Studenten/-innen	Lukas Kretschmar
Dozenten/-innen	Prof. Hansjörg Huser
Co-Betreuer/-innen	Basil Weber
Topic	Software and Systems
Projektpartner	Urban Games GmbH, Schaffhausen, SH

Lukas
Kretschmar

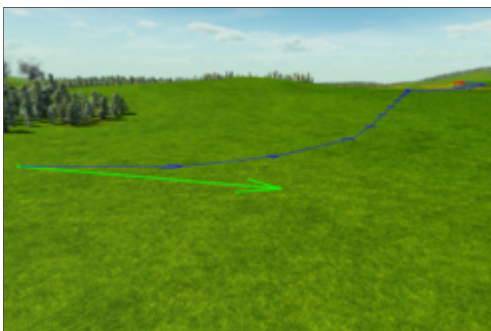# Constrained A-Star Pathfinding in a 3D-Environment

A conceptual feasibility study
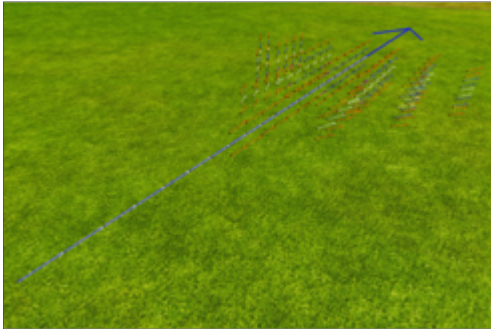
An example of expanded nodes based on a given origin node.

Aerial view of a proposed path.

The path tries to follow the landscape but then creates a tunnel towards the target since a hill is in between.

Introduction: Pathfinding in computer games is a well documented topic.But most of the research is based on 2d grids containing some obstacles.Since pathfinding is just graph search, changing the model to represent a 3d-environment is not that hard to accomplish.But most of the literature relies on the assumption that the full graph is known from the beginning.Two parts about pathfinding not that well documented are the situation a graph is not fully expanded from the beginning and the inclusion of constraints.At the end, it all comes down to how and when we build the graph since the constraints have to be present in the graph.

Proceeding: We describe an approach to combine pathfinding on an incrementally expanding graph bound to several restrictions constraining the reachable nodes.As a concrete problem domain we take railroad track building in Train Fever.Just like in the real world, in the game railroad tracks are bound to some curve radius that cannot be ignored and cannot exceed a maximal slope.Thus, expanding a graph cannot be done to any neighboring node in any direction of a given node.

Solution: The presented solution provides an overview how we combine an incrementally expanding graph, the cost calculation and the heuristic.Furthermore, we present three different versions for the cost calculation and our thoughts on the heuristic we use.