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Tremor Disease Identification and Analysing System

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ABSTRACT: Tremor is a neuro degenerative disease-causing involuntary muscle movement. There are many types of tremors that are caused due to the damage of nerve cells that surrounds thalamus. It is hard to distinguish the tremors, so every tremor type is named behind its frequency type. Proper medication by physician is possible only when the disease is identified. For this requirement, we need a device or a technique to analyze the tremor and for extracting the parameters associated with the signal. These extracted parameters can be used to classify the tremor. There are various diagnostic and treatment monitoring equipment are available for many neuro-muscular diseases. This thesis is concerned with the tremor analysis for the purpose of recognizing certain other neurological disorders. A recording and analysis system for human's tremor is developed. The analysis was performed based on frequency and amplitude parameters of the tremor.

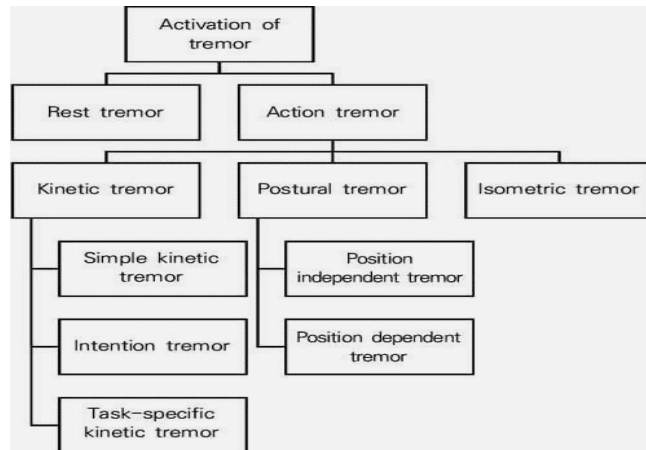
KEYWORDS: MEMS accelerometer, parameter optimization, modeling, evolutionary algorithm, tremor classifier.

I. INTRODUCTION

Tremor can be a symptom associated with disorders in those parts of the brain that control muscles throughout the body or in particular areas, such as the hands. Neurological disorders or conditions that can produce tremor include multiple sclerosis, stroke, traumatic brain injury, chronic kidney disease and a number of neurodegenerative diseases that damage or destroy parts of the brain stem or the cerebellum, Parkinson's disease being the one most often associated with tremor. Tremor is a neurodegenerative disease causing involuntary muscle movements. There are many types of tremor that are caused due to the damage of nerve cells that surrounds thalamus. It is hard to distinguish the tremors, so every tremor type is named behind its frequency type. Proper medication by physician is possible only when the disease is identified. For this requirement, we need a device or a technique to analyze the tremor and for extracting the parameters associated with the signal. The extracted parameters can be used to classify the tremor. There are various diagnostic and treatment monitoring equipment are available for many neuro-muscular diseases. This thesis is concerned with the tremor analysis for the purpose of recognizing certain other neurological disorders. A recording and analysis system for human's tremor is developed. The analysis was performed based on frequency and amplitude parameters of the tremor. Other causes include the use of drugs (such as amphetamines, cocaine, caffeine, corticosteroids, SSRIs) or alcohol, mercury poisoning, or the withdrawal of drugs such as alcohol or benzodiazepine. In this project is very useful for the tremor disease.

Types of tremor

Common types include resting tremor, postural tremor, kinetic tremor, task-specific tremor and intention tremor.



TYPES OF TREMORS

II. MATERIALS AND METHODS

The main idea was to generate a device that acquires signals and observes them, so using a user interface or display were not quite necessary. A sensor which measures the motion and a processor that converts the signals observable in the personal computer are the most important components.

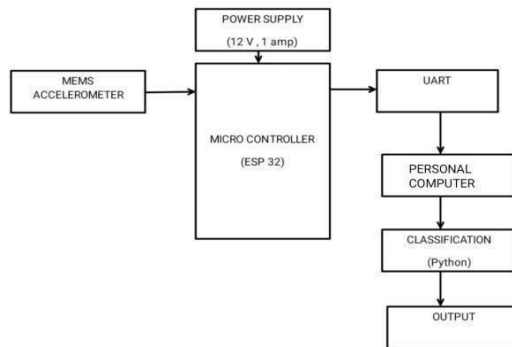


Fig.1 Block diagram

we are placing a mems sensor in the hand of the person to identify tremor disease. The mems sensor will detect shivering of the hand and it will give the output of the mems to the operational amplifier. This amplifier will convert the analog signal into digital and give it to the microcontroller. The controller will send the recognized data to the python software through UART. The received output will be classified in the python software and output will be generated in that. Then the types of tremor will be identified.

MICROCONTROLLER

ESP32

ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the famous ESP8266 SoC. It is a successor to ESP8266 SoC and comes in both single-core and dual-core variations of the Tensilica's 32-bit Xtensa LX6 Microprocessor with integrated Wi-Fi and Bluetooth. The good thing about ESP32, like ESP8266 is its integrated RF components like Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, Filters and RF Balun. This makes designing hardware around ESP32 very easy as you require very few external components.

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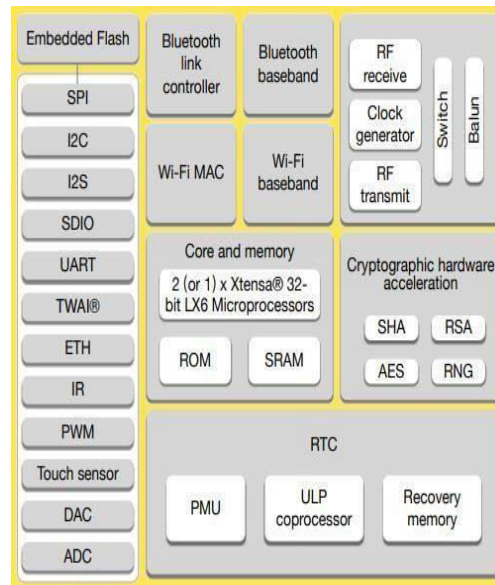


Fig.2 Internal Architecture of esp32

Another important thing to know about ESP32 is that it is manufactured using TSMC's ultra-low-power 40nm technology. So, designing battery-operated applications like wearables, audio equipment, baby monitors, smart watches, etc., using ESP32 should be very easy. ESP32 is a series of low-cost, low-power system on a chip microcontroller with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor and a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process.

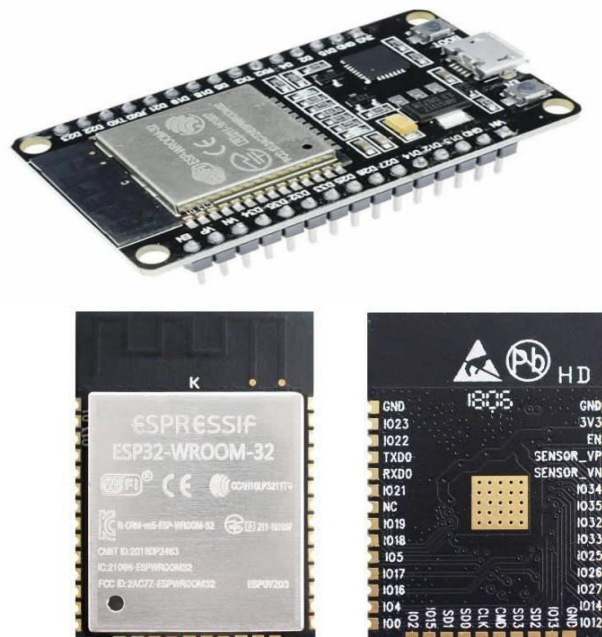


Fig.3 Pin Diagram of esp32

POWERSUPPLY

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

Transformer

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. The positive potential at point A will forward bias D3 and reverse bias D4. The negative potential at point B will forward bias D1 and reverse bias D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow. The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point A. This path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3. One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point B. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier. One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit. This may be shown by assigning values to some of the components shown in views A and B. Assume that the same transformer is used in both circuits. The peak voltage developed between points X and Y is 1000 volts in both circuits. In the conventional full-wave circuit shown—in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts. The maximum voltage that appears across the load resistor is nearly—but never exceeds—500 volts, as a result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

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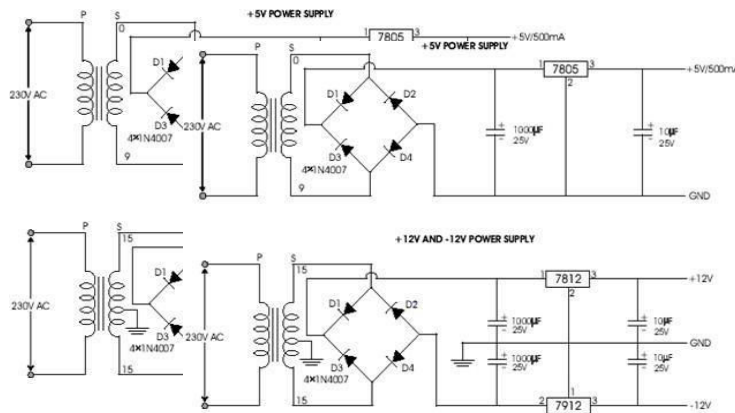


Fig.4 Circuit Diagram of Power Supply

16x2 LCD

LCD stands for liquid crystal display. They come in many sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, 40x2 etc. Many multinational companies like Philips Hitachi Panasonic make their own special kind of LCD'S to be used in their products. All the LCD'S perform the same functions (display characters numbers special characters ASCII characters etc). Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports.

The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply. The 16x2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V). Thus, this is all about LCD 16x2 datasheet, which includes what is a 16X2 LCD, pin configuration, working principle, and its applications. The main advantages of this LCD device include power consumption is less and low cost. The main disadvantages of this LCD device include it occupies a large area, slow devices and also lifespan of these devices will be reduced due to direct current. So, these LCDs use AC supply with less than 500Hz frequency.



Fig.5 LEDDISPLAY

MEMS ACCELEROMETER

The accelerometer is a low power, low profile capacitive micromachined Accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature Compensation, self-test, 0g-Detect which detects linear freefall, and g-Select which Allows

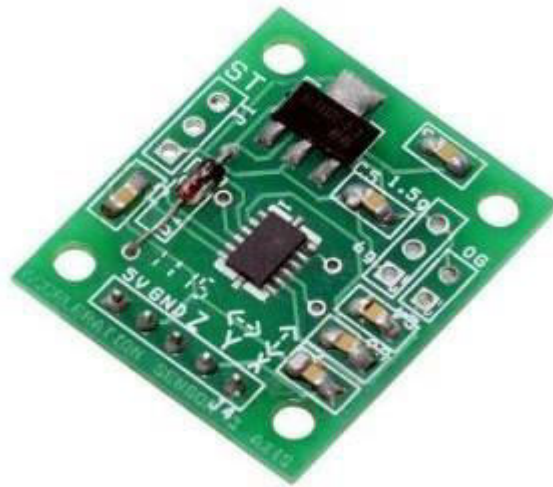
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for theselectionbetween2 sensitivities Zero-g offset and sensitivity is Factory set andrequires no external devices. This includes a Sleep Mode thatmakesit idealforhandheldbatterypoweredelectronics.

Acceleration

isameasureofhowquicklyspeedchanges.Justasaspeedometerisameterthatmeasures speed,anaccelerometerisameterthatmeasuresacceleration.Accelerometers are useful for sensing vibrations in systemsor for orientation applications. Accelerometers can measureaccelerationonone,two,orthreeaxis.3-axisunitsarebecomingmorecommonasthecostofdevelopmentforthemdecreases. You can use an accelerometer's ability to senseaccelerationtomeasureavarietyofthingsthatareveryusefultoelctronicandrobotic projects.



Accelerometer

III. CONCEPTS INVOLVED

ARDUINO SOFTWARE (IDE)

Arduino Bootloader Issue

The current boot loader burned onto the Arduino UNO is not compatible with ROBOTC. In its current form, you will be able to download the ROBOTC Firmware to the Arduino UNO, but you will not be able to download any user programs. The reason for this is because there is a bug in the Arduino UNO firmware that does not allow flash write commands to start at anywhere but the beginning of flash memory (0x000000). See the bottom of this page for more technical details.

Because ROBOTC is not able to burn a new bootloader as of today, you will need to use the Arduino's Open-Source language with a modified bootloader file to re-burn your bootloader on your Arduino UNO boards. The enhanced bootloader is backwards compatible with the original one. That means you'll still be able to program it through the Arduino programming environment as before, in addition to ROBOTC for Arduino.

Hardware Needed

To burn a new version of the Arduino bootloader to your UNO, you'll need an AVRISP compatible downloader.

Using an AVRISP (In System Programmer)

- Your Arduino UNO (to program)
- An AVR Programmer such as the AVR Pocket Programmer
- An AVR Programming Cable (the pocket programmer comes with one)
- If you have extra Arduino boards, but no ISP programmer, SparkFun.com has a cool tutorial on how to flash a bootloader using an Arduino as an ISP.

Using another Arduino as an ISP

- Your Arduino UNO (to program)
- A Working Arduino (doesn't matter what kind)
- Some Male-to-Male Jumper Cables

Software Needed

ROBOTC is not currently able to burn a bootloader onto an Arduino board, so you'll need to download a copy of the latest version of the Arduino Open-Source programming language. [Arduino Official Programming Language - Download Page](#). In addition, you'll need the ROBOTC modified bootloader. You can download that there: [ROBOTC Modified UNO Bootloader - Modified Bootloader](#)

EMBEDDED C

High-level language programming has long been in use for embedded systems development. However, assembly programming still prevails, particularly for digital-signal processor (DSP) based systems. DSPs are often programmed in assembly language by programmers who know the processor architecture inside out. The key motivation for this practice is performance, despite the disadvantages of assembly programming when compared to high-level language programming.

If the video decoding takes 80 percent of the CPU-cycle budget instead of 90 percent, for instance, there are twice as many cycles available for audio processing. This coupling of performance to end-user features is characteristic of many of the real-time applications in which DSP processors are applied. DSPs have a highly specialized architecture to achieve the performance requirements for signal processing applications within the limits of cost and power consumption set for consumer applications. Unlike conventional Load-Store (RISC) architecture, DSPs have a data path with memory-access units that directly feed into the arithmetic units. Address registers are taken out of the general-purpose register file and placed next to the memory units in a separate register file.

A further specialization of the data path is the coupling of multiplication and addition to form a single cycle Multiply-accumulate unit (MAC). It is combined with special-purpose accumulator registers, which are separate from the general-purpose registers. Data memory is segmented and placed close to the MAC to achieve the high bandwidths required to keep up with the streamlined data path. Limits are often placed on the extent of memory-addressing operations. The localization of resources in the data path saves many data movements that typically take place in a Load-Store architecture.

The most important, common arithmetic extension to DSP architectures is the handling of saturated fixed-point operations by the arithmetic unit. Fixed-point arithmetic can be implemented with little additional cost over integer arithmetic. Automatic saturation (or clipping) significantly reduces the number of control-flow instructions needed for checking overflow explicitly in the program. Changes in technological and economic requirements make it more expensive to continue programming DSPs in assembly. Staying with the mobile phone as an example, the signal-processing algorithms required become increasingly complex. Features such as stronger error correction and encryption must be added. Communication protocols become more sophisticated and require much more code to implement. In certain markets, multiple protocol stacks are implemented to be compatible with multiple service providers. In addition, backward compatibility with older protocols is needed to stay synchronized with provider networks that are in a slow process of upgrading.

For example, is required in many algorithms and is supplied as a primitive in many DSPs. However, there is no such primitive in Standard C. To express saturated arithmetic in C requires comparisons, conditional statements, and correcting assignments. Instead of using a primitive, the operation is spread over a number of statements that are difficult to recognize as a single primitive by a compiler.

DESCRIPTION

Embedded C is designed to bridge the performance mismatch between Standard C and the embedded hardware and application architecture. It extends the C language with the primitives that are needed by signal-processing applications and that are commonly provided by DSP processors. The design of the support for fixed-point data types and named address spaces in Embedded C is based on DSP-C. DSP-C [1] is an industry-designed extension of C with which experience was gained since 1998 by various DSP manufacturers in their compilers. For the development of DSP-C by ACE (the company three of us work for), cooperation was sought with embedded-application designers and DSP manufacturers.

The Embedded C specification extends the C language to support freestanding embedded processors

exploiting the multiple address space functionality, user-defined named address spaces, and direct access to processor and I/O registers. These features are common for the small, embedded processors used in most consumer products. The features introduced by Embedded C are fixed-point and saturated arithmetic, segmented memory spaces, and hardware I/O addressing. The description we present here addresses the extensions from a language-design perspective, as opposed to the programmer or processor architecture perspective.

MULTIPLE ADDRESS SPACES

Embedded C supports the multiple address spaces found in most embedded systems. It provides a formal mechanism for C applications to directly access (or map onto) those individual processor instructions that are designed for optimal memory access. Named address spaces use a single, simple approach to grouping memory locations into functional groups to support MAC buffers in DSP applications, physical separate memory spaces, direct access to processor registers, and user-defined address spaces.

The Embedded C extension supports defining both the natural multiple address space built into a processor's architecture and the application-specific address space that can help define the solution to a problem. Embedded C uses address space qualifiers to identify specific memory spaces in variable declarations. There are no predefined keywords for this, as the actual memory segmentation is left to the implementation. As an example, assume that X and Y are memory qualifiers.

PYTHON

Python is a widely used high-level programming language for general-purpose programming, created by Guido van Rossum and first released in 1991. An interpreted language, Python has a design philosophy that emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++ or Java. The language provides constructs intended to enable writing clear programs on both small and large scale. Python features a dynamic type system and automatic memory management as it supports multiple programming paradigms, including object-oriented, functional programming and procedural styles. It has a large and comprehensive standard library. Python interpreters are available for many operating systems, allowing Python code to run on a wide variety of systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation.

IV. RESULTS

As a result of training the classifier using the proposed feature and python, the tremor was classified

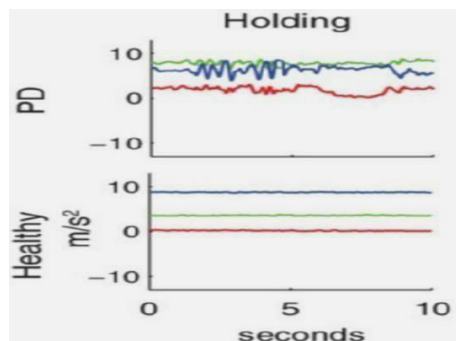


FIG.6 GRAPH

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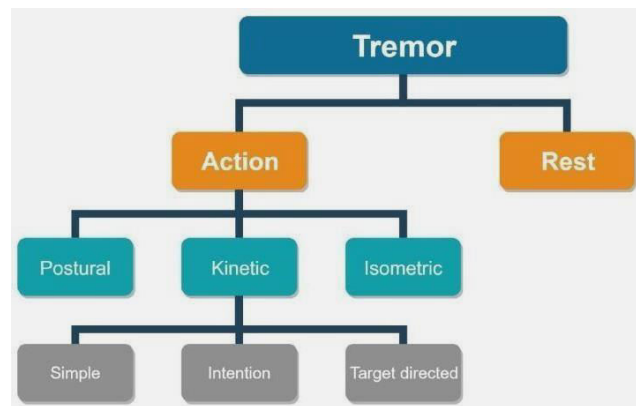


Fig.8 CLASSIFICATION OF TREMOR

V. CONCLUSION

This work developed and identified the type of tremor in patients. The proposed tremor analyzing model in this work distinguishes the better performance than the existing model. It is notable that the tremor detection model was based on long-term acceleration data collection in real life condition which made our model in practical application. And hence we conclude that the types of tremors are analyzed and identified in our project work.

VI. FUTURE SCOPE

In the future, the main issue will be the examination of new features and the use of new methods. The tremor is regular and has a frequency of 4-12 HZ. In order to focus on the frequency component of the tremor, it is expected that diagnostic accuracy will be improved using a fast Fourier transform. Before that, we can identify only the hand type tremor rather than attempting the granular assessment. As a future challenge, we can quantify the different types of tremor such as finger, chin, and associated body parts.

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