PARKINSON MONITORING DEVICE

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ABSTRACT

Parkinson's disease (PD) is a debilitating disease that affects millions of people worldwide and is characterized by both motor and non-motor symptoms. The disorder has a major effect on the quality of life of who gets affected. There are several works of literature on the symptoms of the disease. The most exciting trends include low cost, low power, discreet and reliable sensor devices for tracking and handling pathology. This study focuses on the wearable technologies for PD applications and identifies five key areas: early detection, tremor, body motion examination, motor fluctuations (ON–OFF phases), home and long-term remote monitoring. The idea is to obtain a description of the pathology at each point of development, from the onset of the condition to early symptoms, during disease progression including examination of the more prevalent conditions, and with treatment of the more complex cases. (i.e., motor fluctuations and long-term remote monitoring). There is also no treatment for it, it can only be controlled, and development can be slowed down. Progress should be tracked using all medical signs to allow the patient and the practitioner to keep track of the progress.

1. INTRODUCTION

In today's world, the growth of the Internet of Things, mobile gadgets and the rise of the Internet. Any individual comes to think about yet another disease. Parkinson is one of the diseases which need a great deal of work on the patient who is undergoing it. It is an exceptional condition in which people cannot do their function properly because of their muscles, which may not allow the human body to transmit signals properly. IOT is the field of internet invention, where it is possible to connect research findings with their ordinary products through its assistance. This is integrated into the network by way of network and electronic gadgets or other software so that they can be remotely monitored. This is where a human to a PC network is required, not a human to a human network.

In this project, our wearable monitoring device will have various sensors which will help in the remote monitoring of the patient without him/her going to the hospitals frequently. The various sensors include accelerometer and gyroscope to measure the linear movement of the patient, this sensor will also help in determining the number of times the patient fell or had tremor and will also help in abnormal step detection. SPO2 sensors will be used to detect the heart rate of the patient. In our wearable device, instead of using Bluetooth we will use a GSM module to increase the radius for data collection between the hospital and the patient. Another thing will be a GPS so that the patient can be tracked at all times. Timely announcements for taking water or medicines will also be embedded in the wearable device.

A. State of the art

In order to know about the already available advancements in the field of Parkinson Patient Monitoring using Internet of Things (I.O.T). Various Research papers from reputed Technical and Medical journals to get a clear idea of the existing technologies that are being factored in monitoring of the patient. Also, medical journals were
included in research so as to have a clear view of the prevalent diagnosis and the orthodox techniques that have become standard for Parkinson’s Patient care and monitoring.

It was discovered that Parkinson’s Disease is a neurodegenerative disease, that infers that the neurons, nerve cells in the brain that controls the movements in the various parts of our body weakens with age ultimately leading to different stages of the damage that has been inferred due to it. This problem grows until the nerve cells, neurons become completely impaired. Since the improper functioning of the nerve cells, neurons lead to inadequate generation of Dopamine, which is in turn responsible for causing the movement problems in the body.

People with Parkinson's disease also lose nerve endings that produce norepinephrine, the main chemical signaling service of the supporting nervous system that controls certain automatic functions including heart rate and blood pressure. Some of Parkinson's non-movements, such as fatigue, irregular blood pressure, lower food flow through the digestive tract, and rapid decrease in blood pressure when a person stands up or lies down, may be better understood if norepinephrine deficiency is present.

B. Inferences from existing systems

- The model used were dependent on UDPRS scale for measuring the stage advancement of the Parkinson disease
- Various sensors such as SPO2, Heart Rate, Gyroscope and accelerometer were used to make up the physical wearing devices so as to collect the data
- All the researches used Bluetooth modules for the purpose of communication from sensor to the database
- In some of the methods long questionnaires were provided at random intervals to be answered by the patient
- These questionaries were made to measure the correctness of the data provided by the sensors and have a trusted parameter that is patients answers to compare data with so as to have clear view of how accurate or how well the physical sensors are working. Also, to keep a note of all the non-parameterized symptoms that might be faced by the patient.
- Unavailability of the GSM modules on the sensor system makes it limited to close communication and data cannot be gathered from far places hence people need to be kept in close proximity for data collection
- Some of the sensors used were high end and the same job of that sensor can be done by using a cheaper sensor and optimizing it with software. Hence making it affordable to a larger public
- The system contained one 6 DOF sensor,
- Consisted of an accelerometer and gyroscope.
- The accelerometer's amplitude range was 8 g, and the gyroscope's range was 2000 degrees per second. Data was obtained at a 200 Hz sampling rate.
- Each participant was required to wear three wearable sensors during the measurement period: one on each wrist and one on the chest.
- Handmade accessories were used to mount the wearable sensors to the body.

I. PROPOSED WORK

The participant has to wear the wearable sensor on the wrist and not on the chest. It will be using GSM instead of Bluetooth to increase the range of data collection. Gyroscope and accelerometer will be used, with abnormal step detection and fall detection to measure the level of problem in walking faced by the participant. It will be with added functionalities like heart rate monitoring and SPO2 monitoring. It will be having a feature for timely announcements for taking medicines, water, etc
List of Hardware

- Arduino Mega 2560 Board with USB Cable
- Arduino Nano v3.0
- SIM800L GPRS GSM Module
- GPS Module Ublox NEO6M
- MAX30100 Heart Rate Sensor Module
- DS3231 RTC Module Precise Real Time Clock I2C
- 12mm Small Buzzer
- General Purpose PCB Board – 5.5×3.5
- 0.96” OLED Display Module 128×64
- 4 Pin Female To Female Relimate Connector
- 3.7v battery 2200mAH
- TP4056 With Protection C type
- Mini Booster
- LM1117 3.3V
- ON OFF Switch

C. Schematic Diagram of the system
II. IMPLEMENTATION

- The implemented system incorporates all the sensors which include the SPO2, heart rate, gyroscope and accelerometer. This is run by a rechargeable lithium-ion battery. Which has a Type C port for charging. All the modules are capable to run individually on the battery source.

- It has a main on/off button present so as to have a control over system’s active state and off state. Also, it has two more physical buttons incorporated to switch on and off the tremor and fall detection as and when required by the patient to eradicate to some extent false results.

- The system has a GSM module present in it so as to send the timely medicine and water reminders to the patient. And in case the Panic button is pressed by the patient, then to send the location of the patient to emergency contact.

- The battery backup of the system is 3-5 hours depending upon the usage.

- System has a Wi-Fi module incorporated in it so as to send the accumulated data to the database every 15 seconds. So as to keep the data accumulation in real time

- It has a RTC module installed in it to keep track of the time for the system to help send updates at timely intervals

- Combination of Arduino Mega 2560 Board and Arduino Nano v3.0 is used to accumulate and send data from one module to another.

- 0.96” OLED Display Module 128×64 is used to display all the necessary details on the screen.

- A buzzer is used to give beep alerts, so as to have auditory response present

D. UI for displaying the accumulated data

The UI displays all the necessary data accumulated by the physical sensors and display it in the tabulated form with fields such as ID, Date, Time, Heartbeat, SPO2, Tremor and Fall Data.
E. Database Structure

Following is the database structure used for the implementation of the database. All the fields are non-nullable and ID acts as the primary key for the table which is auto incremental in nature.

F. Implemented System (Parkinson Monitoring Device)

Following picture shows the implemented Parkinson monitoring system. The device is worn on the wrist. And requires a SIM to send message alerts and a Wi-Fi module to send data to data base every 15 seconds.
III. RESULTS DISCUSSION

We have made a wearable monitoring device that consists of various sensors which helps in the remote monitoring of the patients so that the hospital visits decrease. These sensors we have used include accelerometer and gyroscope to measure the linear movement of the patient, this sensor will also help in determining the number of times the patient fall or had tremor and it will also help in abnormal step detection. SPO2 sensors will be used to detect the heart rate of the patient in which the sensor will be connected to the finger. In our device, we have used a GSM module to increase the radius for data collection between the hospital and the patient to reduce the frequency of the hospital visits. Another thing will be a GPS tracker so that the patient can be tracked at all times by the concerned authority. Timely announcements for medicines will also be embedded in the wearable device so the patient doesn’t miss any medicines.

The obtained results indicate that the adopted wearable sensor solution is a valid solution capable of detecting PD symptoms based on motor signals and providing a high degree of accuracy in the overall status of the. Since the clinic trials were conducted over a short period of time, it is difficult to predict the exact future effect. control of patients; however, at the very least, a preliminary quantification of the system's output can be given.

IV. CONCLUSION

This paper demonstrated how continuous patient monitoring can be accomplished using a wearable sensor network to enhance patient tracking and management. Clinical assessment is normally performed by analysing patients' diaries and performing brief punctual checks during the medical examination; however, this procedure cannot provide an overall and reliable estimation of the patient's status; as a result, care is not adjusted based on objective results, causing treatment changes to be delayed.

Wearable sensor solutions, on the other hand, may provide quantitative and objective knowledge about motor complications. Sensor data can be used to provide physicians with an overall and objective clinical status for each patient, allowing care to be tailored to each individual and treatment modifications to be made in response to changes in symptom fluctuation.

G. Message Alerts

(Figure: Wearable device)
We have proposed various wearable answers for checking and analysis of PD by investing more amounts of energy in finding the most prevailing aspects during walk action, for example, heel off, venture length, step length, step time, and plantar weight. The most appropriate wearable sensor gadgets for finding these highlights are wearable insoles, IMU based checking frameworks appended at lower appendage, savvy groups, EMG based gadgets, utilizing an advanced mobile phone outfitted with inertial sensors. Among all these, the insoles end up being more predominant and helpful, proposing that these wearable arrangements must be presented to a bigger populace for legitimacy. From the chose articles, it is shown that dreary extreme movement exercises end up being powerful for PD patients particularly to those with serious engine incapacities. Incredible points of interest are seen with treadmill and tangible engine preparing yet at the same time the outcomes rely upon the ideal area, measure of preparing under management, method of conveyance, force of activity, and the kind of preparing needed to get the advantages.

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