**2. LITERATURE SURVEY**

Exact counts of the number of crashes caused by drowsiness are hard to obtain due to the use of varying methodologies. The Gallup organization surveyed drivers and estimated that during the 5 years prior to 2002 as many as 1.35 million drivers may have been involved in drowsy-driving related crashes (Royal, 2003). A National Highway Traffic Safety Administration report of crash report data from 2005 to 2009 attributed 83,000 crashes per year and 886 fatal crashes per year to drowsy, fatigued, or sleeping drivers. Over the 5-year period these causes resulted in 5,021 fatalities. Similar variability in research methods, driver populations, and findings is seen for the percentage of drowsy driving crashes. The 100-car naturalistic driving study found that drowsy driving contributed to 22 percent to 24 percent of crashes and near-crashes observed (Klauer et al., 2006). In a report to Congress, NHTSA stated that 3.2 percent of crashes were related to actual sleep (NHTSA, 2008). An estimated 1 percent of all large-truck crashes, 3 to 6 percent of fatal heavy-truck crashes, and 15 to 33 percent of fatal-to-the-truck-occupant-only crashes have been attributed to driver fatigue as a primary factor (Knipling & Shelton, 1999). Although the methodologies result in different estimates, all point to a significant problem. According to the National Sleep Foundation’s 2009 annual Sleep in America survey, 28 percent of drivers had driven drowsy at least once per month in the past year. Of those that drove while drowsy, 28 percent have fallen asleep (NSF, 2009). A survey conducted in 2003 found that 37 percent of drivers have nodded off for at least a moment or fallen asleep while driving at least once in their driving careers, while 8 percent of them had done it in the last 6 months. Of those encountering an episode of nodding off, 58 percent of drivers were on a multilane interstate highway, and 92 percent of them were startled awake and of those who were startled awake, 33 percent wandered into another lane or shoulder, 19 percent crossed the centerline and 10 percent ran off road (Royal, 2003). Drowsy driving is not only common in the United States, it was found that one in five Canadian drivers have admitted to nodding off or falling asleep at least once while driving (Beirness, 2005) and that driver fatigue contributes to at least 9 to 10 percent of crashes in the United Kingdom (Maycock, 1997). Clearly, there is cause for concern about the rate of drowsy driving and the resultant crashes, injuries and fatalities. Research continues to be needed to develop technological approaches that will help reduce the numbers of lives lost due to drowsy driving. The present aim is to extend Impairment Monitoring to Promote Avoidance of Crashes