Snapshot 2: Alzheimer Patient Analysis page**
Snapshot 2 depicts the Alzheimer Patient Analysis page. This is the home page of the developed desktop application, which provides options such as Manage Standards and provides analysis for the events such as Medication, Keypad and Rest.

**Snapshot 3: Manage Standards page**
Snapshot 3 depicts the Manage Standards page. In the Manage Standards page the Doctor can set the standard time for Medication (MED) event and Rest (REST) event. For Medication (MED) event the doctor set the time to take medicine and for Rest Event doctor set the duration of sleep time.

**Snapshot 4: Manage Standards page – MED Event**
Snapshot 4 depicts the Manage Standards page for Medication (MED) Event. The Doctor set the standard time for the patient to take medicine at Morning, Afternoon and Evening. The analysis is made on Actual time the medicine taken by the Patient and the Standard time set by the Doctor. Which is shown graphically on line graph and Pie Chart.

Snapshot 5: Manage Standards page – REST Event
Snapshot 5 depicts the Manage Standards page for REST Event. The Doctor set the duration of rest time to be taken by the Patient. The analysis is made on Actual duration of rest time taken by the Patient and the Standard duration of time set by the Doctor. Which is shown graphically on line graph.

Snapshot 6: Analysis page
Snapshot 6 depicts the Analysis page. The Analysis is made on the events such as Medication (MED), Keypad (KEY) and Rest (REST). The Analysis of the events are shown in the Graph and Pie Chart. The Graph shows the event performed on time and missed event. Pie chart represents the Count of Event performed correctly and wrongly.

Snapshot 7: Analysis for Medication Event
Snapshot 7 depicts the Analysis for Medication event using the Graph and the Pie chart. The Graph represents the medicine taken on time and missed medicine. The x-axis represents the number of the events occurred and y-axis represents the time. The Pie chart represents the count of medicine taken on time and missed.

V. CONCLUSION
The proposed system monitors the Alzheimer patient’s activities and assess their condition using periodic reports of the patient’s routine. It is better than the existing systems where the patients are observed manually or the case when the caretakers are family members who can’t be supervising the patient’s activity 24/7. It combines the modern-day technologies IOT and Machine Learning to observe, monitor and assess the patient’s activity.

This project also aims to give Alzheimer patients a sense of competence & ability to handle behavioral problems and take best decision thus thereby reducing the burden on caretakers. The patient’s activities are tracked using sensors such as motion sensor, pressure sensor, IR sensor at the medicine box and a camera to click the images and send them to the family member in case there is no activity sensed by any sensor. Providing security to the patient by notifying the family member through mobile application. The reports are generated using Machine Learning K-NN algorithm and sent to the stand-alone application which helps the doctor to be updated about the patient’s condition.

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