Analysis of Tremor using MATLAB and PIC Microcontroller

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Abstract

Highly interaction in human machine in daily lives has made user interaction progressively very important. Expansion of sensor based advanced technology sophisticated human force and stress in electronic circuits has been greatly reduced the weight and area of consumer electronics products such as smart laptop controls, PC based automation systems helpful for physically challenged. In this paper we propose a completely design and analysis of an intelligent system to identify and to analysis the tremor. Tremor in the project is identified using MEMS accelerometer sensor and the data is sent to PC and analysis is done by plotting on MATLAB. MEMS accelerometer measures the acceleration of the signal in three co-ordinates such as x-axis, y-axis, and z-axis. To capture the hand motions online, the general MEMS sensor which can be operated without any external reference and limitation in working conditions are used.

Index terms: **PIC microcontroller, tremor, MEMS accelerometer, temperature sensors**

I. INTRODUCTION:

The hunger for automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the MEMS Accelerometer sensor based on embedded technology and applications designing. These had greater importance than any other technologies due its user-friendly nature. An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, to identify and to analysis the tremor, is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today.

A tremor is an unintentional and uncontrollable rhythmic movement of one part or one limb of your body. A tremor can occur in any part of the body and at any time. It's usually the result of a problem in the part of your brain that controls muscular movement. Tremors are not always serious, but in some cases they may indicate a serious disorder. Most tremors can't be treated easily, but they will often go away on their own. It's important to note that muscle spasms, muscle twitches, and tremors are not the same thing. A muscle spasm is the involuntary contraction of a muscle. A muscle twitch is an uncontrolled fine movement of a small portion of a larger muscle. This twitch may be visible under the skin.

A spoon that would cancel out its effects He calls the spoon Liftware. There's no on switch; the spoon starts up automatically when it's lifted from the table. The chunky handle vibrates a little in the user's hand. "There's a little motion sensor right near the spoon," Pathak explains. "If I had tremor, it's going to move opposite to what the shaking is doing. So, if I move to the left, it'll physically move the spoon to the right." And that cancels out the tremor as the spoon moves

from plate to mouth. on that would cancel out its effects. He calls the spoon <u>Liftware</u>.

For the proposed design we used Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. For example, air traffic control systems may usefully be viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites.

The hardware and all the software in the system are available to, and extensible by application programmers. Based on performance, functionality, requirement the embedded systems are divided into three categories:

(i) Stand Alone Embedded System:

These systems takes the input in the form of electrical signals from transducers or commands from human beings such as pressing of a button etc.., process them and produces desired output. This entire process of taking input, processing it and giving output is done in standalone mode. Such embedded systems comes under stand alone embedded systems

(ii) Real-time embedded systems:

Embedded systems which are used to perform a specific task or operation in a specific time period those systems are called as real-time embedded systems. There are two types of real-time embedded systems.

- Hard Real-time embedded systems: These embedded systems follow an absolute dead line time period i.e.., if the tasking is not done in a particular time period then there is a cause of damage to the entire equipment.

- Soft Real Time embedded systems: These embedded systems follow a relative dead line time period i.e.., if the task is not done in a particular time that will not cause damage to the equipment.

(iii) Network communication embedded systems:

A wide range network interfacing communication is provided by using embedded systems.

Fig.1 Network communication embedded systems

II. RELATED WORK:

A tremor is an involuntary, somewhat rhythmic, muscle contraction and relaxation involving to and from movements (oscillations or twitching) of one or more body parts. It is the most common of all involuntary movements and can affect the hands, arms, eyes, face, head, vocal folds, trunk, and legs. Most tremors occur in the hands. In some people, tremor is a symptom of another neurological disorder. A very common kind of tremor is the chattering of teeth, usually induced by cold temperatures or by fear. Tremor can be a symptom associated with disorders in those parts of the brain that control muscles throughout the body.

Categories of Tremor

In addition to type, tremors are also classified by their appearance and cause.

a. Essential Tremor

Essential tremor is the most common type of movement disorder. Essential tremors are usually postural or intention tremors. An essential tremor may be mild and not progress, or it may slowly progress. If the essential tremor progresses, it often starts on one side and then affects both sides within a few years.

Essential tremors weren't thought to be associated with any disease processes. However, recent studies have connected them to mild degeneration in the cerebellum, which is the part of the brain that controls motor movement. Essential tremors are sometimes associated with mild walking difficulty and hearing disability, and they tend to run in families.

b. Parkinsonian Tremor

A Parkinsonian tremor is usually a resting tremor and is often the first sign of Parkinson's disease. It's caused by damage to parts of the brain that control movement. The onset is usually after age 60. It begins in one limb or on one side of the body, and then it progresses to the other side.

c. Dystonic Tremor

A dystonic tremor occurs irregularly. Complete rest can relieve these tremors. This tremor occurs in people who have dystonia, which is a movement disorder characterized by involuntary muscle contractions. The muscle contractions cause twisting and repetitive motions or abnormal postures, such as twisting of the neck. These can occur at any age.

d. Cerebellar Tremor

The cerebellum is the part of the hindbrain that controls movement and balance. A cerebellar tremor is a type of intention tremor caused by lesions or damage to the cerebellum from a stroke, tumor, or disease, such as multiple sclerosis. It may also be the result of chronic alcoholism or overuse of certain medications.

e. Psychogenic Tremor

A psychogenic tremor may present as any of the tremor types. It's characterized by sudden onset and remission, changes in the direction of your tremor and the affected body part, and greatly decreased activity when you're distracted. Patients with psychogenic tremors often have conversion disorder (a psychological condition that produces physical symptoms) or another psychiatric disease.

f. Orthostatic Tremor

An orthostatic tremor usually occurs in the legs. This is a rapid, rhythmic muscle contraction that occurs immediately after you stand. This tremor is often perceived as unsteadiness. There are no other clinical signs or symptoms. The unsteadiness stops when you sit, are lifted, or when you start walking.

g. Physiologic Tremor

A physiologic tremor is often caused by a reaction to certain drugs, alcohol withdrawal, or medical conditions, such as hypoglycemia (low blood sugar) or an overactive thyroid gland. Physiologic tremor usually goes away if you eliminate the cause.

Types of Tremors:

Tremors are divided into two types: resting and action.

Resting tremors occur when you're sitting or lying still. Once you begin to move around, you'll notice that the tremor goes away. Resting tremors often affect only the hands or fingers. Action tremors occur during movement of the affected body part. Action tremors are further divided into subcategories:

- An intention tremor occurs during targeted movement, such as touching your finger to your nose.
- 2.A postural tremor occurs when holding a position against gravity, such as holding your arm or leg outstretched.
- 3.Task-specific tremors occur during a specific activity, such as writing.
- 4.Kinetic tremors occur during movement of a body part, such as moving your wrist up and down.
- 5.Isometric tremors occur during the voluntary contraction of a muscle without other movement of the muscle.

Medications used:

There are some medications that are commonly used to treat the tremor itself. Your doctor may prescribe them for you.

- Beta blockers are usually used to treat people with high blood pressure or heart disease. However, they have been shown to reduce tremors in some people.
- Tranquilizers, such as alprazolam (Xanax), may relieve tremors that are triggered by anxiety.
- Anti-seizure medications are sometimes prescribed for people who cannot take beta blockers or who have tremors that are not helped by beta blockers.

Botox Injections

Botox injections may also relieve tremors. These chemical injections are often given to people who have tremors that affect the face and head.

Physical Therapy

Physical therapy may help strengthen your muscles and improve your coordination. The use of wrist weights and adaptive devices, such as heavier utensils, may also help relieve tremors.

Brain Stimulation Surgery

Brain stimulation surgery may be the only option for those with debilitating tremors. During this operation, the surgeon inserts an electrical probe into the portion of your brain responsible for the tremors. Once the probe is in place, a wire feeds from the probe into your chest, under your skin. The surgeon places a small device in your chest and attaches the wire to it. This device sends pulses to the probe to stop the brain from producing tremors.

III. PROPOSED METHODOLOGY:

In day-to-day life Automation has created a bigger hype in the electronics. The major reason for this hype is automation provides greater advantages like accuracy, energy conversation, reliability and more over the automated systems do not require any human attention. Highly interaction in human machine in

daily lives has made user interaction progressively very important. Expansion of sensor based advanced technology sophisticated human force and stress along with power conservation with automation system. Today's healthcare systems in most countries are struggling with increased number of patients and increased costs of patient care per patient. This situation is aggravated by the current trends of unhealthy lifestyle habits, including stress and physical inactivity, which increasingly leads to chronic illnesses such as obesity, diabetes and heart disease, even in younger population. For such cases, early treatment, including physical exercise, could prevent negative outcomes as population ages. Such a treatment would be more likely to succeed if the healthcare system had access to facilities for continuous monitoring of the individual's physical fitness level, because it would allow monitoring compliance and providing feedback. Such facilities would ideally consist of simple, inexpensive and readily available equipment.

Accelerometers can be used to effectively translate finger and hand gestures into computer interpreted signals. Integrating a single chip wireless solution with a MEMS accelerometer would yield an autonomous device small enough to apply to the fingernails because of their small size and weight. Accelerometers are attached to the fingertips and back of the hand. Arrows on the hand show the location of accelerometers and their sensitive directions. The sensitive direction of the accelerometer is in the plane of the hand. Micro-electromechanical systems (MEMS) are free scale's enabling technology for acceleration and pressure sensors. MEMS based sensor products provide an interface that can sense, process or control the surrounding environment. MEMS-based sensors are a class of devices that builds very small electrical and mechanical components on a single chip. MEMS-based sensors are a crucial component in automotive electronics, medical equipment, hard disk drives, computer peripherals, wireless devices and smart portable electronics such as cell phones and PDAs. MEMS technology provides the following

advantages: cost-efficiency, low power, miniaturization, high performance, and integration. Functionality can be integrated on the same silicon or in the same package, which reduces the component count. This contributes to overall cost savings.

Parts list:

- MMA7260Q accelerometer on Sparkfun breakout board
- MIC29150-3.3BT 3.3V voltage regulator
- 2 - 10Kohm 0.25-watt resistors
- 2 - 1N5226B-T 3.3V zenar diodes

This graph shows the X axis. The accelerometer starts level, and then is tilted to the left, then to the right, then level again:
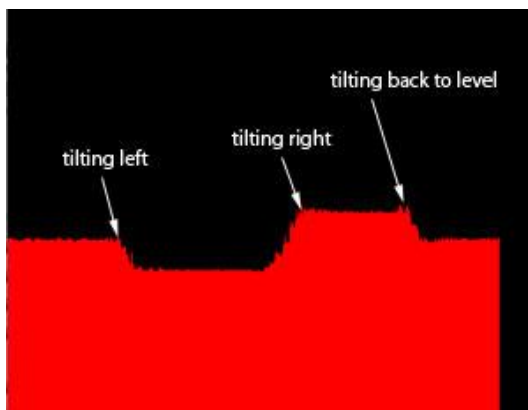
This graph shows the Y axis. The accelerometer starts level, and then is tilted forward, then back, then level again:
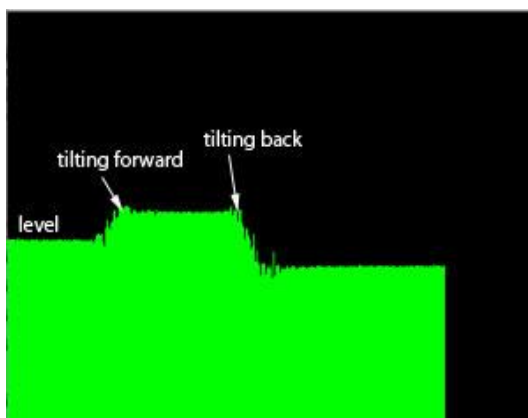
This graph shows the Z axis. The accelerometer is kept level, but raised up in a quick motion, then lowered quickly. Moving up produces a sudden increase in force (and voltage) followed by a sudden decrease when the movement's stopped, then finally the voltage levels out again. Moving down has the opposite effect.

Temperature sensor

The LM35 sensor series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. To detect the heat produced during fire occurrence, engine over heat of vehicles, we make use of it. The temperature sensors contain a sensing element enclosed in housings of plastic or metal. With the help of conditioning circuits, the sensor will reflect the change of temperature.

Figure- 2.LM35 Temperature sensor

In this paper we are presented MMA7260Q based tremor analysis on PC using MATLAB software. MATLAB stands for matrix laboratory. MATLAB (matrix laboratory) is a numerical computing environment and fourth-generation programming language. Developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and Fortran.

MATLAB can be used in a wide range of applications, including signal and image processing, communications, control design, test and measurement, financial modeling and analysis, and computational biology. For a million engineers and scientists in industry and academia, MATLAB is the language of technical computing. The MATLAB serial port interface provides direct access to peripheral devices such as modems, printers, and scientific instruments that you connect to your computer's serial port. This interface is established through a serial port object. The serial port object supports functions and properties that allow you to

- Configure serial port communications
- Use serial port control pins
- Write and read data
- Use events and callbacks
- Record information to disk

Instrument Control Toolbox™ software provides additional serial port functionality. In addition to command-line access, this toolbox has a graphical tool called the Test & Measurement Tool, which allows you to communicate with, configure, and transfer data with your serial device without writing code. The Test & Measurement Tool generates MATLAB code for your serial device that you can later reuse to communicate with your device or to develop GUI-based applications. The toolbox includes additional serial I/O utility functions that facilitate object creation and configuration, instrument communication, and so on. With the toolbox you can communicate with

GPIB- or VISA-compatible instruments. Using MATLAB we can select COMPORT, BAUDRATE, START BIT, STOP BIT, PARITY BIT and DATA BIT for serial communication.

- Create a serial port object:

Obj=serial('port','propertyname',propertyvalue)
Example: s = serial('COM1','BaudRate',9600);
To specify properties during object creation
s = serial
('COM2','BaudRate',9600,'DataBits',8);
Obj = serial('port') creates a serial port object associated with the serial port specified by port. If port does not exist, or if it is in use, you will not be able to connect the serial port object to the device.
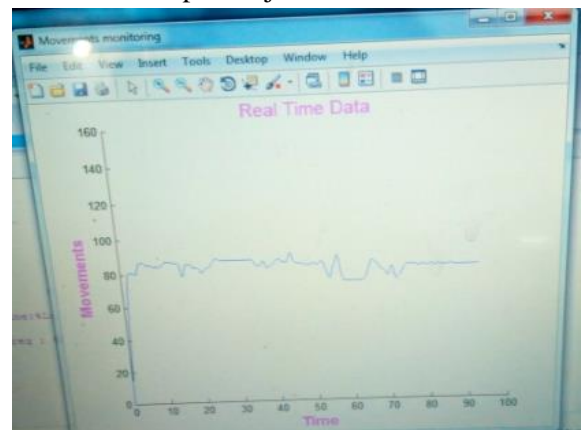

Fig 3.Tremor Analysis plotting Graph on PC using MATLAB software
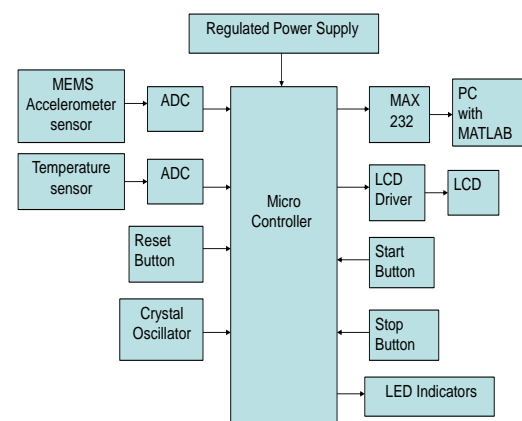

Analysis of Tremor using PIC Microcontroller

Fig 4.Block diagram of proposed design

IV. HARDWARE DESIGN FOR PROPOSED SYSTEM:

In the Proposed intelligent system to identify and to analysis the tremor we used MEMS accelerometer sensor for tremor detection, LCD for displaying the parameters of temperature and tremor results. Tremor in the project is identified using MEMS accelerometer sensor and the data is sent to PC and analysis is done by plotting on MATLAB. The system also monitors the body temperature on to the LCD display module.
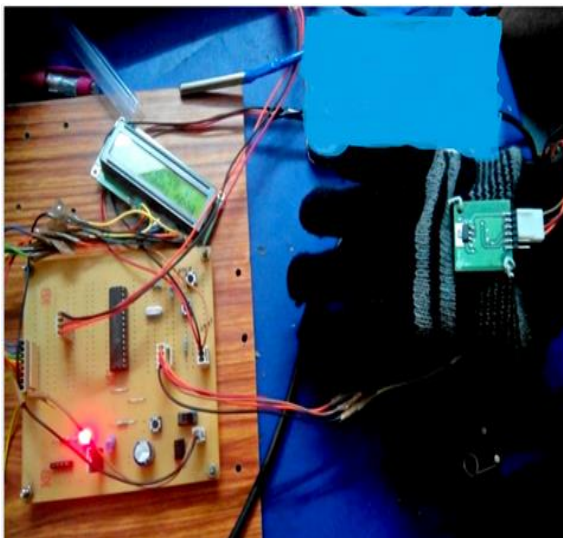

Fig.5 Hardware design of the proposed system

The main controlling device of the whole system is a Microcontroller. MEMS accelerometer sensor, temperature sensor, LCD, MAX232, start and stop buttons are interfaced to Microcontroller.

The sensors like temperature measures body temperature The Microcontroller gets information regarding the vibrations through MEMS accelerometer sensor and sends the data to PC and LCD depending on the input from start and stop buttons. Data to PC is sent through a line driver IC MAX232. The data received by PC is accessed by MATLAB software and plotting is done. To perform the task, Microcontroller is loaded with an intelligent program written in embedded 'C' language.

S.No. Of Patie nts	Rest Tre mor	Postural (Holdin g A Cup)	Kineti c (Pointi ng Nose And Finger)	Temper ature (degree Fahrenh eit)	Before		After 6 Weeks	
					Time (30 seconds)	Frequen cy	Time (30 second s)	Freq uency
1	Yes	-	-	101	60	45	60	22
2	-	Yes	-	101	60	50	60	29
3			Yes	101	60	43	60	25
4	Yes			100	300	130	300	90
5		Yes		100	300	135	300	97
6			Yes	100	300	121	300	94
7	Yes			102	30	43	30	15
8		Yes		102	30	50	30	23
9			Yes	102	30	52	30	19
10	Yes			98.7	30	26	30	5
11		Yes		98.7	30	31	30	15
12			Yes	98.7	30	29	30	17
13	Yes			100	60	33	60	10
14		Yes		100	60	42	60	14
15			Yes	100	60	39	60	14
16	Yes			103	30	50	30	19
17		Yes		103	30	63	30	24
18			Yes	103	30	57	30	27
19	Yes			100	120	63	120	14
20		Yes		100	120	74	120	17
21			Yes	100	120	65	120	15
22	Yes			99	60	32	60	5
23		Yes		99	60	40	60	8
24			Yes	99	60	36	60	6
25	Yes			101	30	40	30	11
26		Yes		101	30	53	30	17
27			Yes	101	30	49	30	14
28	Yes			99.3	60	50	60	21
29		Yes		99.3	60	63	60	29
30			Yes	99.3	60	59	60	24

Fig: 6 Output results in table format

The paper results of "Analysis of Tremor using MATLAB and PIC Microcontroller" was designed such that it is used to identify and to analysis the tremor. Tremor in the project was identified using MEMS accelerometer sensor and the data is sent to PC and analysis is done by plotting on MATLAB window. The system also monitors the body temperature on to the LCD display module.

The Tremor analysis is done and 30 readings are analyzed The Tremors are analyzed at different parameters like rest tremors, kinetic tremors and potential tremors. The readings are taken for patients before the medication has started and after 6 weeks of medication. We observe that tremors are reduced after medication.

IV CONCLUSION:

The existing system proposes a way to use the resources provided by the controller which has good availability and is able to monitor the vital parameters like tremor and body temperature of health in a cost efficient manner is an Integrating feature of all the hardware components been used and developed in it with PIC microcontroller. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for an automatic license plate recognition system has been designed perfectly. Secondly, using highly advanced IC's like MEMS accelerometer sensor, MATLAB for plotting with the help of growing technology, the project has been successfully implemented with a unique idea. Thus the project has been successfully designed and tested. This system can be extend the wireless distance by using high efficiency WIFI module for data transmission from sensor unit to the PC for future extension. The proposed model can also be added with hand written recognition using MATLAB and MEMS sensor. An acknowledgement of the operations which are being performed to PC can be given by using GSM modem from any where in the world.

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