

Automatic Body Fall Detection System for Elderly People using Accelerometer and Vision Based Technique

S. M. Turkane, Swapnil J. Vikhe, C. B. Kadu, P. S. Vikhe

Abstract: *Body Falls in older adults are the significant cause of injury. Falls incorporate dropping from a standing position or from uncovered positions, for example, those on stepping stools or stepladders. The seriousness of damage is commonly identified with the height of fall often leading to disability or death. In this research generally we uses wearable sensor and vision based technique that is automatically detect body fall as early as possible. Accelerometer is used for measuring or maintaining orientation and angular velocity. In vision based procedure first we procure casings or video arrangements from the camera. The division module separates the body outline from the foundation. For Feature Extraction we used GLCM method. SVM method is used for classification. By using those methods we can surely detect the human body fall and can take the preventive measures.*

Keywords: Body fall, Accelerometer, GLCM, SVM.

I. INTRODUCTION

The primary worries in the recent decades is with the senior or the old age population of the nation[1]. These older population experience variety of a illnesses and diseases condition at very uncertain time. Most of the time injuries are due to the falling on the ground, unconscious and hurting themselves. It will cause serious injury or sometimes death [2]. Therefore, they should be urgently transported to the emergency clinic, where they will be watched and gave medicinal assistance if wellbeing condition is in danger. Simultaneously, the measure of old peoples keeping up their independent life is developing quickly. Be that as it may, remote checking can help to prevent depicted situation, essentially diminish healthcare costs and simultaneously keep up patient's independent way of life [3]. Consequently, there is a reasonable interest in solid multi-useful remote observing frameworks for old individuals, which gather and join various sources of medical information relating to ordinary daily routine of the monitored patient.

As a response to the maturity masses, present day social medicinal services market gives a wide extent of restorative therapeutic gadgets for remote evaluating of basic wellbeing parameters. Most of the supplies is adjusted and maltreatment for spot checking and can't give a constant review of the patient's prosperity conditions.

In addition, various parameters are estimated independently and checking procedure isn't synchronized. Simultaneously fall incident are viewed as one of the most widely recognized and most dangers among older populace, with about portion of nursing home occupants and 30% of freely living individuals falling every year. Along these lines, present day social healthcare will in general incorporate solid fall identification usefulness into general observing system. We model a body fall detection system as a set of services using sensors and video based techniques. Sometimes the person forgot to wear a sensor based circuit. To overcome this we also use video based technique [4].

The system consist of a following parts i) Image Acquisition ii) Segmentation iii) Feature Extraction iv) Classification. As a rule, various parts involving the frameworks are crumbled and working independently from one another. Be that as it may, if we combine monitoring component (for example sensors, video camera, Smartphone's) into smart situations, we will almost certainly do overlook for elder individuals with different endless situation at home. It will improve older patient's degree of freedom and security, which is one of the principle issues in social healthcare industry. With the ongoing advancement on ICT showcase wearable sensors and image processing are regularly conveyed related to environmental devices to improve fall discovery rates and limit false cautions [5].

II. RELATED WORK

Shery Oliver et.al [1] proposed to identify falls by handling with a few component extraction and grouping method for typical just as debilitated individuals. The feature extraction algorithm picked is equipped for detecting, preparing and imparting the fall event under genuine conditions. The blend of numerical information is utilized so as to identify fall with high exactness and dependability. Fouzi Harrou et.al [2] proposed Acknowledgment of human developments is exceptionally helpful for a few applications, for example, brilliant rooms, intelligent augmented experience frameworks, human detection and condition displaying. The goal of this work centers around the identification and order of falls dependent on varieties fit as a fiddle, a key test in PC vision .the recognition is accomplished with multivariate exponentially weighted moving normal (MEWMA) checking plan, which is viable in identifying falls since it is touchy to little changes. Shockingly, a MEWMA measurement neglects to separate genuine tumbles from some like-fall motions.

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To cure this restriction, an arrangement stage dependent on help vector machine is connected on distinguished successions. To approve this approach, two fall recognition datasets have been tried: the University of Rzeszow fall identification dataset (URFD) and the fall discovery dataset (FDD).

Yoosuf Nizamet.al [3] proposed Fall location for older is a noteworthy subject the extent that assistive advancements are concerned. This paper gives a survey of past chips away at human fall identification gadgets and a primer outcomes from a creating profundity sensor based gadget. The three primary methodologies utilized in fall identification gadgets, for example, wearable based gadgets, encompassing based gadgets and vision based gadgets are distinguished alongside the sensors utilized. The structures and calculations connected in every one of the methodologies and their uniqueness is additionally represented.

Pooja Shukla et.al [4] proposed that the population of old people are living alone at home is more. Fall is one of the real hazards for old individuals. In some cases more seasoned individuals may quit fooling around damage to their spine (spinal rope) and that may prompt passing. Once in a while fallen harmed older might lie on the ground surface for a few time after a fall episode has happened. This makes it imperative to have a fall location framework. In this paper, she propose a novel and powerful fall location framework. their methodology depends on movement history. Their calculation gives promising outcomes on video successions of every day exercises and mimicked falls.

Wang, J.et.al [5] proposed, an upgraded fall recognition framework is proposed for old individual checking that depends on savvy sensors worn on the body .Which recognized the unplanned falls in the home medicinal services condition. By using data assembled from an accelerometer, cardio tachometer and savvy sensors, the effects of falls can be minimized and recognized from typical every day exercises. The proposed framework has been sent in a model framework as point by point in this paper.

III. METHODOLOGY

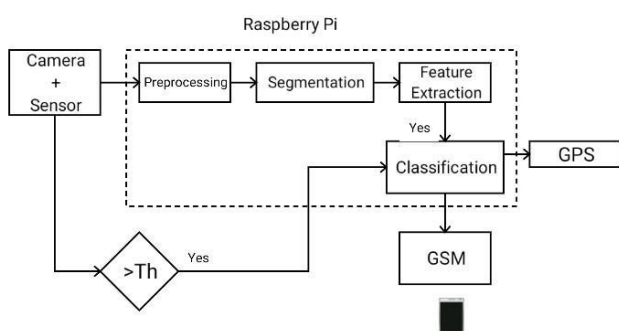


Fig.1.: Block Diagram.

A. Accelerometer

Acceleration defines the measurement of the change in velocity, or speed with respect to time. An accelerator is a simple circuit which is used in larger electronics devices. This angle is used to detect the fall condition.

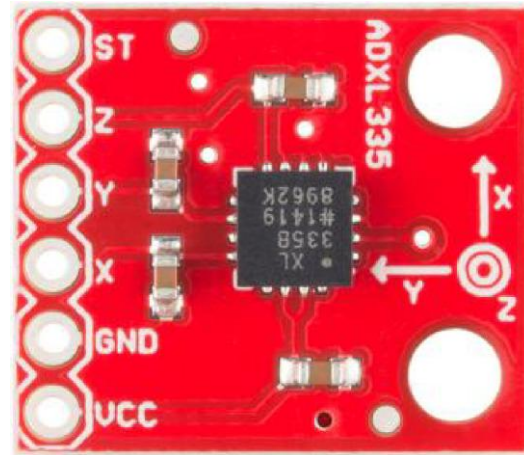


Fig.2: Triple Axis Accelerometer.

X, Y, Z are the three axis of the accelerometer to recognize to distinguish the movement and area of the body of the subject. A fall is distinguished when the negative speeding up is all of a sudden expanded because of the adjustment in direction from upstanding to lying position. Accelerometer sensors are the most prevalent and broadly utilized sensors for distinguishing fall mishaps and detecting body movements; as it has high exactness, even in uproarious estimations a well-perused increasing speed estimation down to 0Hz.

B. Data acquisition

It is the principal stage of vision based technique. Picture procurement in image processing can be comprehensively characterized as the activity of withdrawing a picture structure a few sources, normally an equipment based source. The information obtaining module comprises of gaining edges or video groupings from the camera.

C. Image segmentation

The segmentation module removes the body outline from the background. Highlight extraction is fundamental to video-based fall discovery. It very well may be characterized as the procedure by which significant discriminative data are removed from a sectioned body. A division is applied utilizing foundation subtraction approach.

D. Feature extraction

For Feature Extraction we use GLCM strategy. A measurable technique for looking at surface that considers the spatial relationship of pixels is the dark level co-event lattice (GLCM), otherwise called the dim level spatial reliance grid. The GLCM capacities portray the surface of a picture by ascertaining how regularly matches of pixel with explicit qualities and in a predefined spatial relationship happen in a picture, making a GLCM, and after that removing factual measures from this network.

(The surface channel capacities, portrayed in Texture Analysis can't give data about shape, that is, the spatial connections of pixels in a picture.)

E. Fall classification (Support Vector Machine)

Support Vector machine (SVM) is a non-direct Classifier. This is another pattern in AI calculation which is utilized in many example acknowledgment issues, including surface order. In SVM, the info information is non-directly mapped to straightly isolated information in some high dimensional space giving great grouping execution. SVM expands the minor separation between various classes. The division of classes is completed with various kernels. SVM is intended to work with just two classes by deciding the hyper plane to isolate Two classes. This is finished by augmenting the edge from the hyper plane to the two classes. The examples nearest to the edge that were chosen to decide the hyper plane is known as help vectors.

IV. RESULTS AND ANALYSIS

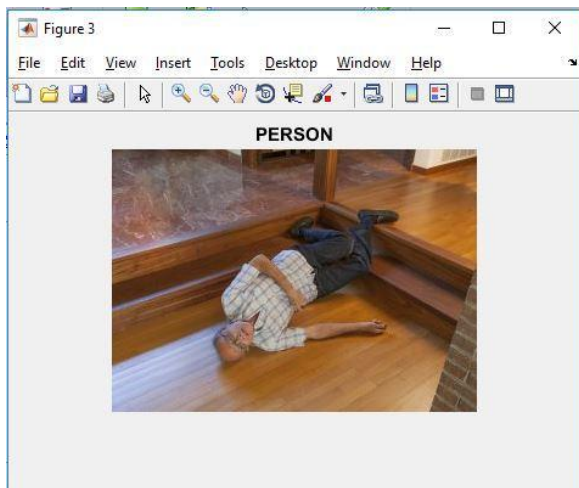


FIG.3: ORIGINAL IMAGE.

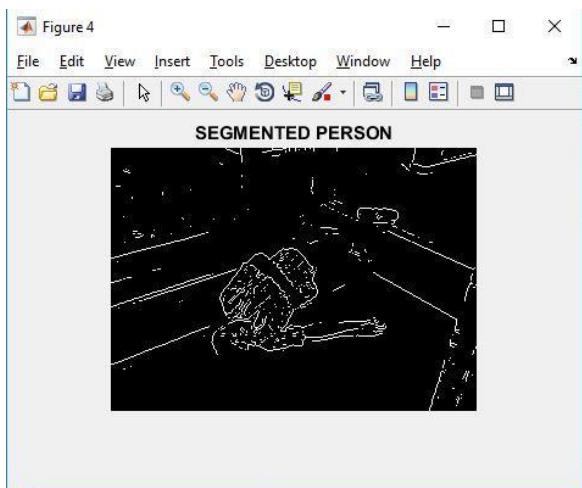


Fig.4: Image Segmentation.

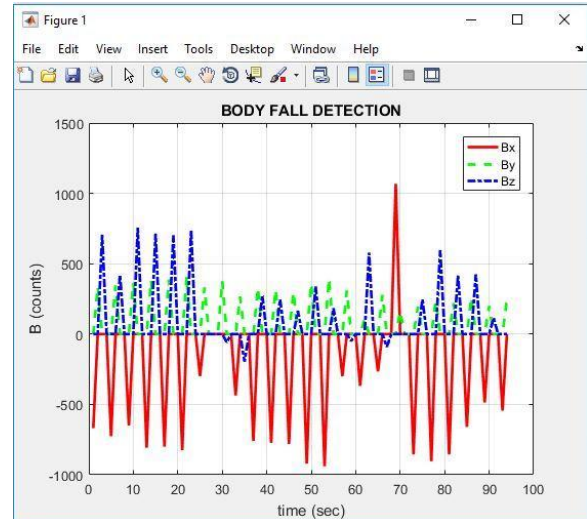


Fig.5:Body Fall Detection (Classification)

The vision based technique in which first the original image is converted into segmented image. By using gray-level co-occurrence matrix we can extract the features from segmented image.

V. CONCLUSION

We have reviewed different techniques for the detection of a fall event using wearable sensors. Gyroscope sensor is mandatory to detect fall. From study of computerized image processing technique we come up with a following conclusion. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix. The SVM method is used for classification.

REFERENCES

1. Sheryl Oliver A, Anuradha M, Jean Justus J, Maheshwari N, "Optimized low computational algorithm for elderly fall detection based on machine learning techniques", Biomedical Research, Volume 29, Issue 20, 2018, pp. 3715-3722.
2. Harrou F, Zerrouki N, Sun Y, Houacine A, "Vision-based fall detection system for improving safety of elderly people". IEEE Instrumentation & Measurement Magazine 20, 2017, pp. 49-55.
3. Yoosuf Nizam, Mohd Norzali Haji Mohd, M. Mahadi Abdul Jamil, "A Study on Human Fall Detection Systems: Daily Activity Classification and Sensing Techniques", International Journal of Integrated Engineering, Vol. 8 No. 1, 2016, pp. 35-43.
4. Pooja Shukla, Arti Tiwari, "Vision based approach to human fall detection", International Journal of Engineering Research and General Science Volume 3, Issue 6, November-December, 2015, pp. 944-949.
5. Wang, J., Zhang, Z., Bin, L., Lee, S. and Sherratt, S., "An Enhanced Fall Detection System for Elderly Person Monitoring using Consumer Home Networks", IEEE Transactions on Consumer Electronics Volume 60, 2014, pp. 23-29
6. Quoc T. Huynh et al. "Optimization of an Accelerometer and Gyroscope-Based Fall Detection Algorithm". Hindawi Publishing Corporation Journal of Sensors Volume 2015, Article ID 452078,.
7. Gregory Koshmak, Maria Linden, Amy Loutfi. "Evaluation of the Android-Based Fall Detection System with Physiological Data Monitoring". 35th Annual International Conference of the IEEE EMBS Osaka, Japan, 3 - 7 July, 2013.
8. Diana Yacchiremaa,b, JaraSuárez de Pugaa, Carlos Palaua, Manuel Esteve . Fall detection system for elderly people using IoT and Big Data "Procedia Computer Science 130 ,2018,pp.603-610.

9. Harrou F, Zerrouki N, Sun Y, Houacine A (2017) Vision-based fall detection system for improving safety of elderly people. *IEEE Instrumentation & Measurement Magazine* 20, 2017, pp. 49-55.
10. Zerrouki N and Houacine A. Automatic classification of human body postures based on curvelet transform. In *Image Analysis and Recognition*, Springer, 2014, pp.329-337.
11. Kwolek B and Kepski M. Human fall detection on embedded platform using depth maps and wireless accelerometer. *Computer methods and programs in biomedicine*, 117(3), 2014, pp. 489-501.
12. Charfi I, Miteran J, Dubois J, Atri M, and Tourkir. Definition and performance evaluation of a robust SVM based fall detection solution. In *Eighth International Conference on Signal Image Technology and Internet Based Systems (SITIS)*, IEEE, 2012, pp. 218-224.
13. Alhimala L, Zedan H, and Al-Bayatti A. The implementation of an intelligent and video-based fall detection system using a neural network. *Applied Soft Computing*, 18, 2014, pp. 59-69.
14. Kwolek B and Kepski M. Improving fall detection by the use of depth sensor and accelerometer. *Neurocomputing*, 168, 2015, pp. 637-645.

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