Development of an SMS-Based Wearable Fall Detection System

Blessing Olatunde Abisoye, Jonathan Gana Kolo, Nafisa Opemi Jimoh, Opeyemi Aderiike Abisoye, Lukman Adewale Ajao
Computer Engineering
Federal University of Technology
Minna, Nigeria
b.abisoye@futminna.edu.ng, jgkolo@futminna.edu.ng, jbleenah@gmail.com, o.abisoye@futminna.edu.ng, ajao.wale@futminna.edu.ng

Abstract—**Fall occurs as a result of lack of physical fitness or loses of stability. Many lives have been shortened or deformed due to the problem of fall. The morbidity and mortality resulted from this problem is very rampant among the age group of 65 and above.Many fall detection devices have poor notification mechanisms in terms of message alertness and position.This device will assist to decrease the danger linked with fall and improves the living of an individual by reducing anxiety and disquiet before a fall. It also helps the user to be more buoyancy in living on-one self and continue with normal life activities. The device also gives fast communication between the fallen patient and the caretakers for speedy medical attention. This work developedan SMS based wearablefall detection system with good notification mechanism to ensure that fall victims receive instant medical attention when a fall occurs. The system employed the use of accelerometer and gyroscope sensors to sense the orientation of the victim. To get the geographical location of the user of the device a GPS module was deployed and to send SMS alert when fall occurs a GSM modules was employed. Fall detection algorithm was developed based on threshold technique. Threshold value was set to distinguish between normal body movement and actualfall. At the completion of the design, some tests were carried out. The device was able to detect daily dynamic movement activities, back fall and side fall whether to the right or left of the user. The device is worn around the waist of the user.**

Keywords- Fall, detection, gyroscope, accelerometer, SMS, Wearable

I.   INTRODUCTION

Most permanent deformities and death experienced today can be averted if proper preventive measures are considered. The second leading cause of death by accidental or unintentional injuries is a fall [1]. When fall occurs the victim may be unconscious, which implies that the victim needs the assistance of someone or medical attention. Most old people prefer to stay alone without any physical contact with relatives and loved ones. Some of the aged people with critical health conditions are at risk when there is no care when fall occurs [2]. Dehydration, low body temperature (hypothermia), Pneumonia, muscle breakdown that can lead to kidney damage and failure known as Rhabdomyolysis and Pressure sores are all medical problems that can arise when a person who has experienced a fall stays longer on the floor without immediate medical attention[3].

Wearable computing originated in the mid of 1990 [4], this technology deals with the application of hardware and software to develop devices worn on the body. They are designed to be handy, less expensive, and comfortable with the capability of functioning without human interference [5]. Wearable computing technology has established itself cutting across various disciplines, which includes development of hand-worn terminals and smart clothing for military and industrial use. They perform related task with mobile phones and other hand-held systems and are seen to even outperform some of these devices [6]. This technology cuts across the medical field, which includes devices as blood pressure monitors, ECG monitoring and hearing aids. They are employed in life-threatening scenario like the pressure bandage system for monitoring scorpion sting [7]. Wearable computing is growing speedily and has become a pronounced area of application of embedded systems and tele-medicine to resolve critical health matters.

According to study, the researches indicated that not only detecting a fall is important but also the location, the time-to-fall, the direction, lying fall period and also the fall condition of the victim matters a lot [8].Researches on fall recognition and detection are still valid today [9]. Literaturesuggests that that, there are three methods applied when detecting a fall. These methods are wearable-based method, video-based method, and ambient-based method. Video-based methods were seen to be more accurate than ambient and wearable-based methods but the system suffers from high risk of privacy and high cost when implementing the cameras [4].

Afall detection system worn as a pendant was proposed. It was divided into two segments: a wearable device acting as a pendant and an application on the cell phone. The wearable device establishes a communication with the application on the mobile phone by the use of a wireless device known as Bluetooth device. Fall was detected by the use of a threshold value for both accelerometer and gyroscope embedded on the pendant. This pendant was worn around the neck. The pendant sends an alert message to the mobile application whenever a fall was detected. The limitation of this system is that the user location cannot be ascertained and Bluetooth has a lower range compared to GSM module and it did not include any form of sending the location user to the caregivers [1].

An autonomic fall detection system was proposed in [10]. The system focuses on how to use an Autonomic Healthcare Management System (AHMS) to detect fall based on IoT wearable devices and cloud computing system technology. The AHMS receives information from a local server which is connected to wearable devices, the system continuously monitors and analyzes the information gotten