Sensors based Wearable and Systems for Detection of Human Movement and Fall

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Abstract: Human computer interaction system is a study of relationship between people and computers mediated information. The future of human computer interaction systems lies in how intelligently these systems can take into account the user's context like Application areas, social organization and work. Researchers on recognizing the daily activities of people has progressed steadily, but little focus has been devoted to recognizing jointly activities as well as movements in a specific activity, their innovation have designed to improve and enrich human beings personal and professional lives, making it simpler to create, communicate with PCs. For many applications such as rehabilitation, design, development and evaluation of models, techniques and human centred perspective, sports medicine, geriatric care and health/fitness monitoring the importance of combined recognition of activities and movements can drive health care outcomes. The consequences of falls, particularly of those which are followed by a "long-lie" of an hour or more, are causing harm , both on a personal and a wide range community level, and includes hospitalization, morbidity and mortality. In different situations, this stresses the importance of monitoring the individuals at risk of falling, detecting falls and implementing a preventative strategies for to minimize the falls risk by allocating a suitable and timely intervention when possible. Since as developed the technological advancements in the fields of mechanical, electrical and computer engineering, particularly involving micro electromechanical Systems (MEMS), have resulted in smaller and cheaper sensors that can operate in a wireless manner. Most systems are available commercially and which are the subject of current research, are enclosed in small cases that can be attached to the body using bands or belts like wrist wearable, a private eye head mounted display and goggle glass.

Keywords—**MEMS Technology, IR Sensor, GSM Modem**.

I. INTRODUCTION

The Purpose of this project is to implement a system for continuous monitoring of older people by using wearable sensors. The entire project can be implemented by dividing it into two parts. One part is responsible for implementing a critical system and is responsible to alert to caretaker whenever person needed rescue or help. Another part is noncritical part and is responsible to send an SMS to the care when the old person is in risk.

The Pulse detector is nothing but an arrangement of the IR sensor is the combination of one IR transmitter and one IR receiver. The IR transmitter will be active if it has been supplied with a sufficient voltage of approximately 3v. IR receiver will detect only IR rays which have been emitted from the IR transmitter. Depending up on the IR rays emission on to IR receiver, it will give different voltages. That means, when IR rays are continuously falling on to the IR receiver, it will give some voltage. If the IR rays stops falling on to the IR receiver, it will give some different voltages. By processing these two different determined voltages, it allows to easily find out presence of IR rays. The IR sensor will form with the combination of IR transmitter and IR receiver. The IR transmitter and IR receiver are kept parallel, with this arrangement IR rays which are emitting from the IR transmitter will not get fall on to IR receiver. And whenever any obstruct arrive in between IR transmitter and IR receiver, the IR rays will get reflected from obstruct and will be received by IR receiver. So that, if any obstruct got detected, IR receiver will give some voltage and in other case IR receiver will give some different voltage. The end node of the IR receiver will be given to transistor circuit to give only either 5v or 0v. And finally, the working of IR sensor will be such that if any obstruct detects, the output of the IR sensor is 0v and in other case IR sensor output is 5v.

Another sensor is MEMS Sensor (It's the abbreviation for Micro Electro Mechanical System Sensor). This MEMS Sensor will be responsible to give digital data for different kinds of mechanical movements. This MEMS Sensor generates the data depending up on position of the MEMS Device with respect to Earth axes. It gives data

relative to its position in the form X-axis, Y-axis and Z-axis coordinates corresponding to the earth. This MEMS Sensor will be attached to the human body. The person normal position values in the form of X, Y and Z are treated as normal condition. Any of the other position values, like when the person is falling, the attached MEMS Sensor will be arrived to some other position nothing but the position of the falling down position of human body. So it gives another different kind data corresponding to the falling position of the human body. When any of the position other than normal position, the system will give an alert such that care taker can assist to set right him.

The second section of the system is alerting system. This alerting system again contains two modules one is LCD display and another one is buzzer. The buzzer module is arranged with the driving circuit such that if 5v has given it gives sound and if 0v has given, it gives no sound. If any of the conditions from the sensors, may be either falling down condition or obstruct condition.

This buzzer will gives sound such care taker get alerted to help me. The LCD display will play multiple role here. This LCD will help in developing the project, MEMS sensors are needed to be checked frequently. These values of MEMS sensor can only be monitored using LCD display. These values of MEMS sensor with different positions can be considered in writing program for the project. And another important use as alerting system. It gives display monitored data of the person every time.
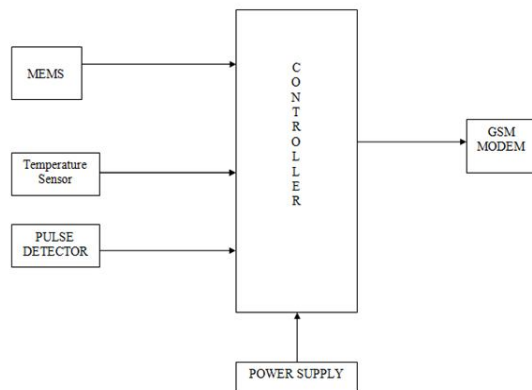
II.SYSTEM BLOCK DIAGRAM

Fig1: System Block diagram

The major components of this project are LPC2148 Microcontroller, MEMS sensor, LCD Display Unit, Temperature sensor, Pulse Detector, GSM modem and power supply Unit are given to the device. The purpose of this project is to implement a system for continuous monitoring of older people by using wearable sensors. The entire project can be implemented by dividing it into two parts. One part is responsible for implementing a critical system and is responsible to alert to caretaker whenever person needed rescue or help. Another part is noncritical part and is responsible to send an SMS to the care when the old person is in risk. The pulse detector is nothing but an arrangement of the IR sensor is the combination of one IR transmitter and one IR receiver. The IR transmitter will be active if it has been supplied with a sufficient voltage of approximately 3v. IR receiver will detect only IR rays which have been emitted from the IR transmitter. Depending up on the IR rays emission on to IR receiver, it will give different voltages. That means, when IR rays are continuously falling on to the IR receiver, it will give some voltage. If the IR rays stops falling on to the IR receiver, it will give some different voltages. By processing these two different determined voltages, it allows to easily find out presence of IR rays.

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III. MEMS MODULE DESCRIPTION

MEMS, is a technology can be defined as combination of mechanical functions and Electrical functions on a same chip using micro fabrication Technology. The Mechanical Functions like Sensing, Moving and heating etc. The Electrical Functions like Switching and deciding System capability etc. The MEMS are made up of components size between 1 to 100 micrometer ranges. Generally, MEMS devices generally in range from 20 micrometers (20 millionths of a meter) to a millimeter (i.e. 0.02 to 1.0 mm) in size.

A. Basic Operation of MEMS

MEMS is based on under principle of differential capacitance technology. The capacitor are available in one, two or three axis versions. The First one represent X-axis, second one is Y-axis and another one is z-axis is suitable for depending upon accelerometer measurement .The sensing element of the accelerometer consists of two fixed plates as shown in figure attached to the one to substrate and another to a suspended plate. By sensing of these two plates of motion the value should be changes depending upon tilting x, y and axis Directions.
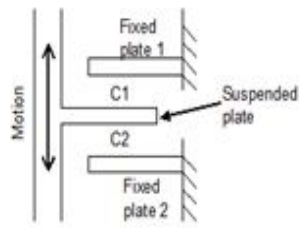
Fig 2: Operation principle of MEMS

B. Basic process of MEMS

The Fabrication steps of basic processing of MEMS are Deposition, pattering and Etching.

Deposition: It consists of chemical Deposition and physical deposition. The Chemical deposition techniques include chemical vapor deposition (CVD), in which a source gas reacts on the substrate to get desired output where as Physical Deposition include Sputtering (bombarding of the target by energetic particles).
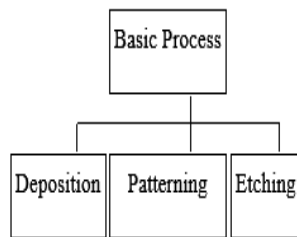

Fig3: Basic process of MEMS

Pattering: It is the transfer of a pattern into a material. Lithography in MEMS is typically the transfer of a pattern into a photosensitive material to a radiation source such as light.

Etching: There are two basic steps of etching processes wet etching and dry etching. In the agriculture, the material is dissolved when immersed in a chemical solution.

IV. Working

The main aim of this project is to provide an assistance to older people such that whenever they are in emergency health condition. The sensors which are interfaced to the micro controller will continuously monitor the Patients health condition. And in case of emergency conditions, it gives an alerting message as SMS to the care taker.

The MEMS Sensor is responsible to convert the coordinates of the device position with respect to Earths coordinates and gives it in the form electrical signals. These signals will be given to the micro controller. This MEMS device will give the coordinates in the form of electrical signals as X-axis coordinates, Y-axis coordinates and Z-axis coordinates. These coordinates are nothing but the 3 dimensional data of MEMS sensor as its position. This is attached to the person's body. When the person is getting fall down, the coordinates of the MEMS Sensor will altered. These different values will be analysed and if the generated values indicates that person is getting fall down then it will be indicated by giving some alert to care taker.
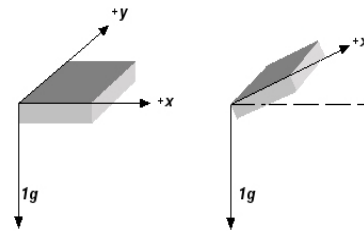

Fig 4: X, Y and Z Directions

The temperature sensor will measure the temperature of the human's body. The pulse detector sensor is used to measure person's heart rate. These sensors will be placed to the person's body. This temperature will continuously give the body temperature as electrical signals. These electrical signals will be processed by the micro controller, if it is detected as emergency condition. That means, if the temperature is more than the normal temperature it will be alerted by sending SMS to the care taker. As well as, the person's heart rate will be measured in digital form. This data will also processed by the micro controller and it checks with normal values of the Person's heart rate. And if the values of out of the normal range,   it will be given as emergency alert to the care taker.

The entire project modules LPC2148 controller, GSM Modem, Pulse detector, MEMS Sensor and Temperature sensor will be connected with the power supply. Since, without the power supply every electronic is nothing.

V. CONCLUSION

In the present study hence, older persons can take care without the person's assistance. And, it can be further implemented with connecting to internet, the results of the person can be sent to Doctors system in HTML page.

VI .REFERENCES

[1]. Desong wang, "user identification based on finger-vein patterns for consumer electronics devices," IEEE paper.

[2]. Mulyona D, Jinn HS. ," A study of finger vein biometric for personal identification." International symposium on Biometrics and Security technologies 2008.

[3]. A.K.Jain, A. Ross, "An Introduction to Biometrics Recognition," IEEE Transactions on Circuits and systems.

[4]. Zhang W, Wang Y (2002) Core-based structure matching algorithm of fingerprint verification. In: Proceedings of the IEEE international conference on pattern recognition, 1:70–74

[5]. Montesinos P, Alquier L (1996) Perceptual organization of thin networks with active contour functions applied to medical and aerial images. In Proceedings of ICPR'96, Vienna, Austria, pp 25–30

[6]. Jain AK, Ross A, Pankanti S (1999) A prototype hand geometry-based verification system. In: Proceedings of the 2nd international conference on audio- and video-based biometric person authentication. Washington DC, pp 166–171

[7]. S. Peleg and J. Naor, "Multiple resolution texture analysis and classification", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.6, no.4, pp.518- 523, 1984.

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