Executive Overview

TITLE: D3.2.1-Design and implementation of CARLINK wireless ad-hoc applications: Puzzle-Bubble

SUMMARY: This report presents Puzzle-Bubble as an entertainment application for VANETs (Vehicular Ad-hoc NETworks).

GOALS:

1. Introducing the motivations for gaming in VANETs.
2. Presenting the Puzzle-Bubble.
3. Checking the feasibility of playing Puzzle-Bubble in real scenarios.

CONCLUSIONS:

1. The real tests allow us to conclude that Puzzle-Bubble may be used for offering entertainment services inside CARLINK Platform.

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CARLINK::UMA

November, 20th 2007

1 Introduction

Entertainment is always an attractive service in computerized platforms. Games are interesting for the passengers since they make more pleasant the road trips. Its utilization range from childrens to adults, what can be profitable for the leisure industry by exploiting VANETs as a new domain for offering services. For us, however, it is a nice way of testing new ad-hoc peer-to-peer communication protocols in real scenarios.

This report presents Puzzle-Bubble, an ad-hoc game for testing VANETs as a new domain of entertainment applications. The report is divided into the following sections: Section 2 explains how to play with Puzzle-Bubble and the communication issues behind. Section 3 details the execution platform for running Puzzle-Bubble and Section 4 presents the results and conclusions about the real tests performed to this application.

2 Featuring Puzzle-Bubble

Puzzle-Bubble is an example of entertainment application which can be part of the services offered by the CARLINK Platform. Puzzle-Bubble is a version of the original game, called **Puzzle-Bobble**[1], especially designed for VANETs. The graphical user interface is shown in Figure 1.

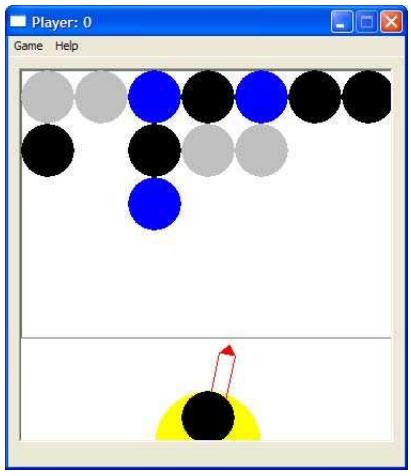

Figure 1: Graphical user interface of Puzzle-Bubble. This Figure shows twelve bubbles in the top of the screen and the cannon is loaded and ready to be shot by the user.

[1]Taito Corporation - `http://www.taito.co.jp`

2.1 Game Rules

The goal of this game is to remove all the bubbles in the screen (Figure 1). There are bubbles with different colours. Bubbles may be deleted by placing three or more adjacent ones with the same colour. The user is able to shoot bubbles by using a directional cannon in the bottom of the screen. The colour of the incoming bubble is randomly chosen by Puzzle-Bubble. When the user removes some bubbles they are sent to the other players and vice versa. Those players who first empty their screens wins. There is also a line in the middle part that is delimiting the maximum number of bubbles that can be accumulated during the same game.

2.2 Communication Issues

The communication between players is done by broadcasting the number of deleted bubbles. When the user places three or more bubbles adjacents with the same colour, Puzzle-Bubble counts the number of bubbles to delete, and this number is sent to all the other players by using a broadcast message. On the one hand, this feature allows to play with more than two players, despite it was a limitation in the original game. On the other hand, nodes which are separated more than one hop can not play together, because the broadcasting is only done by using one-hop communication. This restriction is planned to be removed in the next version of the game by adding a multi-hop broadcasting method.

3 Execution Platform

Puzzle-Bubble has been implemented with JANE [2], a Java-based middleware which is intended to assist ad-hoc network researchers in application and protocol design. Puzzle-Bubble has been executed in laptops running the Java Virtual Machine of *Sun Microsystems*. These laptops were equipped with *ORiNOCO IEEE 802.11b/g PC Card GOLD*[2] connected to a range extender antenna, with 7dB gain, in order to create an effective VANET.

4 Results and Conclusions

We have tested Puzzle-Bubble in a real VANET by using an informal approach, so we did not gather any statistics about the communication status between cars. In these tests we just wanted to check that the game could correctly work in real settings. Therefore, we used two cars moving with the trajectory described in the Figure 2. The tests consisted of placing two players in different cars while moving one behind other at 30km/h.

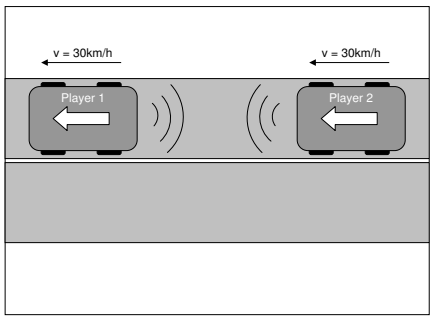

Figure 2: Scenario for testing Puzzle-Bubble in a real VANET.

[2]Proxim Wireless Networks - `http://www.proxim.com`

The experiment took place in the parking at the *E.T.S. Ingeniería Informática*[3], in the *University of Málaga*, during March 2007. This experiment demonstrated that Puzzle-Bubble can be successfully executed in simple but real VANET. Moreover, the high transferring rates reached during the performance of FSF (626 KB/s) [1] opens several posibilities towards future exploitations of vehicular ad-hoc networks as a new leisure platforms for entertainment software.

References

[1] CARLINK::UMA. D2006/10 - VDTP: A File Transfer Protocol for Vehicular Ad-hoc Networks. Technical report, University of Malaga, Spain, 2006.

[2] CARLINK::UMA. D2006/7 - JANE: A Tool for Implementing Applications in Real Ad-hoc Networks. Technical report, University of Malaga, Spain, 2006.

[3]School of Computer Science Engineering - `http://www.informatica.uma.es`