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WEARABLE TREMOR GLOVE

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***Abstract*— The main aim of this work is the measurement the frequency of hand tremors and alert the patient before his or her tremor condition can become severe. Tremors cause deflection in fingers constantly, this deflection is determined using the MPU 6050 sensor (Inertial Measurement Unit or IMU). The data from the sensor is used to measure the vibration of the hand caused due to tremors. An Arduino is used to calculate the frequency from the MPU 6050 sensor and in addition, a buzzer connected to the Arduino alerts the patient or the caretakers of the patient for immediate action or help. These frequency measurements can also be sent to the cloud so that doctors can monitor the condition of the patient using a web application.**

Keywords: Hand Tremors, MPU 6050 sensor, Arduino, deflection, Frequency

I. INTRODUCTION

Shaking hands are commonly called hand tremors. Hand tremors are not considered a life-threatening medical condition, but they can make everyday tasks difficult. It can also be a red flag for neurological and degenerative diseases. One of the most common is Parkinson's disease. Hand tremors and vibrations make it difficult for people to lift and hold objects. A tremor is an involuntary, rhythmic, nearly sinusoidal, abnormally repetitive shaking movement of the body. The main characteristics of vibration are frequency and amplitude. Tremor frequency is highly dependent on pathophysiological mechanisms and is fairly stable over time. To measure hand tremors, there are three main positions: resting, postural, and action. Resting tremor occurs when the affected body part is fully supported against gravity (for example, when the hand is placed on the knee). Postural tremor occurs when the affected body part maintains an anti-gravity posture (such as an arm outstretched in front of the body). Action tremors are caused by spontaneous muscle contractions (for example, when moving the affected body part from one point to another). An MPU 6050 (IMU) sensor is used to measure the received signal and send it to the Arduino. The Arduino microcontroller uses a Wi-Fi module to calculate the tremor frequency. This data and the data from the sensors are then sentto the web application. As a result, even a doctor remote from the patient can easily monitor the patient.

II. LITERATUR SURVEY

Hand tremors are rhythmic movements accompanied by vibrations in one or more parts of the body. Parkinson's disease tremor is the most common condition, affecting approximately 3.8 million people worldwide. Frequent diagnostics can identify tremors in patients and initiate appropriate treatment. The most common system used by doctors to distinguish between different types of tremors is the electromyography technique. Not everyone can afford to have EMG repeated because it is very expensive and needs to be tested frequently to assess the patient's condition and improvement. This section provides an overview of some of these methods to measure and characterize tremors.

A. Wearable Devices

Xiaochen Zheng[1] proposed monitoring patient movements using a system consisting of a smartwatch, a smartphone, and a NoSQL database server. Data analysis methods are proposed to detect impacts and identify associated actions. Tremors can be detected from the difference in operating frequency, and voluntary actions can also be detected. This helps doctors analyze the relationship between tremors and specific behaviors.

B. Mems Based

Hong Ji [2] and others proposed an analysis of tremor characteristics under resting and stressconditions. The tremor was measured using a finger accelerometer during stress and resting (arithmetic) states, resting tremor, and postural tremor. Changes in measurements of tremor peak power, peak frequency, mean frequency, and power spectral density (PSD) distribution were evaluated under different conditions.

C. Transducers

Rodger J Elble [3] suggested that transducers provide reasonably accurate and valid measurements of tremor amplitude, but transducer precision and accuracy are

compromised by natural variations in tremor amplitude. This level of variation is so large that, beyond random variation, the maximum detectable change in amplitude is comparable for scales and transducers. Research is needed in this area to determine the feasibility of detecting small changes using averaged data from long-term continuous recordings with wearable transducer.

D. Others

Houde Dai [4] proposed a quantitative assessment of Parkinsonian tremors based on inertial sensors that can provide reliable feedback on the effect of the medication. The features of Parkinson's disease tremor and its unique properties such as motor fluctuations and dyskinesia are considered.

Shill HA [5] proposed a discussion focused on phenomenology and phenotypes, therapies and clinical trials, pathophysiology, pathology, and genetics. The paper suggests standardized data collection using common data elements for genetic, clinical, neurophysiological, and pathological studies. Patients should be studied properly to collect bio-samples and characterize the natural history of the clinical syndrome including patient-oriented outcomes.

Elble RJ[6] proposed to illustrate the problem of gravitational artifacts in accelerometric recordings of tremors. Gravitational and inertial accelerations were computed for a triaxial accelerometer that was attached to a hand, oscillating vertically about the wrist. Mathematical equations for hand motion were solved with commercial software.

III. HARDWARE COMPONENTS

A. Arduino UNO

Arduino UNO is a microcontroller board as shown in Fig.1 based on ATmega328P.It has 14 digital input/output pins(of which 6 can be used as PWM outputs),6 analog inputs, a 16MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

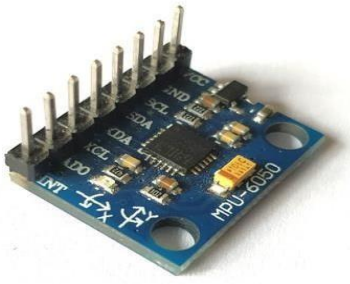

Figure 1. Arduino UNO

B. MPU 6050 (IMU)sensors

C.

Figure 2. MPU 6050(IMU)Sensor

The MPU6050 is a very popular accelerometer gyroscope chip as shown in Fig.2 that has six axes sense with a 16-bit measurement resolution. This high accuracy in sense and the cheap cost makes it very popular. The combination of gyroscopes and accelerometers is commonly referred to as an Inertial Measurement Unit or IMU. IMU sensors are used in a wide variety of applications such as mobile phones, tablets, satellites, spacecraft, drones, UAVs, robotics, and many more. They are used for motion tracking, orientation, position detection, flight control, etc.

D. Buzzer

A buzzer or beeper is an audio signaling device as shown in Fig.3, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, training, and confirmation of user input such as a mouse click or keystroke.

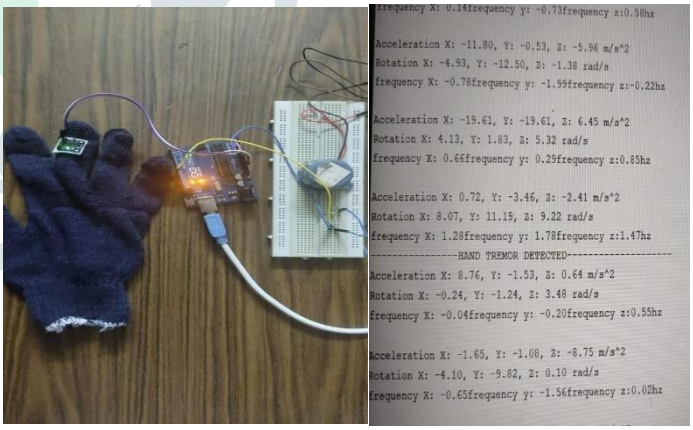

Figure 3. Buzzer

IV. SOFTWARE USED

A. Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

V. PROPOSED SYSTEM

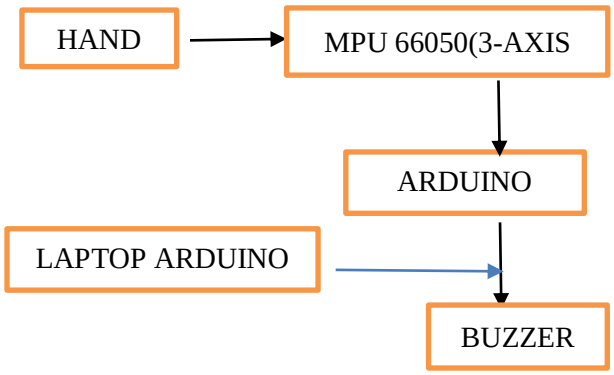

Figure 4. Proposed Model

The Components required to build the proposed model shown in Fig.4 are Arduino Board, MPU-6050 sensor, USB cable, jumper wires and laptop with Arduino IDE installed.

The procedure involved in establishing a connection between the Arduino board, MPU 6050 sensor, and the laptop First USB cable is plugged into the Arduino board and laptop. And then MPU-6050 sensor is connected to the Arduino board by making the following connections between them. 1) Vcc pin of the sensor to the 5V pin of Arduino. 2) GND pin of the sensor to the GND pin of Arduino. 3) the SDA pin of the sensor to the A4 pin of the Arduino 4) the SCL pin of the sensor to the A5 pin of the Arduino.

A. Methodology

The project is planned to design and build an IMU (Inertial Measurement Unit) sensor-based hand tremor detection system for patients with multiple sclerosis or Parkinson's disease.

The IMU sensor detects the rotation in the x,y, and z axes and the signals are sent to the microcontroller from which frequency values are calculated. The output from the microcontroller produces a buzzer sound.

B. EXPERIMENTAL RESULT

a) Experimental Setup b)Monitor Readings

Figure 5. Simulation Output

VI. CONCLUSION

Detection and monitoring of Hand Tremors by the patient itself using Arduino is presented. The proposed system measures the exact frequency of hand tremors and alerts the patient before it can become severe. This can help the patient to perform immediate precautionary measures like intake of medicine or physical therapy. It also helps doctors to classify according to the range of tremors. This model can be further improved by sending the frequency measurement to the cloud so that doctors can monitor the condition of the patient using web applications when they are located remotely.

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