

SUMMARY OF Ph.D. DISSERTATION

School Integrated Design Engineering	Student Identification Number	SURNAME, First name NISHIURA, Tomofumi
Title Development of a bathroom-watching system using a dual-pickup fiber-grating vision sensor		
Abstract <p>Recently, domestic accidents have been increasing in Japan. Specifically, accidents in the bathroom can often result in serious aftereffects, and can even result in death. In a typical case, myocardial infarction or cerebral infarction causes the bather to faint, and he or she is found drowned. Falling also causes a second accident of head injury, fracture and so on. In order to prevent these kinds of accidents, a number of systems have been proposed and implemented. Many of these systems detect movement in the bathroom and activate an alarm when the movement ceases. However, relaxed and fainted postures are similar. Therefore, it is very difficult to differentiate between the two states using a conventional image sensor.</p> <p>The purpose of this work is development of a bathroom-watching system which detects drowning and falling in the bathroom. Drowning detection is made by breath detection and falling detection is made by human's posture acquisition. For such purpose, a fiber-grating (FG) vision sensor which has two pickup devices has been proposed. An algorithm for detecting breathing and acquiring human's posture using this sensor has been developed.</p> <p>The first chapter is introduction of this dissertation. General background of this research and conventional methods for bathroom-watching are reviewed.</p> <p>Chapter 2 describes principle of the sensor. Firstly, basic theory of distance measuring using an FG is described. In the second place, a dual-pickup FG vision sensor is proposed. Finally system configuration and basic performance of distance measuring are described.</p> <p>Chapter 3 describes watching method. In the algorithm, the system discriminates bather's state using five parameters which quantitatively represents sensor visibility, silhouette position, silhouette movement, human's breathing and silhouette height.</p> <p>Chapter 4 shows experimental results. The experiment confirmed that the system properly triggered an alarm for every scene imitating a fatal accident. Moreover, no false alarms were made. This result shows effectiveness of the algorithm described above.</p> <p>Chapter 5 describes a supplemental watching method using an FG vision sensor solely. In this method, human's breathing is detected by clustering algorithm.</p> <p>Chapter 6 sums up this work. This chapter mainly has three discussions? (1)influence of camera tilt on amount of movement of FG spots, (2)way of setting waiting time and (3) future tasks from a practical point of view.</p> <p>Chapter 7 describes the conclusions of this dissertation.</p>		