ALMA MATER STUDIORUM – UNIVERSITÀ DI BOLOGNA

Corso di Laurea in Ingegneria e Scienze Informatiche

Eterogeneità dei sistemi di Aggregate Programming: estensione del sistema ScaFi per l'uso di robot Thymio

Tesi di laurea in:
Objective Oriented Programming

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III Sessione di Laurea
Anno Accademico 2023-2024

Abstract

Max 2000 characters, strict.

Qualsiasi tecnologia sufficientemente avanzata è indistinguibile dalla magia.
Terza Legge di Arthur C. Clarke

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Chapter 1

Introduction

Write your intro here.

Elvis Perlika: Add sidenotes in this way. They are named after the author of the thesis

You can use acronyms that your defined previously, such as Internet of Thing (IoT). If you use acronyms twice, they will be written in full only once (indeed, you can mention the IoT now without it being fully explained). In some cases, you may need a plural form of the acronym. For instance, that you are discussing Virtual Machines (VMs), you may need both VM and VMs.

Structure of the Thesis

Elvis Perlika: At the end, describe the structure of the paper

Chapter 2

Background

I suggest referencing stuff as follows: **??** or **??**

2.1 Paradigma OOP e Programmazione Funzionale

2.1.1 Paradigma OOP

L'Objective Oriented Programming è un paradigma nel senso stretto del termine poichè rappresenta un modo di organizzare e rappresentare un mondo. Il paradigma in questione deve la sua potenza nella capacità di simulare entità reali ed è riassumbile con la frase *Everything is an Object*. È rilevante parlare di OOP in quanto il paradigma di programmazione funzionale, che è alla base di ScaFi, è un'estensione di esso. Il potere della programmazione ad Oggetti (OOP), come detto precedentemente, risiede nella capacità di simulare un mondo e permette di farlo grazie agli "oggetti", essi sono istanze di Classi, le quali a loro volta sono strutture dati astratte che permettono ad ogni loro istanza di avere uno stato (definito dai *fields*) e un comportamento (definito dai *methods*). I pilastri della programmazione ad oggetti sono l'incapsulamento, l'ereditarietà e il polimorfismofig. 2.1.

- **Incapsulamento**: Questo principio vuole che i dettagli implementativi di una classe siano nascosti ad altre classi. È un approccio progettuale che mira ad isolare ogni sistema e set di dati.

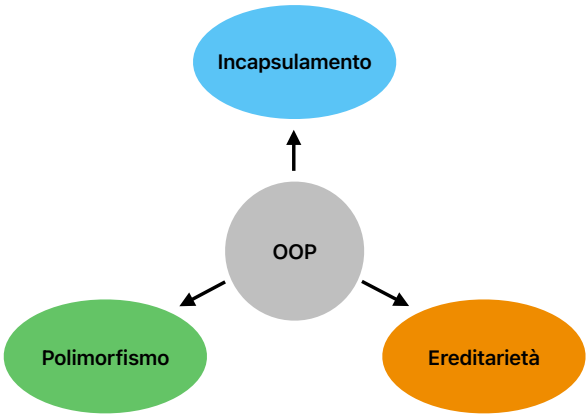

Figure 2.1: Principi della OOP

- **Ereditarietà**: Con ereditarietà si intende la specializzazione di una classe figlia da una classe madre. Questo permette di creare classi più specifiche che ereditano le proprietà e i metodi della classe madre incoraggiando il riuso del codice.

- **Polimorfismo**: Il polimorfismo è la capacità di un ogetto di assumere più forme. In OOP il polimorfismo è realizzato attraverso l'*overloading* e l'*overriding*. L'overloading è la possibilità di avere più metodi con lo stesso nome ma con diversi parametri [1], mentre l'overriding è la possibilità di ridefinire un metodo della classe madre nella classe figlia[2].

La programmazione ad oggetti si differenzia dalla più clasica programmazione funzionale in quanto controlla la complessità del software supportando la scomposizione gerarchica attraverso sia i dati che l'astrazione procedurale. Tra i benefici della OOP troviamo la predisposizione al miglioramento della qualità e della leggibilità del codice e la facilità di manutenzione.

Non è, tuttavia, priva di difetti, richiede un particolare impegno gestire il sistema da realizzzare all'aumentare della sua complessità. Altri paradigmi, come la programmazione funzionale, possono essere più adatti a determinati problemi.

[1] I parametri possono differire sia in numero che in tipo.

[2] Quando viene chiamato un metodo su un oggetto polimorfico, la scelta di quale implementazione dello stesso metodo scegliere avviene a runtime, in base al tipo effettivo dell'oggetto.

2.1.2 Programmazione Funzionale

Nel caso della OOP abbiamo riassunto il paradigma con la frase *"Everything is an Object"*, per la programmazione funzionale possiamo riassumerla con *"Everything is a Function"*. Quando si parla di funzioni nel ambito della Functional Programming (FP) si intendo **funzioni pure** cioè senza effetti collaterali. Per effetti collaterali si intende che la fuzione fa altro oltre a restituire un risultato. Un paio di esempi, presi da `Functional Programming in Scala`, sono:

- Modifica di una variabile
- Modifica del campo di un oggetto
- Leggere da o scrivere su un file
- "Disegnare" sullo schermo

Si potrebbe pensare che con l'uso della FP si possano costruire solo programmi semplice, nella realtà non c'é alcuna limitazione sulla complessità del software da costruire poichè il paradigma della FP esprime un nuovo modo di pensare e scrivere il codice.

Nel dettaglio, per **funzione pura** si intende una funzione $f : A \to B$, (una funzione che prende un input di tipo A e restituisce un output di tipo B) che mette in relazione ogni elemento di A con esattamente un valore di B. Qualsiasi altra operazione che non sia utile a calcolare $f(a) = b$ con $a \in A$ e $b \in B$ deve essere intesa come effetto collaterale della funzione e quindi evitata se si vuole creare una funzione pura.

Un esempio di funzione pura, senza effetti collaterali, è la funzione di somma che prende in input due valori e ne restituisce la loro somma.

```
1  def sum(a: Int, b: Int): Int = a + b
```

Formalmente si può definire una funzione pura con il concetto di Referential Transparency (RT):

> Una funzione f è Referentially Transparent se per ogni contesto C nel quale la funzione viene inserita, essa può essere sostituta dal risultato della stessa funzione f senza condizionare il risultato di C.

È proprio questa proprietà che permette ad un programma progettato con approccio funzionale di essere maggiormente scalabile e mantenibile.

2.2 Paradigma dell'Aggregate Programming

Nei capitoli precedenti si è esaminata l'evoluzione dal paradigma **OOP!** (**OOP!**) a quello FP, la quale, ha pemesso di gestire in modo più pratico progetti più complessi e semplificandone la manutenibilità. Una ulteriore, più specificica, evoluzione è quella portata dal paradigma dell'Aggregate Programming (AP). Quest'ultimo mira a rendere la progettazione, manutenzione e testing nell'ambito del controllo di dispositivi hardware di larga-scala.

La tecnica dellìAP si basa su 3 principi fondamentali per la costruzione di sistemi robusti e resilienti:

-

2.3 ScaFi e Macro-Swarm

2.4 Thymio e tdmclient

2.5 Aruco Tag

Chapter 3

Analisi

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3.2 Gestione dei vincoli di compatibilità del sistema Thymio

Chapter 4

Design

4.1 Architettura server Flask

4.2 File di configurazione

Chapter 5

Implementazione

5.1 Implementazione del server Flask

5.2 Esempi di Algoritmi AP applicati ai Robot Wave e Thymio nello stesso ambiente

You may also put some code snippet (which is NOT float by default), eg: section 5.2.

5.3 Fancy formulas here

```
1 public class HelloWorld {
2   public static void main(String[] args) {
3     // Prints "Hello, World" to the terminal window.
4     System.out.println("Hello, World");
5   }
6 }
```

Chapter 6

Conclusione

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Acknowledgements

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