Submitted for the Degree of MEng in Computer Science
for the academic year of 2016/17.

Run Frank in Browser

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Except where explicitly stated all the work in this report, including appendices, is my own and was carried out during my final year. It has not been submitted for assessment in any other context.

I agree to this material being made available in whole or in part to benefit the education of future students.

Signature: _____ Date: _____

Supervised by:
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University of Strathclyde, UK
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Abstract

Frank is strongly typed, strict functional programming language invented by Sam Lindley and Conor McBride and it is influenced by Paul Blain Levy's call-by-push-value calculus. Featuring a bidirectional effect type system, effect polymorphism, and effect handlers. This means that Frank supports type-checked side-effects which only occur where permitted. Side-effects are comparable to exceptions which suspend the evaluation of the expression where they occur and give control to a handler which interprets the command. However, when command is complete depending on the handler the system could resume from the point it was suspended. Handlers are very similar to typical functions but their argument processes can communicate in more advanced ways. So the idea is to utilize this functionality in the web. Side-effects might be various events such as mouse actions, http requests etc. and the handler would be the application in the web page.

In this project the main goal is to compile Frank to JavaScript and run it in the browser. So, for example, user would be able to edit their MyPlace pages using Frank language. This involves creating a Compiler and Virtual Machine (abstract machine) which can support compiled Frank structure.

Acknowledgements

I would like to express my special thanks of gratitude to my supervisor, Conor Mcbride for his guidance throughout this project.

Also, I would like to thank my friends for helping me think with our numerous technical discussions.

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Abbreviations

API	**A**pplication **P**rogramming **I**nterface
JSON	**J**ava**S**cript **O**bject **N**otation

Chapter 1

Introduction

This chapter focuses on explaining the project motivation, objectives and outcome. Furthermore, last section, explains the report structure.

1.1 Background

1.2 Objectives

- Develop Code Compiler which compiles Frank code to JavaScript program.
- Develop Abstract Machine implementation which supports the output of the Compiler.
- End result must facilitate client-side communication of events and DOM updates between Frank code and the browser.

1.3 Project Outcome

1.4 Summary of chapters

Chapter 2

Related Work

2.1 Vole

Vole is lightweight functional programming language with its own Compiler and Abstract Machine. Compiler compiles the Vole code to JavaScript, which can be used by Vole.js (Abstract Machine) and run it on the browser. It has some support for effects and handlers.

2.2 Shonky

Shonky is untyped and impure functional programming language. The key feature of Shonky is that it supports local handling of computational effect, using the regular application syntax. This means one process can coroutine many other subprocesses. In that sense it is very similar to Frank, just without type support. Its interpreter is written in Haskell, although it has potential to be ported to JavaScript or PHP to support web operations.

2.3 Frankjnr

Frankjnr is an implementation of Frank programming language described in "*Do be do be do*" (Sam Lindley, Conor McBride & Craig McLaughlin 2016).

2.3.1 Frankjnr limitations

- Only top-level mutually recursive computation bindings are supported;
- Coverage checking is not implemented;

2.4 Ocaml

2.5 Haste

Haste is an implementation of the Haskell functional programming language, designed for web applications and it is being used in the industry. It supports the full Haskell language, including GHC extensions because it is based on GHC compiler. Haste support modern web technologies such as WebSockets, LocalStorage, Canvas, etc. . Haste, also, has support for effects and handlers. Furthermore, Haste programs can be compiled to a single JavaScript file.

2.6 Conclusion

Chapter 3

Initial development & Simple system

Chapter 4

Research containing a figure

4.1 Introduction

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4.2 Method

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4.4 Discussion

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Figure 4.1: RV Calypso is a former British Royal Navy minesweeper converted into a research vessel for the oceanographic researcher Jacques-Yves Cousteau. It was equipped with a mobile laboratory for underwater field research.

Chapter 5

Research containing a table

5.1 Introduction

This is the introduction. Phasellus non purus id mauris aliquam rutrum vitae quis tellus. Maecenas rhoncus ligula nulla, fringilla placerat mi consectetur eu. Aenean nec metus ac est ornare posuere. Nunc ipsum lacus, gravida commodo turpis quis, rutrum eleifend erat. Pellentesque id lorem eget ante porta tincidunt nec nec tellus.

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Row 3	0.4	0.4
Row 4	0.5	0.6

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Chapter 6

Final research study

6.1 Introduction

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Chapter 7

Conclusion

7.1 Thesis summary

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7.2 Future work

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Appendix 1: Some extra stuff

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Appendix 2: Some more extra stuff

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References

Sam Lindley, Conor McBride & Craig McLaughlin, 2016. *Do be do be do*,