PATIENTS GESTURE TRACKING AND PULSE MONITORINGTHROUGH IOT

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Abstract:

Patients suffering from conditions like aphasia, Parkinson's disease, dysarthria, cerebral palsy and Bell's palsy (facial paralysis) are often unable to communicate their basic needs due to loss of speech because of which even a task as simple as asking for water or food becomes difficult. Given the advancement in technology we believe that this should not be the case. In this paper, we propose a prototype to help track particular hand gestures of a patient in order to help them communicate. We do so using an accelerometerand gyroscope sensor to observe the hand gestures If the gesture satisfies certain conditions, an event is triggered and notificationsare sent via IFTTT to the attendee's email or mobile phone. There is a pulse sensor to monitor the heart beat rate of the patient, where event is triggered when the pulse is extremely high or low, thus, ensuring additional safety of the patient.The patient can be constantly monitored using our android mobile application, 'CommuniCare', on which his pulse graph can be viewed. The web based observing platform helps keep a constant track of the pulse rate of the patient as the sensor data is continuously collected in ThingSpeak database which can be used for future assessment of the patient. With this prototype, we wish to help patients to be ableto communicate their basic needs even when they cannot do so vocally.

Key Words: *Internet of Things, Wearable Glove, Gesture Tracking, Pulse Monitoring, ThingSpeak, IFTTT, Android*

1. INTRODUCTION

The presence of aphasia is one of the reasons for poor recovery of a patient after a stroke (Fang, Chen, Li, Huang, & Zeng, 2003 [1]). It also leads to increased dependency on institutional care (Tennant, Geddes, Fear, Hillman, & Chamberlain, 1997 [2]). Even though there is not much published prevalence data on aphasia in India, it can be inferred from the available disability statistics and stroke data, that the prevalence of aphasia is high. It was also foundthat 25% of people with ischemic stroke were also affected by aphasia (Panicker, Thomas, Pavithran, Nair, & Sarma, 2003 [3]). As mentioned by Duffy (1995), 27% of people dealing with neurogenic disorder also possessed aphasia. 11.65% of the total disabled population are verbally impaired. Alarmingly, the most common cause of speech impairment is aphasia[4]. Aphasia, including Parkinson's disease, cerebral palsy, broca's aphasia, and partial paralysis causes inconvenience in vocal communication of the patient and alsomight lead to depression of the patient.

We believe that given the technological progression, there should be ease in helping aphasia patients communicate better. As of now, there are not many devices that can be helpful in this front. There are devices like the Slate and Pictorial software. These, according to us, are not efficient as they require a lot of movement from the patient's side, which causes inconvenience. With the kind of developmentthat there is, this should not be the case. They should be able to communicate with ease. At least, basic communication should be accessible to everyone.

Our prototype makes use of an accelerometer and gyroscope, that are used for gesture tracking. Each gesturehas a particular meaning so that when a patient moves his hand in a particular way, it gives out a message to the attendees. Also, using a pulse sensor, we can constantly track their pulse rate. In case of abnormal pulse, a notification can be sent to the attendees and the doctors. This way, aphasia patients' needs can be catered to in a more efficient way.

1.1 EXISTING SYSTEM

Currently in India, there are devices to help patients dealing with aphasia in communicating their needs. Few such devices are Pictorial Software; Assistive Devices: Hand Switches, Foot Switches, Voice Output Communication Aid (VOCA), GUPSHUP; AVAZ[5]; SLATE and ADITI: A non-contact switch[6]. These devices require a lot of effort from the patient's side. As there are certain restrictions on the movement of patients suffering from aphasia, the abovementioned devices are not feasible. These devices are also not very cost effective, making them inaccessible to everyone.

2. PROPOSED SYSTEM

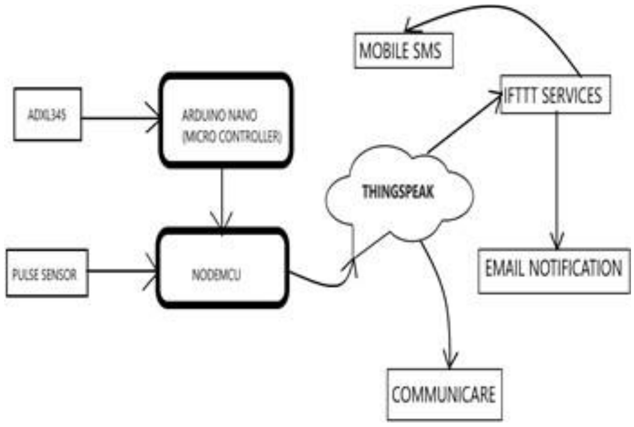


Fig-1: Working Flowchart

2.1 COMPONENTS:

2.1.1 Sensors:

2.1.1.1 Accelerometer and Gyroscope:

Adxl345 is a small, ultralow power, 3-axis accelerometer andgyroscope. It can be interfaced through either SPI or I2C. It measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock.

2.1.1.2 Pulse sensor:

This is an Arduino compatible, plug-and-play heart-rate sensor that works at 3.3V and 5V. The sensor has two sides, one with an LED and other with the circuitry. This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed overa vein in our human body. This can either be your Finger tip or your ear tips, but it should be placed directly on top of a vein.

2.1.2 Microcontrollers:

2.1.2.1 Arduino Nano:

The Arduino Nano is a small, breadboard-friendly board based on the ATmega328P.

2.1.2.1 NodeMCU:

It is an open-source firmware using which one can easily prototype an IoT product. It consists of the ESP8266 wifi module.

2.2 Protocols:

2.2.1 I2C communication:

The I2C communication is a four wired half duplex serial communication. It deals with the multimaster and multi slave configurations. The four wires are vcc, gnd, sda and scl. Thevcc and gnd is used for the power supply and sda(serial data), scl(serial clock) for serial communication.

2.2.2 Serial communication:

In serial communication the data is transferred bit by bit. This serial communication usually is wired. It will stream only one bit at a time. There is no clock.

2.2.3 IP protocol:

The internet protocol is used to transfer the data packets fromthe source to the destination by using the internet.

2.2.4 HTTP(Hypertext transfer protocol):

The Hypertext Transfer Protocol, used for the data communication, is the base communication in the world wide web (www). It provides the standard for web browsers over the internet.

2.3 Working:

Using ADXL345 and pulse sensors, we take inputs from the patients. The ADXL345 sensor is used to track the movementof the patient's hand and pulse sensor is for collecting the patient's heart rate.

Via I2C communication, Arduino nano microcontroller collects data from ADXL345. Whenever a gesture is made, itsends the data to NodeMCU using serial wire communication.

Pulse sensor is connected to NodeMCU which collects its data and also receives data from nano using a single wire communication. It sends the received data to ThingSpeak cloud by ESP8266 WiFi module inbuilt in NodeMCU using IP protocol.

ThingSpeak stores all the data received from the nodeMCU. The received data is visualized in the form of graphs. Using ThingSpeak HTTP and REACT, it sends out triggers to IFTTT when certain conditions are met. IFTTT sends notifications to our email and mobile phones (SMS)

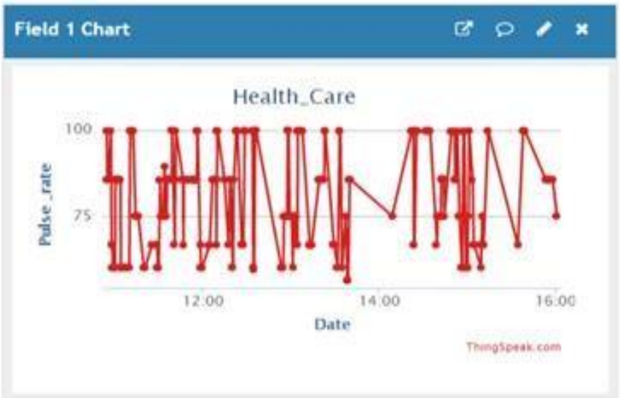
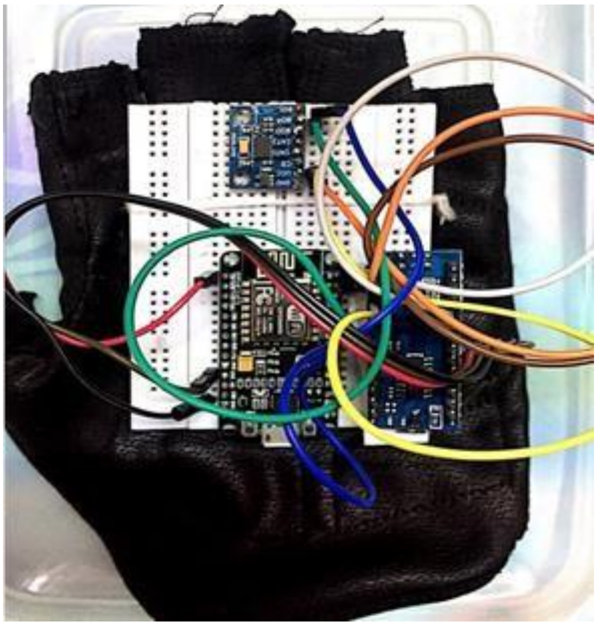


Fig-2: Pulse rate Graph

The graphs from ThingSpeak can also be viewed on our ownandroid application, 'COMMUNICARE'.

The wearable glove is a carefully designed solution. It serves a major purpose of assisting a patient who cannot communicate vocally and deals with motor impairment.

Fig-3: Proposed Prototype



3. FUTURE WORK

This gadget can be improved by utilizing a camera instead ofsensors to detect motion/movement. This can be achieved using computer vision. A non-wearable movement detection device has a wider range of applications and is also more feasible in real life.

4. CONCLUSIONS

We designed this prototype with the intention of applying thecurrent trends in technology to help ease a patient's life as we believe that over a million people across the globe failing to communicate their basic needs is unacceptable. With the kindof advancement in technology that there is, the lengths patients' need to go to for conveying a simple message is extreme. With the help of our prototype, not only do we aim to help in the patient's interaction with his attendees, but also the data that is generated via these sensors can be used by a physician for further analysis of the patient.

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