The shortest way to win a round of golf.

In golf, the aim is to hit a ball accurately into a hole in a minimum number of strokes. The aim of my TIPE is to find the best path to follow to help a player on a defined course, by comparing different shortest path algorithms (such as Dijkstra's algorithm).

Golf is the world's most popular individual sport, requiring precision, skill, and endurance. Enabling a golfer to understand and see the shots that lead to victory gives the sport a chance to be more accessible and fun for beginners.

Thematic positioning (STEP 1):

- COMPUTING (Practical computing) –
PHYSICS (Mechanics)

Keywords (STEP 1):

Keywords (in French)	**Keywords (in English)**
Graphes-Grille	*Lattice-Graph*
Dijkstra	*Dijkstra*
Simulation	*Simulation*
Frottements	*Friction*
Optimisation	*Optimisation*

Annotated bibliography

Many sports and games (such as chess) can be simulated by a machine to achieve victory. On a golf course, there are several obstacles that prevent the ball from going straight to the hole [1]. Careful placement of these elements can make a game more intense and complicated. We create a simple model to favour the implementation of courses via "grid graphs" [2]. With the help of width traversal on a graph and Dijkstra's algorithm [3], we're able to trace a path from start to finish. All that remains to be done is to add free-fall motion without friction with the air but with the ground, thanks to applications of Coulomb's law [5] in mechanics. Once the rudimentary implementation is complete, we need to carry out a physical study of the ball's motion. To ensure that the golf ball follows the desired trajectory, we use a "golf club" with a "loft".

"loft" [6], i.e. the angle at which its face opens. This allows the ball to be carried even further to the fairway in fewer strokes. Add to this a model with air friction [6] and you have a simulation that's pretty close to reality, capable of identifying high-potential shot zones (which make it easier to win). However, the simplicity of the terrain: it's just a flat surface with a constant dynamic friction force, obstacles are represented by circles and weather conditions are neglected. This is why we take the liberty of using "voxels" to model the terrain and push the simulation to the limit of realism.

The problem

How can we optimize golf strategy using shortest path algorithms and accurate ball movement modelling, while considering the topographical constraints of the course?

Objectives of the candidate's TIPE

- Design a golf course generation algorithm integrating physics, regulatory dimensions, and topography to create varied and realistic courses.
- Identify and integrate specific strategies to efficiently bypass course obstacles, using search algorithms adapted to the golf course's topography.
- Visualize golf ball trajectories and associated parameters.

References (STEP 1)

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[6] A. PEYTAVIE E. GALIN J. GROSJEAN, S. MERILLOU : Modélisation de terrains complexes 3D