UNIVERSITY OF READING

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER SCIENCE UNDERGRADUATE REPORT - RUBIK'S CUBE SOLVER

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A report submitted in partial fulfilment of the requirements of
the University of Reading for the degree of
Bachelor of Science in *Computer Science*

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Declaration

I, Callum, Claton, David, McLennan, of the Department of Computer Science, University of Reading, confirm that all the sentences, figures, tables, equations, code snippets, artworks, and illustrations in this report are original and have not been taken from any other person's work, except where the works of others have been explicitly acknowledged, quoted, and referenced. I understand that if failing to do so will be considered a case of plagiarism. Plagiarism is a form of academic misconduct and will be penalised accordingly.

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Callum David Claton McLennan
December 24, 2020

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Abstract

random words that attract the reader

Glossary

Terminology

Cubie	One of many smaller cubes that make up the Rubik's cube.
Center	A cubie with one colour on the face in the center of the cube.
Edge	An edge cubie has two colours as they're on the edge of the cube.
Corner	A corner cubie has 3 colours and there are always 8, regardless of cube size.
Face	A face is a side of a Rubik's Cube. There are 6 faces regardless of size.
A letter by itself refers to a clockwise rotation of a single face by 90°.	
A letter with a ' ' ' is a 'prime move' which means the face rotates counter-clockwise 90°.	
A letter with the number 2 after it marks a double turn 180°.	
X, Y, Z rotations aren't normally required to solve a cube. These are whole cube rotations.	

Moves

	Front	Right	Up	Left	Back	Down	Entire cube rotation		
Normal moves	F	R	U	L	B	D	X	Y	Z
Prime moves	F'	R'	U'	L'	B'	D'	X'	Y'	Z'
Double moves	F2	R2	U2	L2	B2	D2	N/A		

Contents

1 Introduction

This is my attempt at a Rubik's Cube Solver. I will be doing my best to log the progress I make and what motivate my decisions regarding features and methods I include.

1.1 Background

The Rubik's Cube is a well known puzzle all around the world and it's considered extremely difficult to solve.

1.2 Aims and Objectives

My ambitious goal is to create some form of heuristic based search algorithm or perhaps a constraint solver to solve the cube and perhaps various cube sizes. However, it's very likely I could stray and use a different, more efficient and well suited algorithm to solve the cube(s).
A cool feature I'm eager to add is a custom scramble where the user can manually change the digital cube to their real world physical cube's scrambled state then get my program to solve it and provide the algorithm (steps) to solving that particular scramble.

1.3 Research Hypothesis

Although this project is ambitious, I'm hoping that with my current experience solving Rubik's Cubes, this project will move forward more fluently than previous projects I've pursued and hopefully I'm able to better diagnose, understand and solve issues during the project creation.

I'm excited to discover if I can create or piece together an algorithm that is versatile enough to solve different sized cubes but considering that I feel this project is a big challenge regarding just the 3x3x3 sized cube, I wouldn't be too disappointed if I didn't succeed in creating an algorithm that can solve all sized cubes.

2 Literature review

3 Methodology

3.1 Human algorithm

3.2 Search algorithm

Layer by layer approach

Kociemba approach

4 Results and analysis

5 Conclusions and future work