A REVIEW ON: CHILD ACTIVITY MONITORING TECHNIQUES

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Abstract: This paper presents a brief survey of child activity recognition techniques to reduce child accidents such as inadver- tent injuries at home. The automatic recognition of child activities is required to reduce the frequent accidents which cause injuries in children. These injuries mostly occur when the baby starts walking and may require medical care or hospitalization. To prevent the child home accidents a safety management method must be developed. This paper concludes with the comparison of different approaches of recognizing the activities and also includes some promising directions for future research.

Keywords: Child Activity Recognition, Sudden Infant Death Syndrome (SIDS), child safety, accelerometer, child care, baby care, barometric pressure sensor

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INTRODUCTION

In recent years, automatic recognition of human activities has drawn much attention due to the growing demands from various applications such as surveillance system, entertainment systems and healthcare systems. In surveillance system, the automatic detection of abnormal activities, such as automatic reporting of an individual with a bag hanging around at the station or airport, can be used to alert the related authority about the dangerous activity. Similarly, in an entertainment system the automatic activity recognition can be used to improve human interaction with the computer. Furthermore, in healthcare system the activity recognition can be used to help the patients, such as detecting a hazardous activity performed by a patient. Although numerous activity recognition methods have been reported, the human activity recognition is one of the difficult issues in terms of accurate recognition.

The automatic recognition of child activities enables the child safety and child development monitoring at home. The babies usually start walking at the age of nine to sixteen months and as they start walking the risk of falling increases. This falling may cause frequent injuries in children which may require close attention or hospitalization. These falls may also increase the risk of serious injuries or long term disability.

For healthy infants, Sudden Infant Death Syndrome (SIDS) is one of the extremely important problems needed to be addressed. SIDS is defined as unexplained death of a healthy infant, aged from one month to one year, which is caused without any warning. In accordance to the National SIDS/Infant Death Resource Center, SIDS is responsible for roughly 50 deaths per 1,000,000 births in the U.S. in 2004. The SIDS rate has been declining due to the awareness in caregivers and parents but it is still far higher than one would expect in such a developed country like the U.S. [3].

The rest of the paper is organized as follows: after the introduction, section II gives a brief overview of the techniques used for monitoring the child activities to reduce frequent accidents and section III concludes the paper.

II. OVERVIEW ON CHILD ACTIVITY MONITORING TECHNIQUES

This section covers a detail review on the various proposed methods for detecting children’s activity. There are many ways to recognize the daily activities of children. One way is to detect child’s movement by using camera’s; however drawback of this solution is that recognition of a moving person requires a large number of cameras which is of high cost. Second way is to use portable devices such as mobile phones or watches with sensing and computing power to
detect physical activities. Child activity recognition using accelerometer and RFID cards uses a tri-axial accelerometer worn on leg, hand and waist of the body to prevent unintentional injuries due to accidents. A sensor worn on waist would fail to detect activities related to head motion, hand motion and body tilt. Hence multiple sensors are used to improve the accuracy of the system. RFID cards are used to trace the movements of the child thus avoiding hazardous activities [1].

Remote infant monitoring system used CO2 sensors to monitor the exhaled air from a child in order to reduce the risk of Sudden Infant Death Syndrome. These CO2 sensors are placed in the crib around an infant to monitor the exhaled air concentration variation by him/her. If anything unusual is observed the data is detected and sent through wireless system to activate an alarm for further diagnosis. Infants can take various sleeping positions and due to air circulation the air may spread in many directions. Hence the CO2 sensors must be placed around the crib. The processing board is placed outside the crib which consists of wireless module for transmission and reception of information [3]. Figure 1 shows the survey result of the number of deaths caused due to SIDS.

Child activity recognition from multi sensor data uses multiple sensors to enable applications such as child development monitoring, child energy expenditure estimation, child obesity estimation etc. In this paper two approaches have been discussed: real time automatic recognition which includes fall detection and stair climbing and long term activity recognition which includes energy expenditure estimation and child obesity prevention. This activity recognition is done in two stages: feature extraction stage and classification stage. In feature extraction stage the multi sensor device provides tri-axial acceleration data, air pressure data, and tri-axial gyroscope data. In activity classification stage, the classification techniques are applied on the extracted features [7].

![Fig. 1. Deaths caused by SIDS [10]](chart.png)
Activity recognition using cell phone accelerometers uses the phone based accelerometers to identify the physical activity that the user is performing. This system uses android based cell phone which includes a 3-axis accelerometer that measures acceleration in all three directions. In this system a single device is used which is kept in users pocket, hence comfortable to use [8].

CONCLUSION

This paper presented various techniques to monitor the children’s activities. Recognizing the human activity is a challenging issue which mostly used accelerometers to detect the physical activity. To prevent the infants from a serious problem such as Sudden Infant Death Syndrome, CO2 sensors were placed around the crib in the first method, whereas the second method used phone based accelerometers to identify the activity that the user is performing. The third method used multiple sensors to detect fall related accidents and estimate energy expenditure and prevent child obesity whereas the fourth method used RFID cards to trace the child’s movement. Multiple sensors are mostly used for collecting different types of sensing information which would give accurate results. However for children under 3 years of age, the device should be comfortable to wear and easy to use if it used continuously. Hence only one single unit of sensor nodes should be used which collects multiple types of information.

REFERENCES


