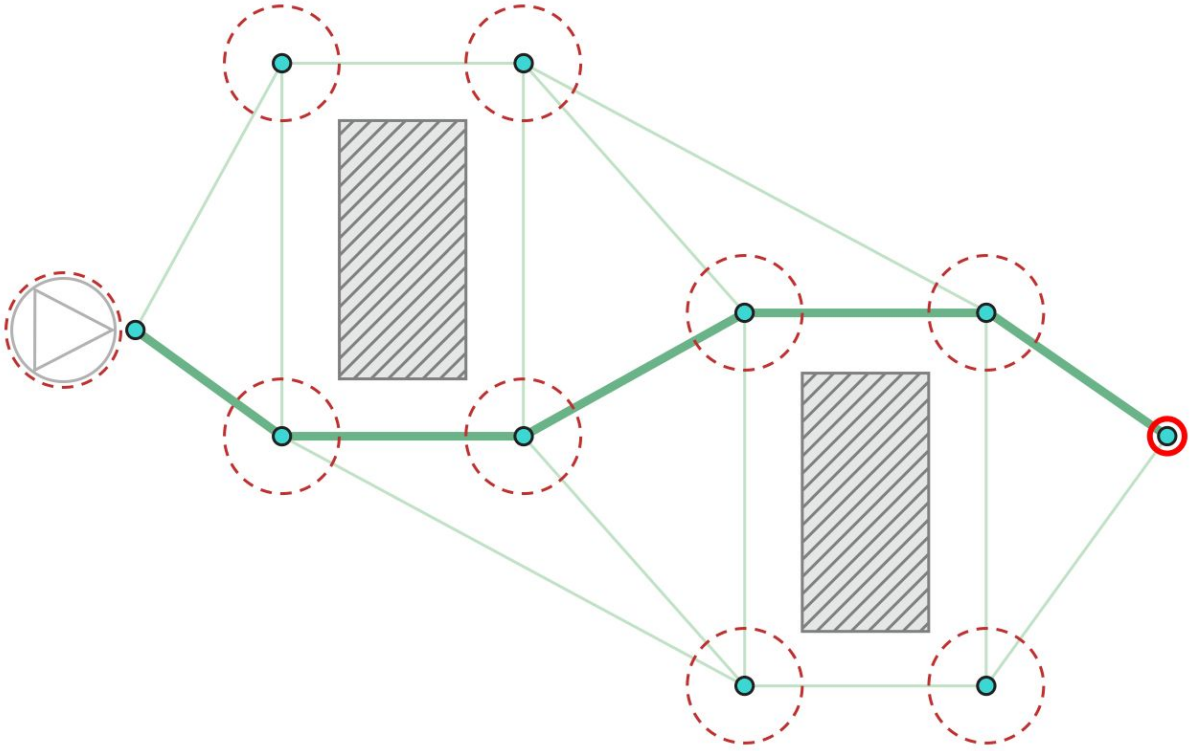
Pathfinding System Research



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Introduction

We are developing a routing app within a building called Guidance. We are aiming for a user friendly mobile web application that can tell you how u can get to a certain location within the building safely. Our application is fast, reliable and ethical.

DOT Framework Methods

What is a DOT Framework

The DOT framework can help you to structure your research and to communicate about it. The Development Oriented Triangulation (DOT) framework consists of three levels: The "What" of your research (the domains) The "Why"of your research (the trade-offs) The "How" of your research (the strategies and methods)

Methods:

- Available product analysis
    - Why: Find out if what you are planning to do has already been done (in full or in part) by someone else.
    - How: Identify existing solutions that may solve the problem (or a part thereof) you are trying to fix with your solution. Decide if it is worth the effort to recreate their work, or whether it is better to simply buy it from them or embed their work in yours.
- Expert interview
    - Why: A domain expert can put you on the right track when you enter a new domain or field of expertise. The expert can recommend sources, give you a sense of direction or point out common pitfalls.
    - How: Find an expert who is willing to talk to you about the problem and arrange an interview.
- Prototyping
    - Why: Develop, evaluate or communicate a concept, design or problem solution to make your ideas concrete, to learn whether they work and to discover the technical limitations or possibilities.
    - How: Start by determining what you want to learn from your prototype. Determine which kind of prototype suits your needs best: for example, you can create a paper or electronic prototype of your UI, a proof of concept or a proof of principle.

Research questions

Problem:

As options we have 2 systems: a grid system and a node system. These are the options chosen as these are the most logical choices for an indoor floor plan system. One has a grid on which you can draw out the folder and the other can place your nodes and set routes for it. Now we have to choose one of the two as we don't have time to make a working prototype for both of them.

Main question:

What map system where a pathfinding algorithm can be built in meets the performance requirements of the system without asking for too much time from implementation?

Sub-questions:

1. What floorplan systems are there?
2. How does the software perform in relation to the wishes?
3. How much time does it take to implement the system?

Available Product Analysis

What Floorplan Systems Are There?

Grid System

The idea is that you have a grid over a map on that grid you can turn off a folder on which an algorithm has to work. This grid has a few objects such as a start, end and wall point. The idea came from tutorials on pathfinding. This seemed like a good solution for mapping a map.

Floorplan Scanner System

The idea is that you give an image of a floorplan, this image is then scanned and returns all the walls. This was a faster but trickier solution for mapping a floor plan.

Node System

The idea is that you can place nodes between these nodes for set paths on an image of a map. On which an algorithm looks for which of these paths is best to use to reach the end point.

Expert Interview

Interview

We arranged a meeting with a project manager at Phillips. We talked about his opinion on creating a routing algorithm. We submitted the idea of creating a grid system. The project manager's first point was on how we were going to create a system so that an admin can create one. This system needed to be easy enough to understand in a short period of time. It shouldn't take someone a lot of time setting up the grid system for a floorplan and the system should notify the user when it tries to do something that can't work. This is a lot of work on its own. This admin system would take a very long time to set up, let alone making it good enough for an end user to operate it. We looked at making a floorplan scanner that would automatically scan for walls and door openings but that, again, would take a lot of time and would be a risk to try in the short period of time we had. The outcome was clear: a grid system wasn't a logical choice for the time we had. The project manager proposed the idea of using a node system. He talked about it being way less work to set up a good admin system for. It needed less bug fixing and error handling and thus was a more logical choice for us. The project manager had some experience in using a node system and told us about the expandability of it. We can make our own custom nodes that hold custom data. With this we can expand infinitely on it if we want to add features in the future.

Prototyping

How Does The Software Perform In Relation To The Requirements?

Requirements

For the project, the software must be fast and reliable so that the user does not get into annoying situations.

Performance

Grid System:

The grid system has to look for every box in the grid to see if it needs something to do with it

For example, whether this box is a wall or empty. Even when looking for a path, it should also check box by box to see if he should do something. This can make the software feel a little slow.

Floorplan Scanner System:

The scanner had to look for every single pixel in the image and check if it has the selected color. If the image was high resolution however it would need several seconds to scan everything.

Node System:

The node system places all of the stored objects on a map. For example, the nodes. When searching for a route, the node system only has to look at available nodes. This way you limit the results and the software will work faster also there is less room for calculation errors.

Conclusion

We ended up choosing the node system because of the limited time we had to realize our project. This way we could ensure that our project would be quick to load and reliable to use. The other options would just take up 2 much time and needed a lot of tweaking so they would become more consistent.

Sources

Gave the idea for the grid system:

https://www.youtube.com/watch?v=msttfIHHkak

DOT Framework:

http://ictresearchmethods.nl/Main_Page