[Date]

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AI Home System Linked To Scalextric Track

OCR Computer Science Project

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# Analysis

## The Problem

Above all preference, I would like to create an AI with the ability to beat a human in a race (Scalextric). I will achieve this via computer vision and human learning. The AI should be able to find the optimal current at each stage of the track in order to achieve the best possible time to finish a lap. I will do this by linking a Scalextric track to a self-made, Google AIY kit, using libraries and Google’s public code for the kit itself. The majority of the programming will be done on a raspberry pi using python as this is seen as the best language to code AI in. The AI will be able to locate its position on the track via computer vision. It will be able to do this due to an input from a top down camera, allowing it to understand the view of the whole track and its position upon it.

## The Stakeholders

Currently, my stake holders are people who are interested in Scalextric, who could play on their own and try to race against the AI however, in the future this could be implemented in the development of driverless cars. This could make life much easier and safer in the future as this could reduce the amount of car crashes every year due to lack of potential for human error while driving. The age range for this product is for ages between 6 and 18.

My main stakeholder is Tom Smith, who is a 15 year old male, with an interest in both computer science and Scalextric. The problem he faces is that he isn’t challenged by anyone else who plays against him, as he is significantly talented at Scalextric. He is extremely interested in having the opportunity to have an opponent which has significant potential to beat him. This would be better than any existing solutions as they do not have truly difficult AI’s with real potential of being a challenging opponent. The convenience of having a stakeholder like Tom is that he can provide very quick and accurate feedback frequently, allowing me to understand the possibility for improvement. This will allow me to build upon multiple prototypes and have a relevant member of the public to test my product from a separate view to me. This could allow me to make my hardware and/or software more ergonomic to the user.

This was the response from my stakeholder, Tom Smith, when I asked him 10 questions about the project.

1. What age range do you think this project is suitable for?  
   I'd like it to be suitable for 15-16 year olds like me. Either gender
2. Do you find anything confusing about the idea for the project?  
   No.
3. Do you find anything confusing about the hardware?  
   No
4. Do you find anything confusing about the software?  
   I'm not sure yet what the software would run on - that's for you to decide. As long as it can control a car I'm not fussed how it works
5. Would you buy this product from a store?  
   Yeah, if it was relatively cheap and looked high quality. It'd be fun for parties or events
6. What would you want this product to be able to do?  
   It must be able to control a car, so I guess it should sense where the car is on the track and be able to change the speed, aiming to get around the track as quickly as possible without falling off. If it could learn from its mistakes that'd be great.
7. Do you prefer the idea of this product more interesting or entertaining than other products such as Real FX Racing?  
   I don't know much about REAL FX Racing, but if your idea could be simpler to use and cheaper to buy that'd be great.
8. What would be the ideal shape and size of the Scalextric track?  
   A simple figure of 8 would be ideal - that's the most common shape.
9. How quickly do you reckon the AI will be able to complete the track (your suggested shape)?  
   Not sure really, sorry.
10. Would you like to use a voice operated system for this product or not?  
    That would be awesome!

## Existing Solutions

Real FX Racing have already implemented the idea of AI in toy racing cars in one of their latest products which similarly uses computer vision for the car to be able to drive by itself (<https://www.youtube.com/watch?v=I6qGNQfZiLE> ). Their product targets the idea that you can have your best lap time mimicked by another car using the saved movements which you have made (acting as a ghost trail of your quickest lap). This simply records every input which you make while controlling the car during your quickest lap. This is an interesting idea and is actually quite a good solution for the existing problem. However, the idea that AI could be used to drive on a Scalextric track is much more complex as there is a higher skillset for one of these tracks than there is for something like a Real FX Racing track. The problem here is that they use closed source software which you cannot access even if you buy the product, meaning that I cannot see what makes their product the most efficient.

## The Essential Features

## Potential Limitations

## Hardware and Software Requirements

## Success Criteria

|  |  |  |
| --- | --- | --- |
| Criteria | Explanation of Criteria | How Criteria is Met |
| 1) There must be a start and finish line | The program must be able to recognise the start and the finish line so that it can understand whether or not it has completed a lap | I will have red tape on the beginning/ end of the track in order for the camera to see if the Scalextric car crosses the finish line. This will be done via computer vision |
| 2) The program needs to understand where the car is on the track | The program must understand at all times whether the car is on the track or where on the track the car is. | I will implement this by placing green tape on the car and using computer vision for the program to understand whether the car is on the track and/ or where on the track the car is. |
| 3) The program needs to control the car | The program needs to be able to control the car, changing the speed of it when it reaches bends and straights. | I will implement this by using a volt-meter and an ammeter to measure and release electrical currents, controlling the car’s movement. I will also use a neural network for the program to learn how to move across the track with an optimal speed. |
| 4) The track needs to be in the shape of a figure of 8 | The track needs to be a simple figure of 8, as suggested by the stakeholder, built from working Scalextric pieces which still work. | This will be done by using second hand pieces for the Scalextric track, which will be tested by me |
| 5) The whole project needs to be suitable for both genders | The project needs to be simple and easy to use |  |
| 6) The project needs to be suitable for ages between 15-16 | The project needs to be ergonomic for users and |  |
| ?) (possibly) The program will use voice command | The program needs to use voice command in order for the user to turn the program on | I will do this by using the google AIY kit which comes with a microphone and basic voice commands already preinstalled. These can be altered to be specified to my specific situation |

# Design

## Decomposition

## Structure

## Algorithms

## Usability

## Variables, Data Structures and Classes

## Iterative Development

## Further Data

# Developing

## Iterative Developments

## Prototypes

## Structures

## Examples of Code (Annotated)

## Variable Names

## Validations

## Review

# Evaluation

## Success Criteria

## Potential In Future

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## Usability

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