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IOT Analytics Based Framework to Closely Monitor Patients with PD (PARKINSON'S DISEASE)

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Abstract - Current challenges demand a large restructuring of the global healthcare system. A more efficient system is required to cope with the growing world population and increased life expectancy, which is associated with a marked prevalence of chronic neurological disorders such as Parkinson's disease. In other words, humans are in need of a more efficient healthcare platform, which can serve the demand of larger and older populations at an affordable cost.To develop an IOT-Analytics based distributed platform to collect real time motion metrics of patients with Parkinson's disease. The data could be obtained by Android phone through app and connect them to a medical database. Data can be collected not only during regular medical visits, but also at home during activities of daily life.Using machine learning algorithms, work has been accomplished to analyse the data and track disease progression and quickly identify the efficacies of alternative treatments. This information can be used by hospital administration to provide better treatment and day to day support for the patients.

I. INTRODUCTION

Parkinson'sDisease (PD) is a chronic, neurodegenerative disorder of the central nervous system which most commonly affects, elderly people of ages 60 and above. However, some people can be diagnosed with PD at an age as early as 40 years or younger. It develops progressively and the symptoms increase in severity over time. These symptoms include

i. Tremors, usually in hands and fingers
ii. Slow movement (known as bradykinesia)
iii. Rigid muscles
iv. Impaired posture and balance
v. Loss of automatic movements
vi. Speech and writing changes

Parkinson's has affected a large percentage of people, and has no cure. However, the early detection of PD plays a huge role in the treatment process. Smart mobile phones have proven themselves capable of analysing medical data for a few years now and by utilizing this capability in a profound and innovative way.

Detection techniques for Parkinson's Disease:

Since the fundamental driver of Parkinson's is not known, there is no particular test to analyse this issue. Trained neurophysiciansanalyse Parkinson's malady in light of the patients' history and visual examination and further investigation through Unified Parkinson's Disease Rating Scale (UPDRS), blood testing to discount different infections with comparative side effects. Distinctive imaging methods, for example, Magnetic Resonance Imaging (MRI) all the more precisely the Functional Magnetic Resonance Imaging (FMRI) are utilized to distinguish Parkinson's in its beginning periods; Positron Emission Tomography (PET) is another imaging procedure which is used to screen the dopamine level in the cerebrum.

The medicinal portable application executes a few solid and long-standing PD determination tests. These tests incorporate a scope of standard hand tremor tests, finger tapping tests, and spiral-drawing tests used broadly by neurologists and PD experts for early discovery and condition evaluation. And objectives of this work include :

- Build a cloud application to collect real time data from IoT enabled wearable devices, from patients diagnosed with Parkinson's disease.
- Apply machine learning algorithms to classify the data and provide useful alerts to caretakers and hospital staff.
- Apply data analytics to provide useful reports to doctors to help in further diagnosis.

II. LITERATURE SURVEY

[1] The work done by Cristian F. Pasluosta discusses the recent wearable advances and the Internet of Things idea applied to Parkinson's disease with an importance on how this technical platform may lead to a shift in paradigm in terms of diagnostics and treatment.

[2] A state of the review by AbdulwahabSahyounet.al, focuses onParkinson's Disease (PD) signs assessment tool using an Android cell phone application that allows PD patients to evaluate their signs using both quantifiable and qualitative tests.

[3] The work done by N. Kostikis covers cell phone based tool to precisely evaluate upper appendage tremor in Parkinson's Disease (PD) patients. The tool utilizes signals from the phone's accelerometer and gyroscope, which can be used to evaluate a patient's tremor indications.

[4] The paper by SiddharthArora in is to exactly distinguish Parkinson's disease (PD) patients from healthy controls using self-managed tests of gait and postural influence. Also makes use of customer cell phones with in-built accelerometers, to measure and evaluate key development severity signs of Parkinson's disease.

[5] The work done by George Rigas, Alexandros T. Tzallas discusses that tremor is the most widely recognized motor issue of Parkinson's Disease (PD) and thus its detection plays a pivotal part in the administration and treatment of PD patients.

III. ANALYSIS

This section describes the design decisions and strategies that effect the overall organization of the IoT analytics based device to monitor the patients and its higher-level structures.

ARCHITECTURE DIAGRAM

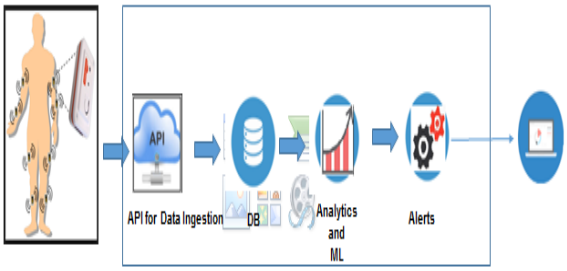

Figure 1: System Architecture of the Project Workflow

The system architecture of IoT analytics based system is as shown in Figure 1. The system architecture shows the components required for this project. Here the real time tremor value is read from the patients through android mobile phone, which is updated in cloud. Apply machine learning algorithm to classify the criticality of patients based on different factors such as tremor value, trained data set (age, genetic factor, activity level, speech level) and analytics for data and send alert notification to caretaker or hospital, if patient is critical.

IoT analytics based framework which uses a cloud environment to upload a real time data. It classifies the data by considering different parameters and notify the concerned. The main function of IoT Analytics based framework to monitor patients with PD, and classify the patients criticality by considering different factors. It also sends alert notification to caretaker.

IV IMPLEMENTATION

In this work, android application is used to collect the real time tremor values from the patients by placing android phone on the palm of patients.

A. Creation of Android Application Module

This module mainly describes the steps taken to set up a working of android app to upload the data. First step is to set up the configuration and frequency of upload which will get to system service. Then set up the accelerometer sensor with registering the listener. If sensor is changed then read a x,y,z co-ordinate values. By using these values calculate tremor intensity and that value is uploaded to cloud. Figure 2 shows the flow chart for Android application module.

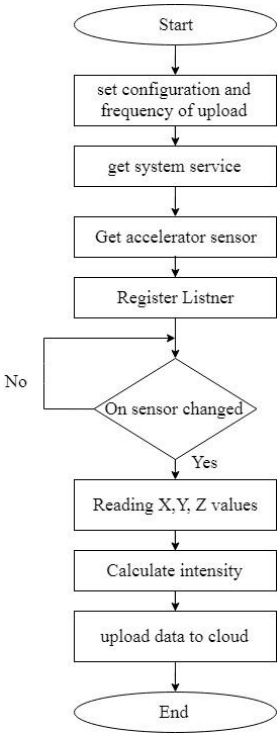

Figure 2 : Flow chart for Creation of Android App Module

B. Classification of Patients Data

First step is to initialize the trained model, then retrieve unclassified patient details. For each patient retrieve the parameters used for classification. Then invoke the predict method for test data. if the label is equal to critical after classification send message to caretaker or hospital. After sending message to the caretaker update patient sensor details. Figure 3 shows the flow chart of classification of patient's data.

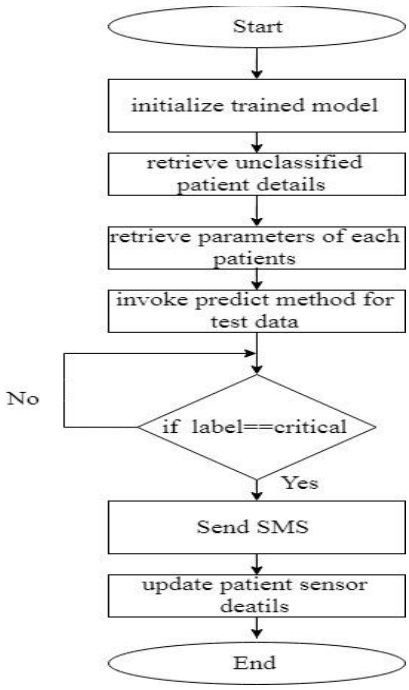

Figure 3: Flow Chart for Classification of Patients Data

V. RESULTS

The results found by the experimental analysis on the available data in term of screenshots. It gives a detailed insight into the system with the help of comparative analysis of the systems. Screenshots help in visualizing the system as it is used in real time.

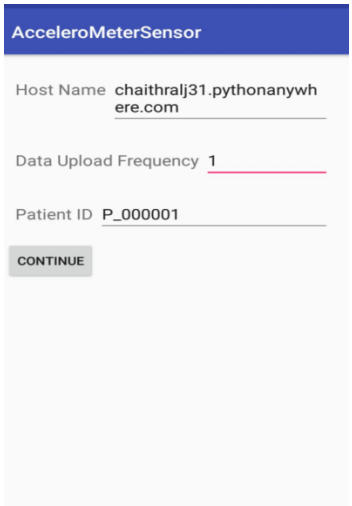

Figure 4 : Configuration Setup

Figure 4 shows the configuration setup for launching Android app, by giving a host name, frequency of upload, and registered patient ID.

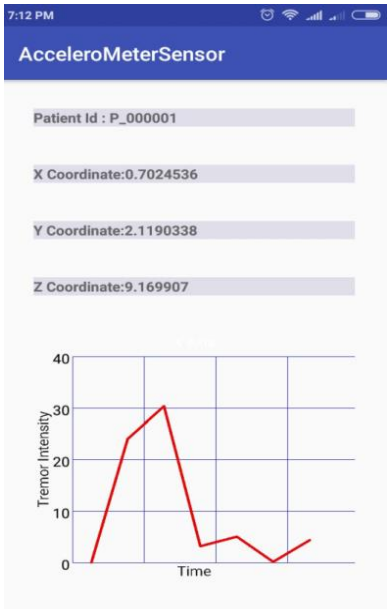

Figure 5 : Screen to Capture Sensor Data

Figure 5 shows the screen to capture the sensor data . Data captured from accelerometer sensor in the smart phone and conversion of x, y, z co-ordinates into tremor intensity is displayed.

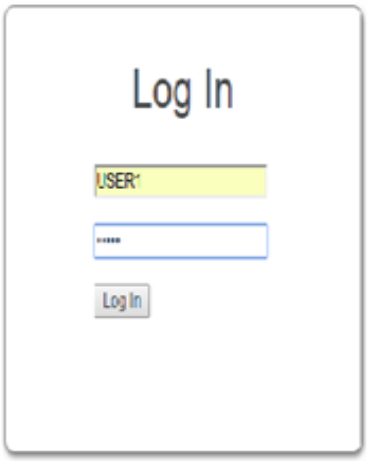

Figure 6 : Login Page for the Patients

Figure 6 shows the login page for the patients. Checking a user identity, if a user is valid then display a home page for the user.

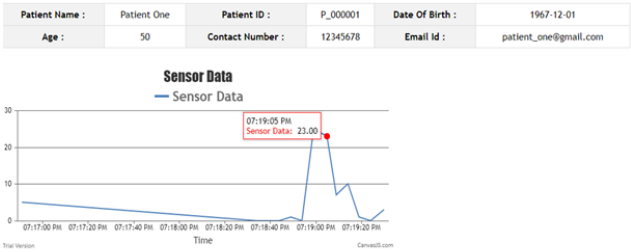

Figure 7 : Dynamic Graph Showing the Patients Data as Critical

Figure 7 shows the dynamic graph representing the patients data as critical. This graph shows a classified tremor intensity with respect to time.

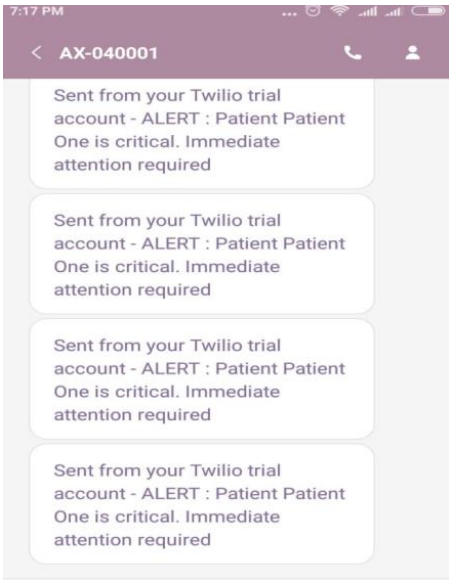

Figure 8 : Notification to Caretaker

Figure 8 shows the SMS alert notification to caretaker when the data classification is critical.

VI. CONCLUSION AND FUTURE WORK

On average, elderly people of ages 60 and above, can be diagnosed with PD. So this motivated researchers to develop an IOT-Analytics based framework to closely monitor patients with PD to provide better treatment and healthcare support.

The real time tremor value is read from the patients through Android mobile phone, which is updated in cloud. Machine learning algorithms are applied to classify the criticality of patients based on different factors such as tremor value, trained data set(age, genetic factor, activity level, speech level) and send alert notification to caretaker or hospital, if patient is critical.

In the future, the project will be progressed to conduct clinical research and develop tremor classification algorithms that help early diagnosis of different types of disorders.

REFERENCES

[1]Cristian F. Pasluosta, Member, IEEE, HeikoGassner, Juergen Winkler, JochenKlucken, and Bjoern M. Eskofier, Member, IEEE, EMBS "An Emerging Era in the Management of Parkinson's disease: Wearable Technologies and the Internet of Things" 2168-2194 (c) 2015 IEEE.

[2]AbdulwahabSahyoun, KarimChehab, Osama Al-Madani, FadiAloul, and AssimSagahyroon" ParkNosis: Diagnosing Parkinson's Disease Using Mobile Phones" 2016 IEEE 18th International Conference on e-Health Networking, Applications and Services (Healthcom).

[3]N. Kostikis, St. Member, IEEE, D. Hristu-Varsakelis, Senior Member, IEEE, M. Arnaoutoglou, and C. Kotsavasiloglou "A Smartphone-based Tool for Assessing Parkinsonian Hand Tremor" 2168-2194 (c) 2015 IEEE.

[4]Siddharth Arora1,2, Vinayak Venkataraman3, Sean Donohue4, Kevin M. Biglan5, Earl R. Dorsey5,6, Max A. Little1,7 " High Accuracy Discrimination Of Parkinson's Disease Participants From Healthy Controls Using Smartphones" 978-1-4799-2893-4/14/$31.00 ©2014 IEEE.

[5] George Rigas, Alexandros T. Tzallas."Assessment of Tremor Activity in the Parkinson's Disease Using a Set of Wearabl Sensors" Ieee Transactions On Information Technology In Biomedicine, Vol. 16, No. 3, May 2012.

[6]Wei Wang, Xun Wang and Lei Xie" Tremor Detection Using Smartphone-based Acoustic Sensing"Ubicomp/Iswc '17 Adjunct, September 11-15, 2017, Maui, Hawaii, Usa.

[7]R. A. Joundi, J.-S.Brittain, N. Jenkinson, A. L. Green, and T. Aziz, "Rapid tremor frequency assessment with the iPhone accelerometer," ParkinsonismRelated Disorders, vol. 17, pp. 288–290, 2011.

[8]AarushiAgarwal, 1Spriha Chandrayan and Sitanshu S Sahu, "Prediction of Parkinson's Disease using Speech Signal with Extreme Learning Machine" International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) – 2016.