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Real time dementia detection through mobile based activity classification and sound signal analysis

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Abstract : Dementia is a neuron disease where by a patient starts forgetting the recent memories. This is more common in old age patients where they tend to forget to take their medicine or they take their medicine multiple times, they forget to take their food or take the food multiple times and so on so forth. Dementia is also correlated with physiological conditions of a patient. Therefore it is generally very difficult to identify a dementia patient unless closely monitored. In this work we propose an IoT and Big data Collaborated Dementia Detection System specifically for houses where there is genetic heredity of dementia, presence of old age people or old age homes and so on so forth. We deploy various sensors like PIR motion sensor, light sensor & sound sensor into various rooms like drawing room, bed room, bath room, kitchen room etc., We also build an app in the android phone that monitors the user activity. Data obtained from the different sensors of the room along with user mobile phone is mitigated into a cloud storage. The database in the cloud is then analysed using big data analysis Technique to extract the patterns and to find if there is a suspected case of dementia in the specific home or not. The system takes it's decision based on a past datasets, a training dataset or based on anomaly detection. An anomaly detection system is a system that can automatically distinguish the events which are different from the usual events. Our system can be used significantly to assist the dementia patients and extend care for them.

Keywords

Activity classifier, Sound signal, Analysis, Real

1. INTRODUCTION

In recent years, all over the world society has been suffering from aging. From 2000 2025, it is estimated that the number of elderly people living alone increased from3.03 million to 6.8 million [1].Moreover, patients with senile dementia also increased. In 2025, it is estimated that the number of elderly person with dementia increased to 3.23 million [2].Dementia is a serious mental disorder caused by brain disease or injury, and patients with dementia have impairment in memory and judgment [3]. Dementia is disorder of memory and judgment caused by dying brain cell. Therefore, patients suffering from dementia are unable to live with ordinary social life. If dementia has been detected at an early stage, the progress of disease can be slowed. Therefore, early detection of dementia is essential to the patient's therapy. Usually, housemates can detect dementia by noticing the subject being temperamental person. However, it is difficult to diagnose dementia at an early stage of the progression in elderly subjects living alone. In this study, we propose a platform of M2M system. The system can add new sensors and use a variety of analytical methods to correspond a variety of characteristics of Alzheimer's disease patients by using a hierarchical configuration of the device, gateway and cloud. Furthermore, we examined division of functions about device, gateway and cloud in the signal processing, such as characteristic of amount extraction. As an example, we have developed a detection system about forgetting to close a faucet that is seen in early stage of Alzheimer's disease by using M2M Platform.

Organization of Paper: 1.Inrtroduction, 2.Related Work, 3.Proposed System, 4.Sequence Diagram, 5.Algorithm, 6. Result, 7.Conclusion.

2. RELATED WORK

The system detects suspicion of dementia at an early stage of the disease, considering this we proposed a system for elderly people living alone [4] [5]. The system operates in the following sequence. We install sensors in the house of elderly people living alone. Sensors detect behaviour by initial symptom [5]. Sensor information is sent to a database in cloud. The system analyses sensor data in cloud and determines suspicion of dementia [6]. Determined result is sent to the elderly people and their family [4]. We obtain behavioural data of actual patients. We create evaluation methods and analytical methods from behavioural data of actual patients [5].

3. PROPOSED SYSTEM

In the proposed system we propose an IoT and Big Data collaborated technique for detecting dementia. 1. Sensor data acquired from various rooms along with the activity sensor data collected from the mobile is dissipated into the cloud. This Data is first filtered using a data filtering technique and then is processed using AI running in the cloud to determine the cases of dementia in that way patient is not required to fill out any forms (surveys) He can carry out his regular activities and the system is still able detect the cases of dementia.

3.1 System architecture

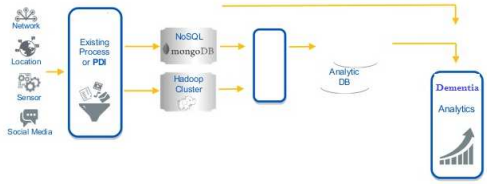

Fig 1. Shows the architecture of the dementia detection system

3.1.1. Sensor monitor

The role of sensor monitor is to get the data from the android sensor.

3.1.2. Data filter

After getting the data which as going to filter the data because every mile second there is a variation of the data, but the human being cannot move in mile second to mile second our movement will be basically mini twice data or second vice data. Our basic requirement is to track movement data. So what we are going to do is using to filter data instead of taking the data of every mile second we are going to filter it in such a fashion that it keeps the data results of a big then data goes to data analytic block.

3.1.3. Data analytic

It is basically a classification system which classifies the data. For example if you sleeping the movement will be almost restricted it is almost zero. So it is classifying that as a sleeping. if your reading there will not be gyroscope will not have x and y movement they have may have certain lateral movement very low so it may classify that kind of data as a reading .when you're sitting every movement will be less it will be much lesser than reading while your reading still steady however whenever you sitting you have just move ability there will be little lateral movement based on that it may say that between your sitting .whenever you are walking at that time the gyroscope the x and y data will be changing based on that it is going to Find that is your walking. And as you change the step as you go from one place to another place the x and y direction changes so it can count the number of steps that you have to taken in the wall .whenever you are raising any staircases when you going up along the x and y value z value also Change , whenever you are going down from the staircase along the x and y value z value also change so based on this it calculates whether your using a step or not and how many number of steps you are gone up and gone down. The role of data analysis block is to classify the filter sensor data into step like sleeping, reading, sitting, walking staircase etc. this data is to put into concept is called movement this movement will find out the data based on the private data

3.1.4. Database

Where we are going to put the threshold database based on the data is going to be calculated. The doctor at the beginning should instruct the patient that in the first month she should have bed rest doctor will b say in the first month the movement should be very limited, in the second month little movement after fifth month one should start walking so doctor will give a chart based on this chart.

3.1.5. Comparator

Comparator will check whether the patient is following the chart or not. As doctor prescribe condition the database value also get change comparator based on those ideal condition will check the result that is coming from our current movement and it is going to give the alert along with that, that data will be stored in a database that means every day how many steps the patient has moved. Every day how much walking he has done and how much calorie as lost and so and so. Not only comparator compare for ideal condition and it will also stores the data for that is doctor want to see what is the mobility of the patient in order to track the whole month data or entire fifteen days of data.

4. SEQUENCE DIAGRAM

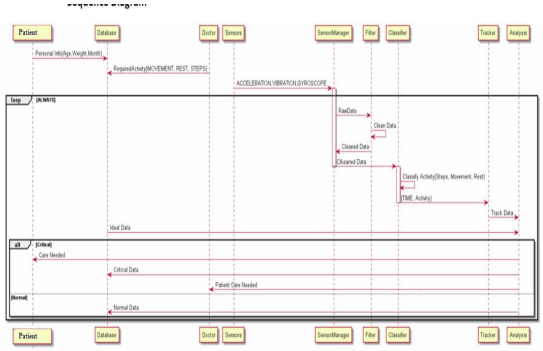

Fig 2. Shows the sequence diagram of dementia detection system.

From the fig. we can see that when patient starts moving that is when he is in motion, he is either walking or speaking with someone else. All the sensors will be collecting the motion and sound values consistently. This will be managed by sensor manager. All the collected values will be given to Classifier which classifies the collected values and keeps on analysing the data. If any abnormality is found it informs the Doctor that the patient is having some abnormalities in his behaviour. Constant update will always be given to the doctor to keep track of what is happening with the patient. So this is done by tracker which does this work to keep patient safe. Side by side all the analysed data will be saved in the database for reference and study of patient.

5. ALGORTIHM

We use a simple but very efficient algorithm for dementia detection system.

Step1)patient->database:personal info(age,weight,month)

Step2)doctor->database:
requiredactivity(movement,rest,steps)

Step3)sensors->sesormanager:
acceleration,vibration,gyroscope

Step4)loop always

Step5)activate sensormanager

Step6)sensormanager->filter: raw data

Step7)filter->filter: clean data

Step8)filter->sensormanager: cleaned data

Step9)sensormanager->classifier: cleaned data

Step10)deactivate sensormanager

Step11)activate classifier

Step12)classifier->classifier:classify
activity(steps,movement,rest)

Step13)classifier->tracker: (time,activity)

Step14)deactivate classifier

Step15)tracker->analysis: track data

Step16)database->analysis: ideal data

Step17)alt critical

Step18)analysis->patient: care needed

Step19)analysis->database: critical data

Step20)analysis->doctor: patient needs care

Step21)else normal

Step22)analysis->database: normal data

Step23)end

Step24)end

6. RESULT

When the VMBroker and the Android Application is run simultaneously using the same port number. When the patient starts using this project (product) he must keep the android phone in his pocket so that wherever he goes collection of motion and sound values should be possible. So when the patient is walking, running, resting, speaking, laughing or shouting the results will be as follows.

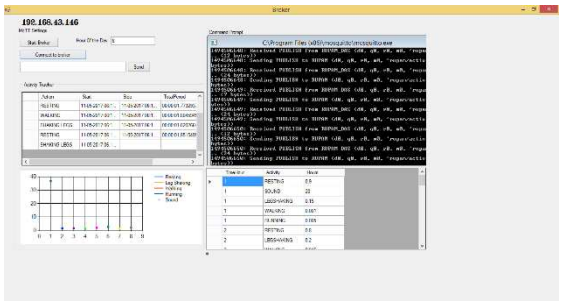

Fig 3. Above Screenshot we can see that the software is collecting the motion and sound values continuously.

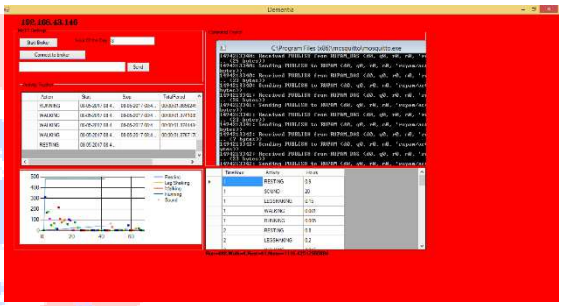

Fig 4. The above Scenario occurs whenever the patient starts to run very fast. The graph shows that patient is running graphically

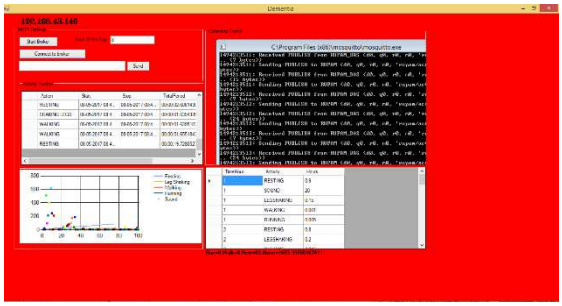

Fig 5. Above Scenario occurs whenever the patient starts to shout. The graph shows that the patient is shouting graphically.

7. CONCLUSION

Dementia is one of the common disease (Symptom) that is often observed in aged people. Many Dementia cases have recently been discovered among people in very low age group also. Dementia is a physiological condition where by a human being tends to forget, gets extremely agitated on certain events, keeps repeating certain events.

Dementia often requires a very sophisticated caregiving process because such patients are open to extremely violent reactions when they find out some people are monitoring them. A lot of studies have been carried out recently to offer appropriate detection and caregiving for the dementia patient.It is often very difficult to identify a dementia patient in the early stage. In this work we have proposed a unique real time technique for identifying and monitoring for the dementia patient. Our technique relies on the combination of machine learning and IoT to classify the activity of the user. By collaborating the analysis of the sound captured by the mobile, the amount of moment that the user is performing at certain given instance of time. We are able to classify whether the user behaviour is suspected to dementia or not. Result shows that the proposed system can classify the dementia behaviour with extreme accuracy. The work can further improved by incorporating other observation such observation from the video feed of the surveillance camera installed at home. User behaviour or activity taken from the video camera can be classified into detection of dementia activity. The system can also be improved by incorporating reminder service by means of which a dementia patient can be reminded to take their medicine, bath, food etc., and if they tend to repeat the process can allow them of this thing.

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