Chapter 4

HTN-Mote: A Platform for On-Board Real-Time Monitoring of Railcars

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ABSTRACT

The safety of rail transportation has always been the top priority for the Federal Railroad Administration (FRA). Legacy technology is still largely relied upon for detection of faults. Modern technology is mostly used to detect a particular railcar rather than to monitor it for problems. Wireless Sensor Network (WSN) technology is being evaluated by the railroads for real-time or near real-time monitoring of the railcar status for timely response to problems and for trend analysis. In this chapter the authors first highlight the importance of freight rail transportation, followed by briefly discussing specific wireless technologies of interest. In particular, the authors present the shortcomings of the ZigBee protocol in the application domain of railcar monitoring. The authors then introduce hybrid technology protocol. Finally, the authors discuss HTN-Mote, a hardware platform to implement hybrid technology network and present the results of tests showing the benefits of the new protocol and hardware.

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INTRODUCTION

Importance of Freight Railroad

Freight railroad is very important to the economic health of a country as it moves commodities between source and the market place, between the place of origin and the place where those commodities are used as raw materials. Hence freight railroads directly help businesses and industries thrive which in turn drives the economy of a country.

In the United States of America freight railroad accounts for 40% of the total freight volume (US Department of Transportation; Federal Railroad Administration, n.d.), when measured in ton-miles. Ton-mile is defined as the movement of one ton of freight over a distance of one mile. The commodities moved by freight rail vary from coal, chemicals, food and related products, automobiles and their related products, lumber and wood products, minerals, metallic ores, petroleum and coal and other miscellaneous products (Overview of Freight Railroad Industry, n.d.) (Class I Railroad Statistics). Figure 1 and 2 illustrate this distribution.

There are several advantages of using freight railroad as well. They are presented as under:

1. A major advantage of freight rail is that it is as much as three times as fuel efficient as trucks.
2. The movement of freight by rail is environment friendly. Environment Protection Agency (EPA) estimates that freight rail produces only 9 percent of total transportation related nitrous emissions and 4 percent of total transportation related particulate emissions although it accounts for nearly 40 percent of inter-city ton-miles (Overview of Freight Railroad Industry, n.d.).

Figure 1. Percent in ton-miles of freight carried by different modes of transport (Adapted from http://www.fra.dot.gov/Page/P0362)
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