Wireless Sensor Network (WSN) Based Human Fall Detection

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Abstract— Human falls are injurious for paralysed and those who recently undergone surgery. This causes serious issues if left unnoticed. The Ultimate aim of the project is to overcome this issue by alerting the caretakers of the patients. When the patient gets a fall an alert message is sent to the caretaker through Smartphone SMS service with the help of GSM Modem. The exact location of the patient can be determined based on Latitude and Longitude positioning through GPS. This system paves way for remote health care. This technique is used in real time applications for doctors to treat the patient in critical situations.

Key words: Accelerometer, GPS (Global Positioning System), Modem, Network Interface Cards, Sensor

I. INTRODUCTION

The consequences resulting from Human Fall may lead to serious conditions if proper treatment is not provided. The majority of serious consequences may be due to delay in assistance and treatment. Such consequences can be minimized if their care taker is alerted in time [1].

The possible fall from height during building construction, painting, mountain climbing, etc.., can be alerted immediately using the proposed system. The Human fall detection using ADXL345 MEMS 3-Dimensional Accelerometer with sensing of fall as output was proposed [2]. To detect the fall of Elderly Patient by capturing of images at different angle of inclination through Map-Cam (Omni-Cam) emerged [3]. Tri-Axial acceleration of human body is used to detect whether the person is healthy or unhealthy based on principle of Hidden Markov Model (HMM) [4]. An address-event vision system detects the Accidental fall of paralysed, Elderly patient and those who recently undergone surgery as Home Care Applications [5]. An automated monitoring using Web Camera system which determine the human fall by detection of face and extraction features was proposed [6]. The Block Diagram and Methodology are explained in next chapter followed by Experimental Results and Conclusion in the Preceding chapters.

II. METHODOLOGY

The unexpected human fall is detected by the 3-Axis MEMS (Micro Electro Mechanical System) Accelerometer. The output of the accelerometer is digitized using ADC. The Digital output of ADC is continuously displayed on LCD. The output is sent to the Mobile Phones of Caretaker/Doctors/relatives of the Fallen Person using GSM (Global System of Mobile Communication). The correct Location of Human Fall (Latitude and Longitude) is positioned using GPS (Global Positioning System). A block diagram is shown for this system.

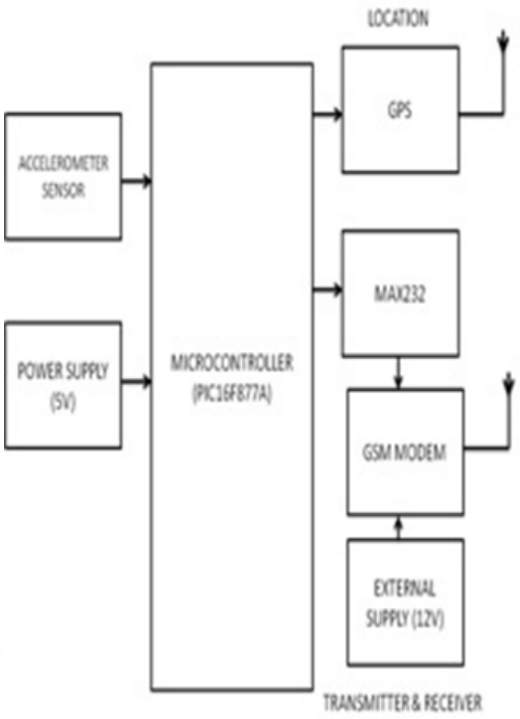

Fig. 1: Block Diagram of Human Fall Detection

A. MEMS (Micro Electro Mechanical System) Accelerometer Sensor:

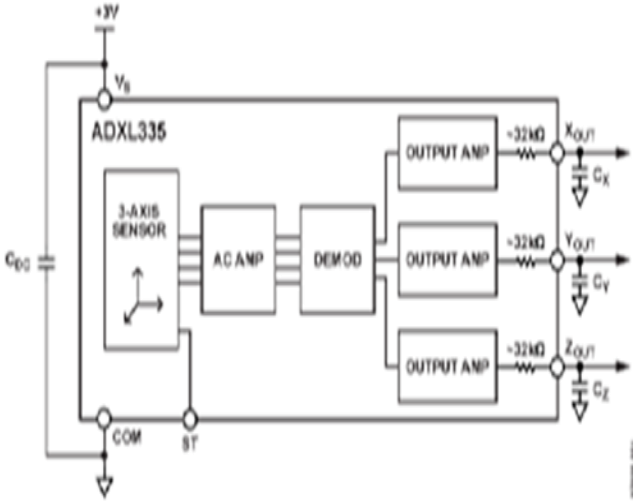

Fig. 2: Accelerometer sensor

This sensor measures Acceleration with a Minimum Full-scale range of (-3g to +3g). It can also measure the Static Acceleration of Gravity in Tilt sensing applications as well as Dynamic Acceleration resulting from Motion, shock or vibration. Accident that occurs around 100m surrounding can be easily identified by using this sensor where the vibration is gradually increased over the threshold value of the sensing range. The above Figure shows 3-Dimemsional Sensing of Accelerometer sensor. The output voltage sensed

increases when the sensor is accelerated along the sensitive Axis. The changes in Motion and Position of an individual are also sensed. The Analog output of the sensor is directly proportional to the changes in Differential Capacitance values present in Accelerometer. This output is drawn through Capacitors and is given to ADC.

B. Analog to Digital Converter:

This conversion from Analog data into a Digital one is achieved using ADC 0804, which is a single channel ADC with 8-bit resolution. It incorporates successive approximation without for conversion of Analog data into its Digital form.

C. GPS (Global Positioning System):

The GPS NMEA (National Marine Electronics Association) messages are identified with online decoder for GPS NMEA Message sentence and processed .The first six bytes of data received are compared with the pre-stored string and if matched then only the data is further accounted. If not the process is repeated again. From the comma delimited GPRMC sentence, Latitude, Longitude, Date, Time, Speed values extracted by finding the respective, positions. The processing unit receives these data through MAX232 serial I/O module and displays on LCD or transmits required data to mobile phone through GSM.

D. Microcontroller (PIC16F877A):

The Microcontroller used in the current work is PIC16F877A. It is the Heart of the developed system which receives the data from the MEMS Sensor and GPS receiver. The sensor gives the Output corresponding to changes in Position of an Individual wearing it. The GPS gives the Position of Individual in terms of Latitudinal and Longitudinal values. The purpose of the Microcontroller is to process these data comparing with stored Threshold values for Normal Condition. If the Tilt of the person due to fall is more than Pre-set values, then the location of the fallen individual is displayed on LCD. The Message of the position should also be sent to Mobile Phones of caretaker, Doctors.

E. Global System of Mobile Communication (GSM):

The Latitudinal and Longitudinal position of the Fallen person can send to the Mobile phones of his/her Caretaker/relative through GSM module for immediate assistance. GSM is standard for Digital Cellular Communication. It transfers signals between Mobile phones and Network for Mobile or normal Telephony by means of Radio Frequency Electromagnetic Fields.

F. Flowchart:

The working methodology of this system is explained with the help of a flowchart explaining the process in a sequence.

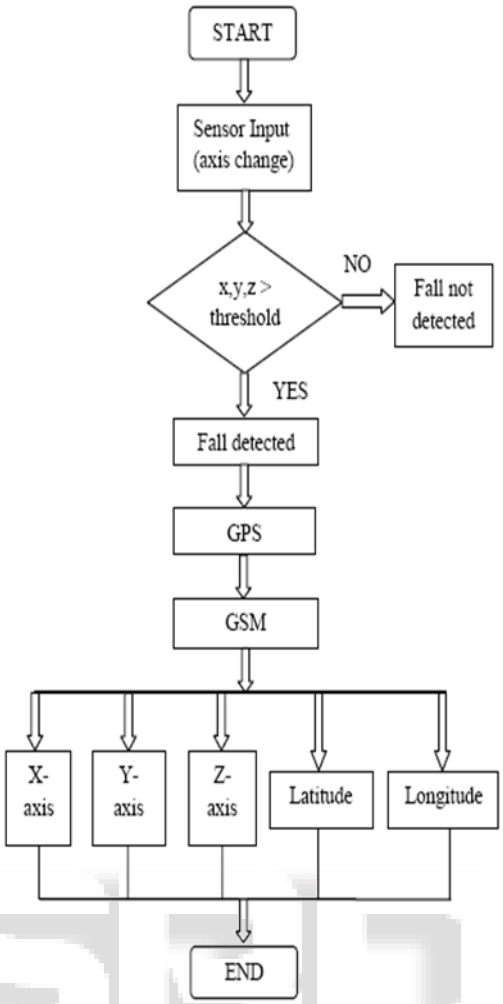

Fig. 3: Flowchart of Fall Detection System

III. Results and Discussion

This system efficiently detects and transfers Human fall information so that the care takers can easily identify exact location of patient.

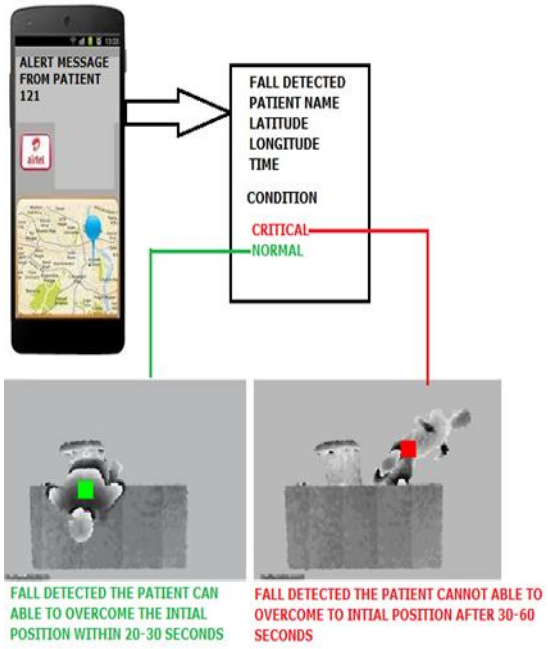

Fig. 4: Output of Human Fall Detection

IV. CONCLUSION

The exact location of patient can be easily positioned by this system. The problems regarding false fall detection is resolved with 30 seconds delay. This system can be widely used for paralysed patients since handling this system is simple.

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