Uplink User-Assisted Relaying in Cellular Networks

Dual Degree Project 1st Stage Report

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Abstract

Currently, there are 31,254 level crossings and around 40% of them are unmanned. The unmanned crossings are responsible for the maximum number of train accidents. The m ain objective of this project is to reduce the number of such accidents by building a reliable system th at can consistently detect a train moving towards the crossing and sets off an alarm at the crossing.

Contents

1 Introduction

The solution to this problem is to build a system that can turn on an alarm at the crossing at least 1 min before the train reaches the crossing and turn off the alarm when the train passes the crossing. To do this, we designed a sensor unit, using two inductive proximity sensors, that can detect a train and its direction, and an alarm unit. The sensor unit will be placed 1.5 km away from the crossing while the alarm unit will be placed at the crossing. When a train passes over the two sensors of the sensor unit, it detects the direction of the train, counts the number of axles[1](n) and sends this information to the alarm unit. If the train is moving towards the crossing, alarm unit turns on the alarm. When the train passes over the single sensor placed at the crossing, the alarm unit down counts the number of axles from n and turns off the alarm when the count reaches 0.

In the next sections we present the block and circuit diagrams of various units of the system, different algorithms used to detect the direction of train and also how false alarm cases are handled.

1.1 Motivation

1.2 Work Reported

1.3 Organization of this report

2 Partial Decode-and-Forward Relaying

2.1 Functional Block Diagram

2.2 Communication unit

Functions:

1. Check if communication link is active
2. Data transfer

2.2.1 Link check

We are using a watchdog timer at the alarm unit to check if the communication link between sensor unit and alarm unit is active.

- Sensor unit triggers by sending some packet (char 'A') to alarm unit, when alarm unit receives this packet it initializes timer (t=0), when timer = T (t=T) it resets Linkflag (Linkflag=0).
- Sensor unit will trigger every t1 sec and alarm unit initializes timer to zero (t=0) setting the Linkflag high (Linkflag=1). In this process Linkflag stays high (Linkflag=1) as long as the communication link is active.
- Linkflag is low (Linkflag=0) implies that it did not receive any packet for the last T sec and the link in not active.

2.2.2 Data Transfer

In our application only sensor unit transmits and alarm unit receives. Sensor unit transmits the following signals.

- Alarm on signal 'D' when train is detected
- Axle count 'W'
- Sensor unit active signal 'A'

[1]We actually count the number of wheels on one side, 4 wheels on each side $\implies$ 4 axles

- False alarm signal ‘F’ in case of false alarm

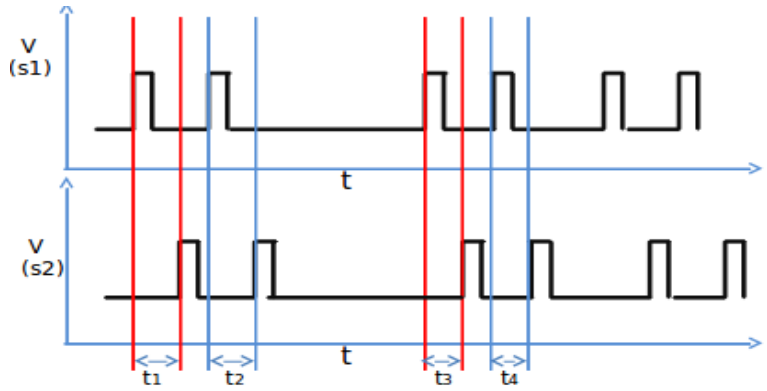

Figure 1: pulses on s1, s2 as train crosses the sensor unit

3 Simulations and Results

4 Conclusions and Future Work

5 References