



CROWD4ROADS
PROJECT

WHITEPAPER

Crowd-sensing and gamification

SmartRoadSense gamification design update

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Collective Awareness Platforms
for Sustainability &
Social Innovation

Introduction

Coventry University's participation within the CROWD4ROADS project utilises the **Disruptive Media Learning Lab's** (DMLL) expertise in adaptive, pervasive teaching methods and learning techniques with an emphasis on **gamification and learning through play**.

Gamification: using game mechanics, dynamics and technologies for learning or behavior change. (Chou, 2013)

The **introduction of gamification elements to SmartRoadSense**, an active crowd-sensing system also participating in the project¹, is aimed at improving **four key areas** of its mobile applications; these are:

- Encouraging greater user interaction with SmartRoadSense,
- Increasing the size of the SmartRoadSense user base,
- Increasing the amount of data collected for lesser travelled roads,
- Encouraging car sharing.

In the five months since CROWD4ROADS project members met in Volos (Greece) in July 2017, and took feedback from CAPSSI reviewers, the design of the SmartRoadSense applications gamification layer has undergone **a period of radical change**. This has seen a complete re-design of the gamification with the intention of aligning it more closely with the aims of CAPSSI (Collective Awareness Platforms for Sustainability & Social Innovation, capssi.eu) whilst retaining key themes, which are desirable from a Crowd4Roads perspective, intact.

¹ Official website: <http://smartroadsense.it/>
Smartphone apps available for [Android](#) and [iOS](#).

Three designs

The process of rebooting the gamification began with an examination of the previous design and the aims of CAPSSI. This led to the idea that the data gathered by users within the SmartRoadSense application could be used to procedurally-generate gameplay levels. This would not only provide the basis for a game, but also supply users with direct feedback about the data they had collected and therefore the condition of the roads which they had travelled.

Using this as a central theme, three new gamification proposals based on popular game genres; a side-scrolling shooter, a platformer and a racing game, were created. These were then presented to the CROWD4ROADS partners at a plenary meeting held at the University of Urbino, Italy, in August 2017. At the close of the meeting, agreement was made that each of the CROWD4ROADS partners would be asked to vote for their favourite proposal, where the winner would be advanced into full design.

Once voting had finished it was clear that project team members overwhelmingly favoured the racing game concept which had been given the working title '*Balance Trucks*'.

Balance Trucks

The concepts behind Balance Trucks are deceptively simple. The gamification will utilise **data from SmartRoadSense**, which has been collected by the user, **to create playable terrain**. The player will be provided with a vehicle and asked to race across the generated terrain in a **time-based challenge** whilst transporting an object to the end of the level.

Throughout each level, the player will be able to collect a range of items including coins, which can be used to purchase new vehicles, upgrades and special boosters, vehicle components which allow them to unlock and build special vehicles, and collectible cards which will provide them with rewards in the form of gameplay bonuses.

Points will be awarded to each player based upon their finishing time, these will be used to increase or decrease the player characters rank which will in turn increase or decrease the games difficulty.

Multiplayer

Guided by gameplay research and user-engagement tests performed within Coventry University, it was decided that, rather than changing the format of multiplayer entirely, the mode would utilise similar methods to generate gameplay as single-player. However, players within multiplayer will not be asked to carry objects with them. Instead, multiplayer gameplay will centre around players competing against each other in a straight race to the finish line, with each player receiving a reward based upon their finishing position.

Terrain generation

The central aspect of the gamification, the process of procedurally-generating each gameplay level, begins with the creation of a playable surface; the foreground terrain. This is created by taking a section of concurrent data entries from within SmartRoadSense and converting them, in-app, into a height-map which resembles a Microsoft Excel graph. The height map is then stretched to correct its scaling and help balance out any major spikes or troughs within the data. Further balancing is then performed on the data to ensure that the terrain does not contain areas which would be undriveable. Finally, to supply smooth terrain at the start and end of each level, fake blocks of data are inserted.

Once the gameplay area has been defined it will be skinned using a series of art layers including a foreground, mid-ground and background. These layers will be used to gradually build up the environment and allow the different layers to parallax with each other and create a 3D effect.



FIGURE 1: GRAPHICAL RENDITION OF A LEVEL OF GENERATED TERRAIN. (PRELIMINARY ARTWORK.)

Moving forward

In recent weeks the development of SmartRoadSense has begun to enter a new phase. The gamifications design is complete, however, work to update and modify the game design documentation will continue throughout development and right up till release. The role of the design team is slowly changing to reflect this as they begin to create game content, writing a series of sustainable factoids for use within loading screens, for example. Additionally, design is providing guidance for the development of artwork for use within the game.

In line with this, a team of art students have been recruited from Coventry Universities Faculty of Arts and Humanities for the task of generating the gamifications artwork. Whilst working as a group, these students have since been split into two teams; one team working to generate environmental art (ENV-ART) and the other focusing on the creation of the games user-interface (UI) and on-screen display (OSD). Over the past month, both art teams have concentrated on completing the first art milestone. This has involved both teams brainstorming ideas for their relevant areas and creating a series of mock-ups evoking concepts which can be used within the game. The next milestone, which starts in January 2018, will see the UI and OSD team generating a complete set of mock-ups for the games UI, whilst the ENV-ART team begin to mock up examples of the vehicles which appear in-game.

At the University of Urbino, a series of tests have been run to determine the most efficient way to incorporate the gamification layer into SmartRoadSense. The team have determined that the Urho Engine will provide the most functional code pipeline and have created demos for both Android and iOS devices which illustrate the games basic physics model is viable.

In conclusion, the gamification of the SmartRoadSense application has seen a period of intense change over the past five months. This has seen a new direction for the gamification agreed upon and advanced into design. A full set of design documentation has been written by the team at Coventry University, and these have since been delivered to the development team in Urbino. Design has now changed direction slightly and begun to work on content creation and, to some degree, production

as they manage the art team and their deliverables. To facilitate this, a team of student artists have been recruited at Coventry University with the aim of creating artwork for the gamifications gameplay environments, user-interface and on-screen display. The first art milestone has been met and work will begin on milestone two in January 2018. Momentum also continues to build at the University of Urbino where key decisions have been made in relation to the gamifications software engine and a series of prototypes have been created using the Urho engine.

As development continues, 2018 looks like it will be a very interesting year!