

## AN INTELLIGENT RFID FALL NOTIFICATION SYSTEM

YEONG-LIN LAI\* AND CHIH-CHENG CHEN

Department of Mechatronics Engineering  
National Changhua University of Education  
No. 1, Jin-De Road, Changhua 50007, Taiwan  
\*Corresponding author: yllai@cc.ncue.edu.tw

Received May 2010; revised September 2010

**ABSTRACT.** *In this paper, we present an intelligent fall notification system using radio frequency identification (RFID) technology integrated with wireless sensor networks. The intelligent RFID fall notification system provides real-time monitoring and identification features for the elderly either at home or in nursing facilities. Once the fall accidents happen, the medical personnel or the users' family are informed through the system so that they can take immediate action and seek adequate emergency care. We adopt dual-band RFID protocols in the system, in which the high-frequency (HF) band of 13.56 MHz is for the identification of personnel and the microwave band of 2.45 GHz for fall detection, emergency voice communication and temperature sensing. The multi-functions of personal identification, fall detection, voice communication and temperature sensing are achieved by the intelligent fall notification system through the integration of RFID platform and wireless sensor networks.*

**Keywords:** Radio frequency identification (RFID), Tag, Reader, Fall notification

1. **Introduction.** In recent years, along with the development of the economy and the changes in the family type, there has been an increase in the number of elderly people over the age of 65. In the United States, it has been predicted that this segment of the population will increase by 137% from 1999 to 2050. The aging population will become a serious public health problem for the USA, especially in the period from 2011 to 2030 [1-4]. It is common for fall accidents to occur in the lives of the aged and vulnerable people all over the world, with falls being a major source of death and disability among elderly people. The serious injuries which many elderly people suffer from different fall accidents result in tremendous medical costs [5,6]. Falls and fall-related injuries pose a serious threat to the elderly, and, since the elderly population is increasing, fall notification for the elderly is of enormous significance [7-9]. Clearly, there is an urgent need for an emergency fall notification system which will bring immediate care to the elderly who have suffered falls and who suffer from fall-related injuries.

The development of fall notification systems has attracted considerable interest. Sixsmith et al. reported a fall notification system using the infrared technology with array-based infrared detectors [10]. However, as the user did not wear a fall sensor, the fall notification system was unable to accurately determine the specific fall conditions. The system could also be disturbed by other moving objects, easily causing error alarms. There was also no emergency voice communication installed in the system, so users could not call for outside help. The system could not identify the personal information on users who fell. A garment-based fall notification system was presented by Nyan and coworkers [11]. The user would wear an accelerator-embedded garment which sensed and sent notification of the fall conditions automatically, but neither voice communication nor user identification functions were provided by the system. Maurer, et al. developed a fall