

# Posudek bakalářské práce

Matematicko-fyzikální fakulta Univerzity Karlovy

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**Název práce** Real-time Strategy game toolkit for Godot engine  
**Rok odevzdání** 2024  
**Studijní program** Informatika  
**Specializace** Computer Graphics, Vision and Game Development

**Autor posudku** Adam Dingle **Role** Opponent  
**Pracoviště** KSVI

Prosím vyplňte hodnocení křížkem u každého kritéria. Hodnocení *OK* označuje práci, která kritérium vhodným způsobem splňuje. Hodnocení *lepší* a *horší* označují splnění nad a pod rámec obvyklý pro bakalářskou práci, hodnocení *nevyhovuje* označuje práci, která by neměla být obhájena. Hodnocení v případě potřeby doplňte komentářem. Komentář prosím doplňte všude, kde je hodnocení jiné než *OK*.

**K celé práci**

lepší OK horší nevyhovuje

Obtížnost zadání	x	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Splnění zadání	<input type="checkbox"/>	x	x	<input type="checkbox"/>
Rozsah práce ... <i>textová i implementační část, zohlednění náročnosti</i>	<input type="checkbox"/>	x	x	<input type="checkbox"/>

## Comments:

The goal of the thesis was to implement a toolkit for developing real-time strategy games in Godot. The thesis includes a toolkit implementation written in C++ and C#, plus a demo game written in C#.

The demo game is primitive. Some of its graphical elements are ugly placeholders (such as Godot icons) that could easily have been replaced with nicer pixel art. The game is playable, but is uninteresting since the enemy units just sit in one place, so it's trivial to win: just produce a bunch of units, then attack the enemy. It's possible to create new buildings (of a single type) and units (of two types), but there are no resources to gather as in most RTS games. I found that the game often produced errors or crashed when units or buildings were destroyed. For more details, see my comments in the section "Implementační část práce" below.

In my opinion the thesis text has several problems. Although it has a nice high-level overview of RTS games in general, its description of the toolkit itself is not always easy to follow. It describes various individual classes and components, but doesn't provide a high-level overview of the toolkit's capabilities. For example, does the toolkit contain an AI strategy that can be used across various games? That's one of the stated goals (in section 1.5 Project Goals), yet the thesis says almost nothing about whether an AI player was actually implemented or how it works.

As another example, the demo game can evidently find paths, but how does this work? Is this using Godot's pathfinding capabilities, or does this come from the toolkit itself? Section 2.1.2 "C++ project" says "The project currently provides TileCollisionShape2D node that is used for Building collision and Unit pathfinding around them", yet the thesis text says nothing about how these collisions and pathfinding work.

Also, the thesis text describes various classes and interfaces (e.g. Attack, Ability) at a high level, but provides no API reference for these classes or even a description of their most important methods, so it's not always clear how they can be used.

In section 2.1.1 "Program structure" the thesis describes the structure of the source tree, but it doesn't make clear which parts of the source code belong to the RTS toolkit and which belong to the demo game.

Finally, the text is not always easy to read since it has many errors in spelling, grammar, capitalization and punctuation. For more details, see the section "Textová část práce" below.

**Textová část práce**

lepší OK horší nevyhovuje

Formální úprava ... <i>jazyková úroveň, typografická úroveň, citace</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Struktura textu ... <i>kontext, cíle, analýza, návrh, vyhodnocení, úroveň detailu</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Analýza	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vývojová dokumentace	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Uživatelská dokumentace	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

In Figures 2.1 and 2.2, I had to study the code to figure out that "A" means an abstract class and "C" is a non-abstract class. The thesis text should have made this clear.

Some abbreviations are not explained. For example, section 2.1.3 the text contains "CC in all cases" and section 3.1 says "Menu.tscn plays a FFA at the Background". The reader may not know what CC or an FFA is.

The text contains many errors in English and typography that make it hard to read. Here are some of the classes of errors that exist, along with a few examples of each class.

- In the text identifiers are written in the ordinary variable-width font, but should be in a fixed-width font as is standard in programming documentation. For example, "Physics.cs", "PhysicsConsts" and "PhysicsValues" in section 2.1.1 should all be in a fixed-width font.

- Numerous words are misspelled, e.g. "succesful" -> "successful"; "commerecially" -> "commercially"; "functinality" -> "functionality" (all in the Preface).

- Some terms are not capitalized correctly, e.g. "GDscript" -> "GDScript" (Preface); "Company of heroes" -> "Company of Heroes" (1.1.1); "Game Jams" -> "game jams" (1.2).

- There's some confusion between the plural suffix "s" and the suffix " 's ", e.g. "individual unit's" => "individual units" (Preface); "lets focus" -> "let's focus" (section 1.1).

- There are many errors involving the articles "a" and "the", e.g. "a well known Godot engine" -> "the well-known Godot engine" (Preface); "with RTS games mentioned above" -> "the RTS games mentioned above" (Preface); "Godot engine natively supports" -> "The Godot engine natively supports" (Preface). These make the text hard to read especially for native English speakers.

- Some sentences are missing a period at the end, e.g. "It is inspired by Python..." (1.3.1); "Ideally the project would be written in..." (1.3.3); "The definition then has to be written for each class..." (1.3.4).

I think that a spelling or grammar checker could have found many of the errors I've listed above.

## Implementační část práce

lepší OK horší nevyhovuje

Kvalita návrhu ... architektura, struktury a algoritmy, použité technologie	<input type="checkbox"/>	x	<input type="checkbox"/>	<input type="checkbox"/>
Kvalita zpracování ... jmenné konvence, formátování, komentáře, testování	<input type="checkbox"/>	x	<input type="checkbox"/>	<input type="checkbox"/>
Stabilita implementace	<input type="checkbox"/>	x	x	<input type="checkbox"/>

I was able to build the C++ and C# components of the project and run the demo game on Ubuntu 24.04.

The demo game is pretty primitive. Here are some things I noticed:

- As far as I can tell, the player's units and the enemy units look exactly the same. This is confusing, and makes the game hard to play.
- The Godot icon for barracks is ugly. Also, to the left of the barrack is an ugly gear icon - when I select it, I see that its name is ScrapPile. What is the purpose of this? I see that a unit can move under the ScrapPile, which doesn't look great.
- The scene tree contains some sprites labeled FogOWar, but the game apparently doesn't implement a fog of war feature and the text doesn't discuss it at all.
- If I zoom out all the way, then I can't pan the view to see the top of the world.
- I can't click the minimap to pan to the clicked spot.
- When I use the mouse wheel to zoom in, the center of the visible area changes, moving toward the upper left. That's awkward. For example, if I pan the view so that the enemy barrack in the lower right is visible, then if I zoom in it's not visible any more. Instead, it would be better if the terrain under the mouse cursor remained at the same screen position when I zoom in or out.
- Panning with the mouse is a bit clunky, for a couple of reasons. First, it only works if I move the mouse cursor just outside the window. If I quickly move the mouse out of the window and it lands further outside the window, the view does not pan. This feels inconsistent. Furthermore, if I move the mouse just outside the window so the view is panning in a certain direction, say to the right, and then I quickly move the mouse to some other point that is e.g. far below the window, the view will continue panning rightward. That seems wrong.
- It would be nice if I could alternatively pan in some other way, e.g. by either (a) pressing the arrow keys or (b) clicking and dragging with the middle or right mouse button.
- The first time I run the game, it seems to work fine. But when I run it a second time, I get tons of errors of this form:

```
E 0:00:00:0827 void RTS.Gameplay.BuildOrderPlayer._Process(double):  
System.NullReferenceException: Object reference not set to an instance of an object.
```

To work around this, in BuildOrderPlayer.cs I changed the line

```
else if (item is Unit unit)
```

to

else if (item is Unit unit && target != null)

- The black hand cursor is hard to see when I move it over screen areas that are black, such as the menu areas at the top or the selected info area at the bottom.

- Does the second player use an AI strategy, or is it completely passive? Section 3.1 says "It contains one human player and one AI player", but also says "The other player is a blank player with no agenda", so this is ambiguous. Basically the enemy seems to be completely passive: its units will attack my units if I go near them, but it doesn't seem to train any new units or move its own units into my territory. So this isn't much of an enemy at all, and it would be a stretch to call it an AI.

- To select a single unit, I have to click inside a fairly small area at the base of the unit. Instead, it would be nicer if I could click anywhere on the unit.

- If I have selected several units, it would be nice if I could unselect one of them by holding down Shift or Ctrl and selecting it. That doesn't seem to work in the current implementation.

- If I select a bunch of knights and archers, I see them all in the UnitsSelected area below the map. In that area, I can click an individual knight or archer to see information about it in the UnitInfo area. However, when I do so the image to the right of the UnitsSelected/UnitInfo area doesn't update. This is confusing.

- When I ask a knight to build a Barrack, I need to right click at the position where I want it to be built. If I left click, nothing happens. This confused me for a while.

- The Knight has an ability called Empty. When I click it, I see a blank area where I can only click Back to go back. What is the purpose of this?

- If I move one of the player's units into the enemy area and let the enemies attack it, the unit will die. Then the game crashes with this error:

```
E 0:00:19:0703 void System.Linq.ThrowHelper.ThrowNoElementsException():  
System.InvalidOperationException: Sequence contains no elements
```

- I selected a bunch of my units and used them to attack the enemy barracks. As they moved toward it, they were attacked by the enemy and several units were lost. As this happened, I saw several errors "unable to Remove selectable" in the Godot output area.

- The King unit has no abilities. What is its purpose? If it dies, does the player lose? It's not mentioned in the thesis text.

- If I select a barrack and click Train Knight or Train Archer twice in short succession, only one knight or archer is trained. So presumably after I train a unit, it takes some time (perhaps a second or so) before another unit can be trained. However there's no indication of when it becomes possible to train another unit, which is unsatisfying.

**Celkové hodnocení** 3 (Dobře)  
**Práci navrhuji na zvláštní ocenění** No

**Datum** 28.8.2024  
**m**

**Podpis**