

Chapter 15

Mechatronics of Recent Advances of Sensors for Assistive Technologies

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ABSTRACT

In this paper, the recent advances of sensors incorporated in assistive technologies are presented. Features of conventional sensors are largely electromechanical. However, the last two decades has, due to the move towards digital scholarship, witnessed the emergence of contemporary sensors that incorporate information technology (IT) component. Hence the term mechatronic or mechatronised sensors. Based on the function and of modern assistive devices, a variety of sensors are described with their features and applications. Further improvements and future trends are pointed out and discussed.

INTRODUCTION

This article familiarizes the reader with transducers, sensors and actuators from the mechatronics point of view. The understanding of this information is important to micro electro mechanical systems (MEMS) or Microsystems technology. Most of MEMS are or consist of sensors, transducers or actuators on hardware frames driven by some form of software platform, hence mechatronics of MEMS. The paper will base the premise of its content on mechatronics MEMS at the university of Botswana, faculty of engineering and technology in the department of mechanical engineering and zero into the control systems and mechatronics laboratory. Computer controlled systems continually monitor the operation of today's systems (mechanical, electrical or electromechanical). Through sensors, computers receive vital information about a number of conditions, allowing minor adjustments to be made far much quicker than ordinary mechanical systems. Sensors convert temperature, pressure, speed, position and other data into either digital or analogue electrical signals. A digital signal is a voltage signal that is either on off with nothing between. Recent developments in ambient assistive living technologies have demonstrated the feasibility of using ambient sensors in supporting independent living (Marc, 2003). Unlike wear-

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able sensors, they tend to have more battery and processing capacities, but have limited use in capturing physiological information or in multiple occupancy dwellings.

The purpose of this paper is to present the work on present recent advances, development and application of sensors for assistive devices that can be used for the aged care and to rehabilitate persons with disabilities. On the same token, the paper aims to sensitize searchers and practitioners to be aware of the challenges in this area. The paper is organised as follows: section 2 presents variety of sensors applied in assistive technologies; finally section 5 concludes the paper. For the sake of anonymity, companies used in this paper will be referred to as companies A, B or C, likewise, people's identity will not be disclosed.

RELATED STUDIES

Sensors have four main components i.e. sensing, processing, communication, and energy/ power unit. Body sensors fall into two main categories, i.e. implantable and wearable... The former measures parameters inside the body and mostly operates as interface to relatively small software components attached to or implanted into human bodies. Te implantable sensors provide bidirectional communication interface between a person and a remote information system that provides healthcare services, diagnosis, or upgrades (NASA, 2007). Wearable sensors, although not as invasive as their implantable counterparts, nevertheless must withstand the human body's normal movements and infringes on them as little as possible (Khalil, 2008).

Efficient sensors with the assistive devices could enable early disease detection, remote diagnosis and independent living of elderly or disabled people and chronically ill patients.

Transduction Devices

A transducer is any device which converts one form of energy into another. Examples of common transducers include but not limited to the following:

- A microphone converts sound into electrical impulses and a loudspeaker converts electrical impulses into sound (i.e., sound energy to electrical energy and vice versa).
- A solar cell converts light into electricity and a thermocouple converts thermal energy into electrical energy
- An incandescent light bulb produces light by passing a current through a filament. Thus, a light bulb is a transducer for converting electrical energy into optical energy.
- An electric motor is a transducer for conversion of electricity into mechanical energy or motion.

Basic Transduction Concept

There are many variables which affect our everyday lives, such as: the speed of a car, the velocity of the wind and the thermometer in a home. In most situations these variables are continuously monitored. It is these variables that are the feedback that is used to control the car, the operation of an air conditioner, heater levels and oven temperatures. The elements that sense these variables and convert them to usable output are transducers. In principle, a transducer is defined as a device that converts an input energy

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