Proposal Graduation work

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| Student Name | Floris Leysen |
| Major | GAME DEVELOPMENT |
| Minor |  |
| Presentation | November  January June |
| Supervisor | Steven Verborgh |
| Coach | Jorge Monterrubio Sanudo |
| Working days on site | Monday  Tuesday  Wednesday  Thursday  Friday |

Project title:

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| Long-term sci-fi vegetation progression simulator |

Research Question:

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| How can the progression of vegetation in a contained environment, based on seeding, be accurately simulated real-time in a game engine? |

Project outline:

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| **ENVIRONMENT** - Sci-Fi; feels familiar by rooting in our nature, but adding elements that don’t exist here - Inspired by No Man's Sky    Source: reddit.com/4yuhxz  **SCOPE** - Timespan: calculations based on a day passing, can be accelerated or decelerated. If slow growing vegetation like trees are part of the possible growths, simulations will need to span many years. If not, it should give good results after just several years.  - Environment bigger than a back yard, smaller than a forest - Test case will likely be executed in 2500-10000m² - It is assumed that the environment can sustain the chosen vegetation in terms of nutrition and temperature. The only environmental element influencing vegetation growth is placement of surfaces (e.g.: some can only grow on the sides of objects, or need light to grow) - Environments do not have to be realistic (refer to image’s floating slab of ground) - Seasons remain the same as on Earth, but duration can vary  **VEGETATION** All vegetation has predefined visuals to indicate various states of progression. Most vegetation has a seasonal cycle that changes its properties. (e.g.: grasses will stop spreading during winter season, generally seeds are only produced during spring season)  **Specific properties:** Spreading: - Can either reproduce or spread through roots in or on the ground (like our grasses) - Can only spread through reproduction (fruits, seed pods)  Survival: - Relies on soil for energy - Relies on light for energy - Draws from roots of nearby vegetation for energy - Draws from tree it is located on for energy - Relies on wind for energy  Growth locations (possible options): - Can only grow on trees (or other plants) - Can grow anywhere as long as it is pointed upwards (i.e.: not on sides or bottoms) - Take root above ground and are suspended there - Can grow anywhere as long as it is not pointed upwards - Can grow anywhere with room to grow upwards (like ivy)  Progression patterns (possible options): - Seed => seedling => singular plant or tree => grow => reproduce (back to grow) => die - Seed => seedling => singular plant or tree => spread through roots => grow => possibly reproduce (back to spread) => die (when conditions are unfavorable or after lifetime end)  Seasonal patterns (possible options): - Spring reproduction => summer growth => fall stagnation => winter pause - Spring growth => summer stagnation => fall pause => winter reproduction  **PREDICTED PROCESS** - In editor, before running: Create volume, defining which vegetation is allowed to grow in this area and the amount of those plants' seeds being present in the ground before simulating. Note: if there are no plants that can grow just by having a seed in the ground (i.e.: no conditions like needing another plant nearby), nothing will grow. It is also possible to have seeds or roots enter the volume at set intervals. They come from an unknown outside area and were taken here via wind, animals...  - At start: The volume will check all objects inside of it, and spawn the amount of predetermined seeds spread out over the area.  - During running (early stage): The seeds will get a chance to grow. It is likely that most seeds will be eliminated unless the specific vegetation has seed with high chance of surviving. Some vegetation will appear.  - During running (mid stage): Progression pattern is followed; more vegetation will appear and grow bigger.  - During running (final stage): Vegetation will start dying, freeing up space for others to grow. The ones that take their place will grow and eventually die, too. This cycle is repeated indefinitely.  **INTERACTIONS**  Since vegetation won’t just sit tight until it withers, there are some situations that can spell an early end to its life. - Bigger plants might inadvertenly eliminate nearby other plants by taking away their sunlight - Some might not survive a certain season because it froze on a cold day  - Disease or predator damage (outside unknown factors), these can spread to other nearby vegetation - Vegetation cannot grow on a patch of ground another plant is already occupying (exception: vegetation of the type that grows on trees) - Withered plants enhance their soil and improve growth of vegetation that reoccupies their space  **VEGETATION GENERAL PARAMETERS**  - Resistance to disease and predators - Seed survival chance - Expected lifespan  - Growth rate (before counting factors that influence growth like sunlight)  **ENVIRONMENTAL PARAMETERS** - Disease/predator appearance rate  - Season durations - Possible vegetation and the amount of seeds present for each of those (refer to section “Process”) |

Method and approach:

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| Analyze spreading patterns of grass-likes and reproductive types (fruits, seed pods)  Figure out which model can be used to represent the vegetation Influence of light on plant growth and calculating average time spent in light for an object (over 24h)  Detection of surfaces inside a volume (for vegetation placement)  Find optimization techniques for large interactive systems intended for use in a game  Investigate real life vegetation response to seasonal changes  Weighing engine options |

Deliverables:

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| - Engine package aimed to be used in games as a means of evolving environments throughout the passing of time, without placing any vegetation beforehand  - Package has customizable parameters to influence the simulation (see project outline)  - A video showing simulation of a few years  - Videos showing partial test cases |