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Assessment And Attenuation Of Essential Tremor Of Hand Using Vibration Sensor And Matlab Software

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***Abstract*: Essential Tremor is the most common form of pathological tremor, it is a common neurological movement disorder causing involuntary oscillations in body parts. This work approaches a light weight, wearable tremor suppression orthosis using an spring on-off technique. This method uses a wearable inertial sensor to extract tremor data and the data is given to Matlab wavelet code for estimating severity of tremor frequency then based on its output spring on-off technique is applied.**

***Keywords:* Essential Tremor, Vibration Sensor, Wavelet Analysis, Spring on-off technique, Tremor suppression, Matlab Software.**

I. INTRODUCTION

Essential tremor is a pathological or physiological tremor, It is an involuntary vibrations in the voluntary body movement. Physiological essential tremor is normal not visible to naked eyes but the other one called pathological tremor which is a serious disorder affects many of the daily task. Essential tremor affects body parts such as neck, limbs, wrist, throat(voice). As per the studies tremor frequency is very small which lies between 3-15 HZ. Using this method we can easily estimate tremor data and controlled by using spring on-off technique. As we know in order to dampen the vibrations in any device we put on load on the device to suppress the frequency since for hand we cannot put any load for frequency so here we approached a spring on-off technique. In spring on-off method spring will be tightened and loosed based the result obtained from the wavelet analysis, that is the number of spring rotations is based on the frequency to be controlled. Here wavelet analysis is used for estimating the severity of tremor and it suggest how much frequency should be suppressed. As per the studies though treatments are available for the tremor such as medication, relaxation techniques, deep brain stimulation, surgery many of the patients are not getting relief from the tremor. So research in this field is still going on and several suppression systems are also developed. Such as Controlled Energy Dissipation Orthosis (CEDO) developed by Aisen et al., A dumped joystick was developed by an MIT group, and an On-Off Tremor Suppression Orthosis with Electromagnetic Brake developed by Gil Herrnstadt and Carlo Menon .

A drawback with many of these suppression systems is their bulkiness. This work aim to demonstrate an alternate to previously suggested tremor suppression systems.

II. CIRCUITRY AND SOFTWARE

The circuitry includes power supply system, regulator, Driver IC, Vibration sensor, miniatured DC motors, Spring as well as a port for interfacing data from hardware to the computer. The software part includes MATLAB software in that wavelet analysis code will be written for data analysis.

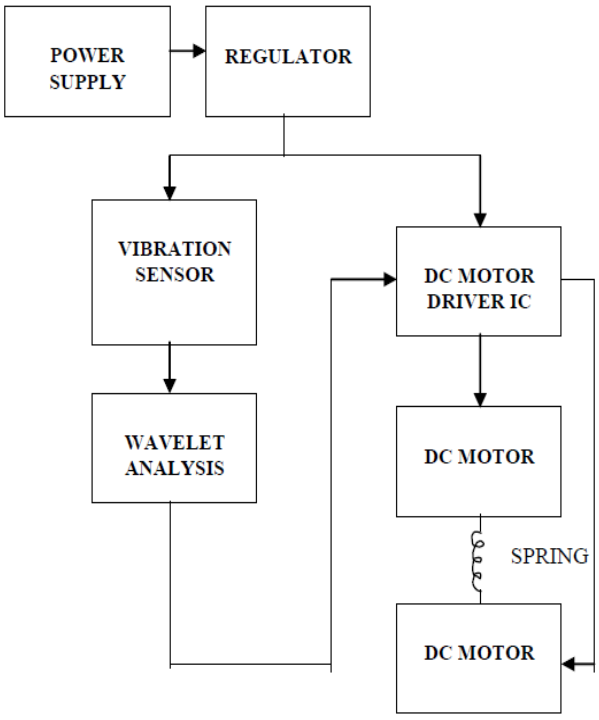

Fig 1: Block diagram of tremor analysis and suppression system

III. ANALYSIS AND CONTROL STRATEGY

The process of tremor frequency analysis includes following methods. All the components which are mentioned in the block diagram are fabricated and placed in a belt which is wearable. This belt is connected to the wrist and, later as per mentioned earlier system will perform wavelet analysis to estimate the tremor signal and compare it with the predefined frequency then gives its output. This output is taken as input for the MATLAB that contains necessary code for performing spring on-off process by controlling DC motor. Then the output of MATLAB will be given to DC motor driver and the motors starts rotating and spring starts compressing to required rotations. This process will give support to hand and it will reduce the vibrations. The system will continuously monitor the tremor status and spring will go on-off based on it.

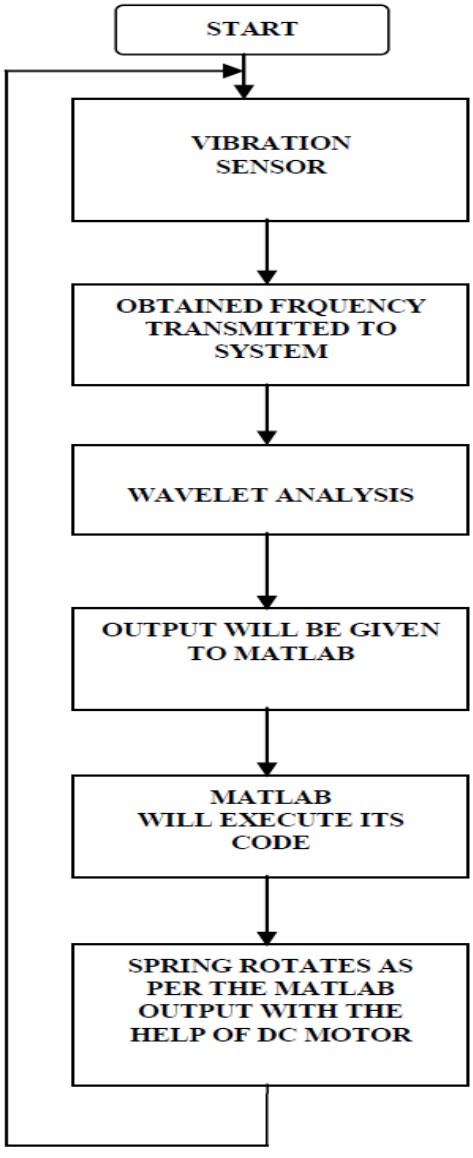

Fig 2. Process flow of tremor analysis and suppression

IV. WAVELET ANALYSIS

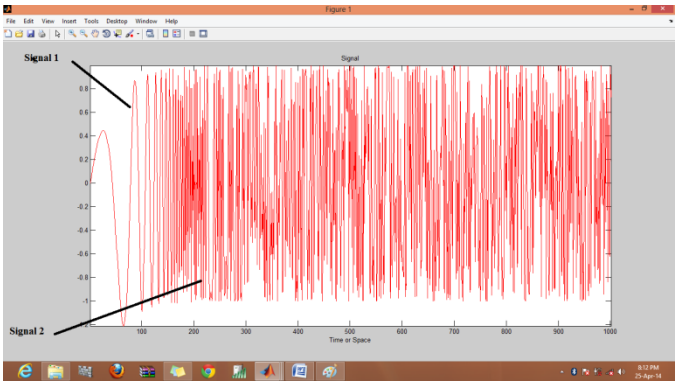

Fig 3. Tremor signal

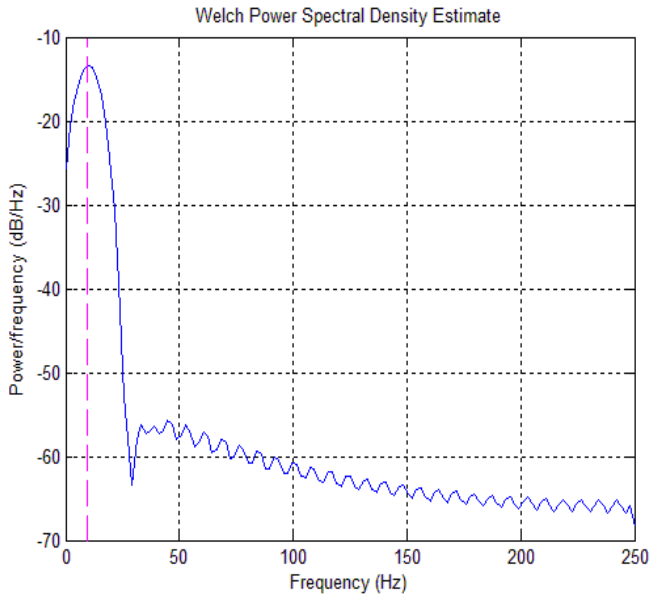

Fig 4. PSD of Signal 1

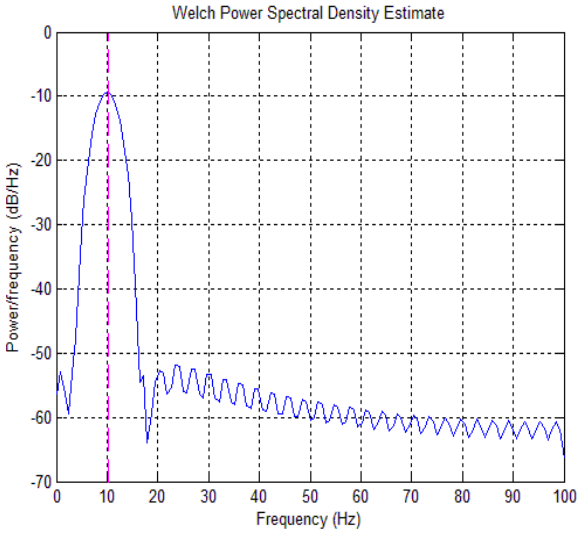

Fig 5. PSD of Signal 2

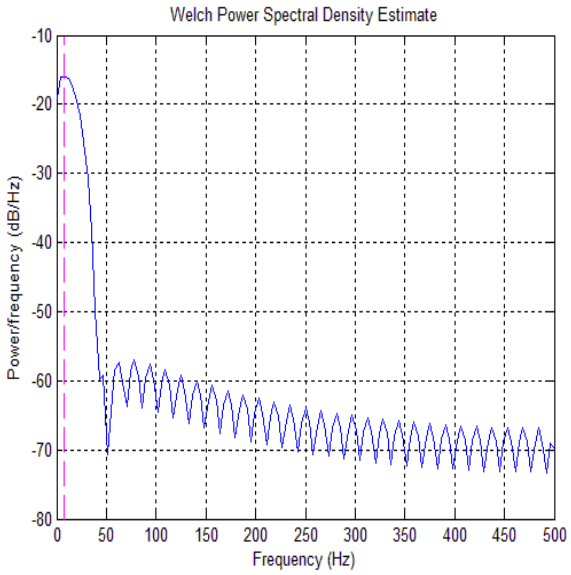

Fig 6 : PSD representing frequency to be controlled

V. CONCLUSION

As mentioned before Essential Tremor is a motion disorder which affects daily task. This tremor make a person tolose his confidence because of its nature of unwanted vibrations. So this system will try to reduce the tremor and helps them in gaining their confidence avoiding embrassing conditions. MEMS sensor is very small, light weight which is used in system in order to reduce the weight of the system. This system can be easily wearable in wrist and the sytem will continuously monitor the frequency and reduces frequency by spring on-off technique.

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