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Device Which Will Help Older People From Hip Facture

Oyndrila Roy
Department of Engineering and Architecture
Heidelberg University of Applied Sciences, Ludwig- Guttmann- Straße 6, Germany

Aranyak Roy
Department of Electronics and Communication Engineering
SRM University, Kattankulathur, Chennai, India

Dr.Debasis Roy
Center for Interdisciplinary Research and Education
West Bengal, India

Abstract- A hip fracture is another term for a broken hip. It is a common injury in older people, especially for women with underlying 'thinning' of the bones (osteoporosis). Old people have tendency to fall and injure themselves. Older people's hip can break in different places: A hip fracture can be within the joint capsule (intra-capsular) or outside the joint capsule (extra-capsular). Most people who have a hip fracture need an operation by an orthopedic surgeon to fix the break in the bone. Whether your fracture is intra-capsular or extra-capsular will determine the exact treatment that the surgeon suggests. Any underlying osteoporosis should also be treated after a hip fracture, in order to reduce the chance of it happening again. Hip fractures can be a life-threatening injury among the elderly. Annually, thirty million falls are reported, of which two hundred and fifty thousand results in hip fractures. Medical costs for these fractures are estimated between seven and ten billion dollars annually. However, the number of hip fractures is expected to double in the next fifty years, which defines the current problem as critical and alarming. In order to provide a suitable solution to this problem, I have developed a project to build such device. The product will be a belt-like device that would prevent hip injuries by means of sensors that will recognize a potentially injurious fall and then trigger an inflatable cushion before impact.

Keywords – Accelerometer, Microprocessor, Cushioning chamber, Piezoelectric crystal.

I. INTRODUCTION

After age 65 the rate of hip fractures rises exponentially with age. This rise is attributed to several factors, including loss of muscle mass which is necessary for balance; loss of bone mass which reduces the bone's tolerance for impact forces; and a greater probability of debilitating medical conditions.

In nursing homes, the most widely used monitoring devices are products that are activated by the patient when he has fallen and is in need of medical attention. Usually this device is an electronic button, worn around the neck, which when pressed sends a radio signal that summons on-duty nursing personnel. Other devices include pressure pads that are activated when a patient leaves a bed or chair. However, these devices cannot prevent an injury sustained in a fall, but only serve to inform and direct medical personnel to a potentially serious injury. For older people, a hip fracture happens after a fall, usually just a fall from standing. 'Thinning' of the bones (osteoporosis) is the leading cause of hip fracture. If you have osteoporosis you are more likely to fracture your hip when you fall. Osteoporosis means that your bones have become less dense and more honeycombed. This makes them more fragile, so that less force is needed to break them. There are a number of reasons why an older person may fall. It may be a simple trip over a loose rug or an item of furniture. However, sometimes there may be a medical reason for a fall such as low blood pressure, a heart rhythm abnormality, or a faint. If you fracture your hip, the doctors will usually try to work out why you may have fallen. Any underlying problem may need to be treated.

Hip fracture can also occur in younger people. In these cases, it is more likely to be caused by trauma such as a car crash or a fall from a significant height. The denser bones of younger people mean that greater force is needed to break a bone as large as the hip bone.

II. EXPERIMENTAL

The product will consist of four main parts:

1) A belt with small sized containers over each hip.

2) Two inflatable cushioning chambers, each folded up inside one of the containers, which are connected to a means of automatic inflation.
3) An accelerometer and a tilt sensor, to acquire and transmit information about body movement, accompanied by a power source, preferably a lightweight, long life, perhaps rechargeable, lithium battery.
4) A microprocessor to receive the body movement data, compare it with pre calculated data for normal body motion, and then transmit the "positive fall" signal to the inflatable chamber when the incoming data exceeds a predetermined "fall threshold."

Cushioning chambers

An inflatable cushioning chamber is the best way to dissipate energy during a fall. It provides a softer landing than passive hip pads because it can expand to a greater volume, giving the hip more distance to decelerate before hitting the ground. In addition, before deployment, it is much smaller and more comfortable than hip pads because of its expandable nature.
Explosive reactions are used to inflate automotive airbags. Before deployment, the airbag is folded up inside the steering wheel and the chemical reactants are stored in the reaction chamber. When the signal for deployment is sent, the sodium Nitride (NaN3) is ignited by an electrical impulse from the microprocessor. This inflation takes approximately 0.015 seconds for the airbag is fully expanded to meet the rapidly approaching person. Inflation reaction is followed by a deflagration that turns the remaining resultants into a stable glass compound. This reaction takes slightly longer, allowing the airbag to decelerate the driver to a relatively safe speed over the course of approximately two feet and 40 milliseconds.

Accelerometer and a tilt sensor

An accelerometer can be considered as nothing more than a weight on a spring, which is connected to a frame; this is shown in the Figure 1. When the frame is moved, the mass will tend to stay at rest until the spring, being stretched, exerts enough energy on the mass to make it move.
The simplest piezoelectric accelerometer consists of a base of some stiff material. For example, a disk of piezoelectric crystalline material can be combined with weight or seismic mass, with the whole assembly fastened together with a through bolt. Electrical contact is made by means of two electrodes, one on each side of the disk. The base of the accelerometer is attached to the test object, whose movement exerts a force on the seismic mass and induces stress into the piezo disk. The electrodes detect the resultant electric signal and convey it to the read out device.

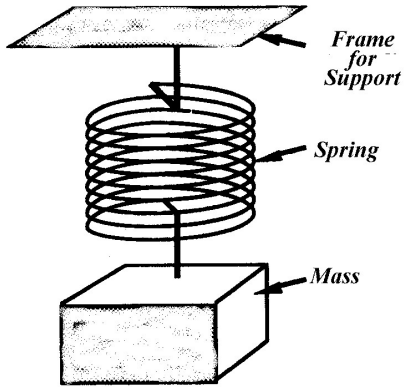

Figure 1 An accelerometer.

The property of the piezoelectric crystal is to produce electric signal due to the vibration or pressure exertion. I have devised a platform on which when pressure is applied an electrical voltage is produced and is recorded on the multimeter.
The following Figure 2, Figure 3 and Figure 4 represents the working of the piezoelectric platform.

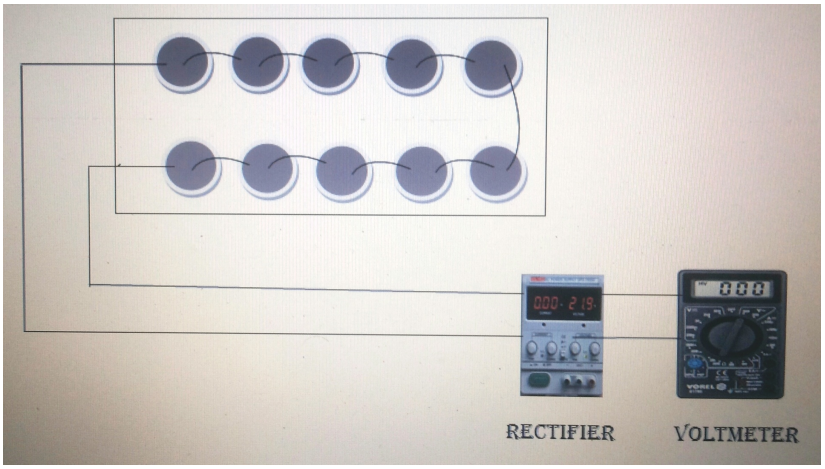

Figure 2 represents the working of the piezoelectric platform.

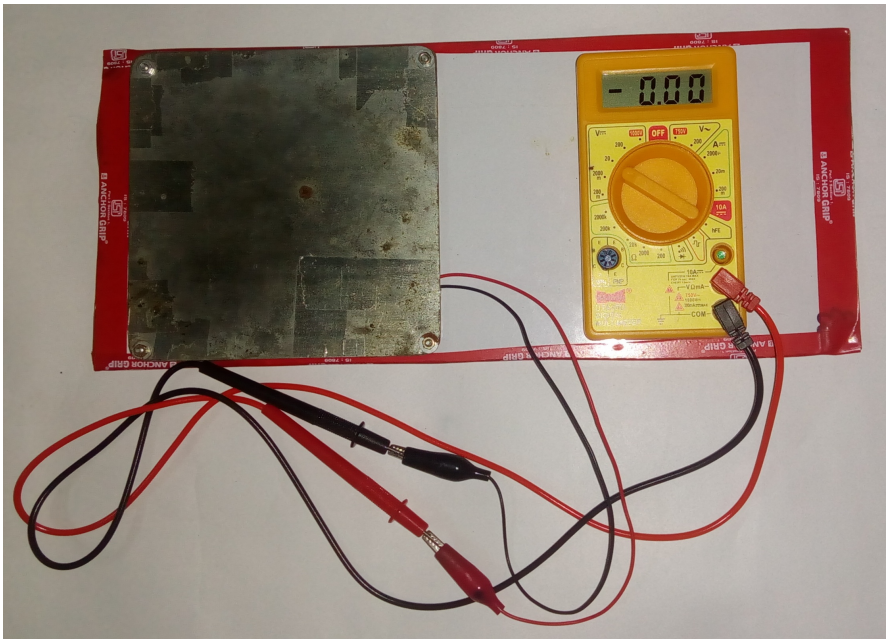

Figure 3 Working of the piezoelectric platform.

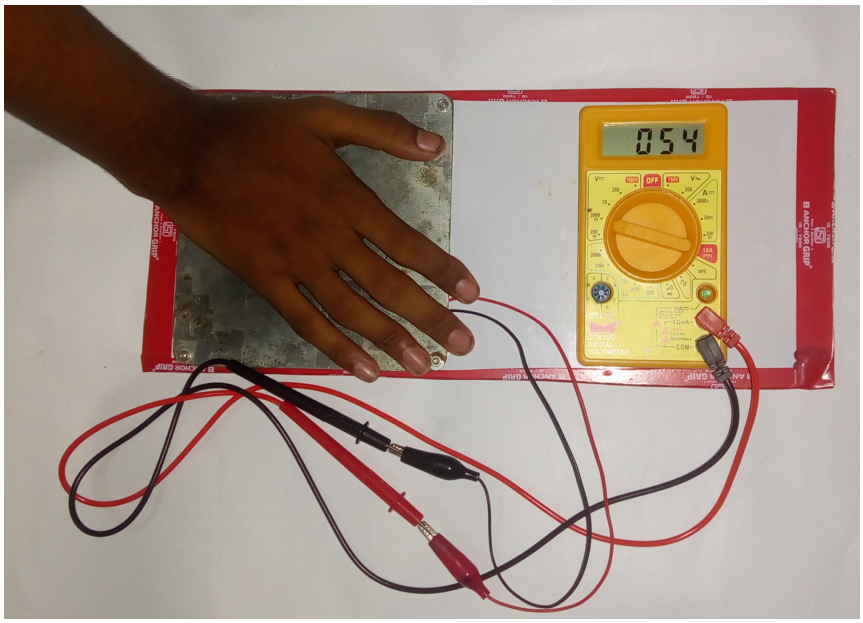

Figure 4 Working of the piezoelectric platform.

III ACKNOWLEDGEMENT

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