

Ryan Morris Project Proposal

by Ryan Morris

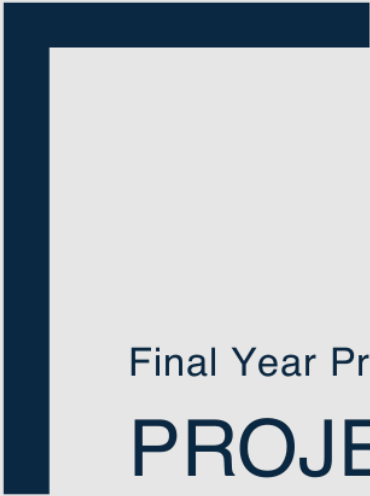
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Final Year Project

PROJECT PROPOSAL

Enhancing Financial Literacy Through a
Web-Based Compound Interest and
Investment Calculator for Young Investors

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Introduction

The power of compound interest is no new discovery, the younger people are when they begin to invest, the longer their money has to compound. If we take the S&P 500 for instance, over the last 30 years (1993-2023) the average return was 9.90%.

Period	Average stock market return	Average stock market return adjusted for inflation
5 years (2018 to 2023)	11.33%	7.28%
10 years (2013 to 2023)	12.39%	9.48%
20 years (2003 to 2023)	9.75%	7.03%
30 years (1993 to 2023)	9.90%	7.22%

[1]

If someone invested £100 per month for 30 years at 9.90% interest, their investment would be worth £218,397.71, with a total contribution of just £36,000.

There are plenty of compound interest calculators on the internet, but I believe there is a gap, and need, for an interactive compound interest calculating tool specifically for high yield stock indices with proven and trackable histories. Stocks I would endeavour to provide historical data on include; S&P 500, Dow Jones, NASDAQ, FTSE100/FTSE250.

I feel current calculators don't go far enough in educating users & are not interactive enough.

The primary objective of the online tool is to visualise data to encourage young people to use their youth to their advantage and invest early to capitalise on the power of compound interest. To achieve this, initial key features include an investment calculator which will allow users to modify variables such as investment duration, interest rates, initial investment amount. Reverse calculations such as "how much would I need to invest monthly at $x\%$ interest rate to have x amount invested by x date" would also be a key feature.

Background (Literature Review)

"A Study of Financial Literacy and Financial Behaviour Among Millennials and Generation Z" by Dr. Anita Riwari, Akash Yadav [2, No. 21] is a journal published study which explores different aspects of financial literacy, including investing behaviours. The study shows that of the 109 participants, a low 35.8% of respondents invest in mutual funds, with a larger percentage (87.2%) opting for savings accounts. The study also shows that just 11% of respondents allege to have excellent knowledge on financial literacy.

Dr. Anita Riwari, Akash Yadav [2, No. 21] also analysed sources of awareness for gaining financial literacy. The use of the internet was prevalent as the most effective source of gaining financial knowledge, this supports my web-based application to encourage financial literacy surrounding investing and compound interest.

Hubbard, Matthews, and Samek [3, No. 2] "Using online compound interest tools to improve financial literacy" notes that people who understand compound interest are typically more likely to effectively financially plan, including investing for retirement and managing credit card debt Lusardi et al [4]. Hubbard et al. [3, No. 2] designed, tested and analysed three tools to establish which data display method was most effective at improving understanding of compound interest (text, linear graphs and volumetric graphs), measured by tests before and after using the tools. The results surprisingly showed that the text-based tool improved understanding more than the two graph-based methods. Interestingly, the tools use "what if" scenarios to prompt and calculate the compound interest, which I agree is a good way to ensure the user is invested and interested in the results. I will explore multiple methods of viewing data on my web-application to ensure the results of any calculations are easily understood.

Hastings and Mitchell [5, p. 1] paper looks at how retirement wealth and investing behaviours are shaped by financial literacy and impatience by analysing experimental data from the Chilean EPS/Social Protection Survey, which is akin to the US Health and Retirement Study. Their results found that impatience, the subjects need for instant gratification rather than long term results, heavily influenced

their self-reported retirement savings. I feel that having an easy to access/use and self-explanatory compound interest calculator which demonstrates a big potential upside to long term investment could encourage impatient users to invest for the future. Hastings and Mitchell also found that financial literacy directly correlates to more retirement savings, again highlighting the need for online tools which directly improve users' financial literacy through education on investing and compound interest.

Summary

The literature review has shown that there is a need for online resources to help educate young people on compound interest and investing. According to Dr. Anita Riwari, Akash Yadav [2, No. 21], more young people are opting for lower yield savings accounts over investing in indices, which could greatly enhance their financial potential, further highlighting the need for educational tools in this area. Hubbard et al. [3, No. 2] research supports my project idea that online tools which present data in text and graph format are effective at improving users knowledge on compound interest. Finally Hastings and Mitchell [5, p. 1] shows us that financial literacy (and impatience) effects long-term investing behaviour. By creating an accessible and engaging web-application I hope to show users of the potential which could be realised through investing.

Similar Tools

Monevator Compound Interest Calculator

Enter your own numbers to see how your money will grow

Currency ☒ £ ☐ \$ ☐ C

Initial lump sum £

Extra added every year* £

Number of years

Interest rate %

Add interest time(s) per year

Result

Future value £

■ Compound interest

■ Without interest

Year	Compound interest	Without interest
0	0	0
5	~10,000	~6,000
10	~25,000	~12,000
15	~50,000	~18,000
20	~90,000	~24,000
25	~150,000	~30,000
30	~218,400	~36,000

* Assumes your additions are made at the start of each year.

[6]

This compound interest calculator by Monevator is simple but effective. It allows multiple currencies, which is a useful and easy addition I could implement on my own web-app. The graph is clear but based on Hubbard et al. [3, No. 2] a text based graphic could be more beneficial for user information. There is no option for historical interest rates.

Investor.gov Compound Interest Calculator

Compound Interest Calculator

Determine how much your money can grow using the power of compound interest.

*** DENOTES A REQUIRED FIELD**

Step 1: Initial Investment

Initial Investment *

Amount of money that you have available to invest initially.

Step 2: Contribute

Monthly Contribution

Amount that you plan to add to the principal every month, or a negative number for the amount that you plan to withdraw every month.

Length of Time in Years *

Length of time, in years, that you plan to save.

Step 3: Interest Rate

Estimated Interest Rate *

Your estimated annual interest rate.

Interest rate variance range

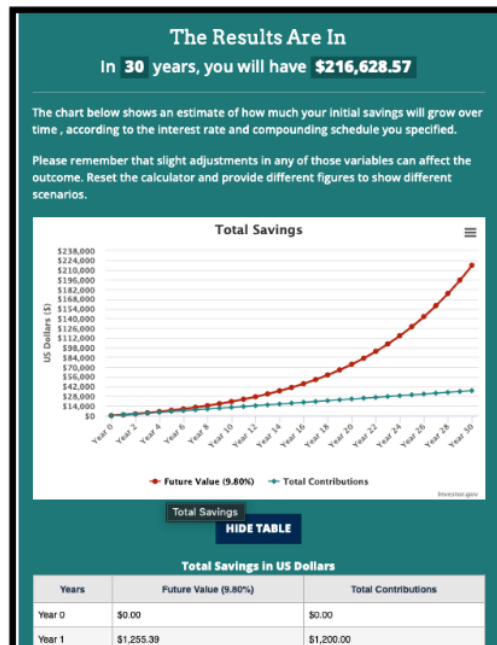
Range of interest rates (above and below the rate set above) that you desire to see results for.

Step 4: Compound It

Compound Frequency

Times per year that interest will be compounded.

CALCULATE **RESET**



Investor.gov [7] have a simple compound interest calculator which is very matter of fact. Beside showing a clear graph and optional, hidable table the website is typical of a US government website and does little to engage the user. We can't use any currency except USD and cannot select an interest from a list of historical indices, only entering a manual interest rate.

Nutmug Calculator

Enter your details

Initial investment

Timeframe

Annualised return rate (%)

Contribution **Period**

Calculate

Your results at the end of the timeframe

Compound projection	Amount
Initial investment	£0.00
Total additional contributions	£36,000.00
Total returns	£182,397.71
Final value	£218,397.71

[8]

Nutmeg provides a very simplistic compound interest calculator, without any text-based or graph-based graphics. The simplistic nature of the calculator could be utilised for an initial summary to accompany other visualisation methods on my web-app, providing a concise overview.

The Calculator Site



Breakdown choice: **monthly** | **yearly** | Table / Chart / Summary

Yearly breakdown

Year	Deposits	Interest	Total Deposits	Annual Interest	Balance
0	£0.00	–	£0.00	–	£0.00
1	£1,200.00	£85.65	£1,200.00	£85.65	£1,285.65
2	£1,200.00	£195.41	£2,400.00	£261.05	£2,661.05
3	£1,200.00	£338.47	£3,600.00	£599.52	£4,199.52
4	£1,200.00	£496.20	£4,800.00	£1,095.72	£5,895.72
5	£1,200.00	£670.10	£6,000.00	£1,765.82	£7,765.82
6	£1,200.00	£861.83	£7,200.00	£2,627.65	£9,827.65
7	£1,200.00	£1,073.22	£8,400.00	£3,700.86	£12,100.86
8	£1,200.00	£1,306.27	£9,600.00	£5,007.14	£14,607.14
9	£1,200.00	£1,563.23	£10,800.00	£6,570.37	£17,370.37
10	£1,200.00	£1,846.52	£12,000.00	£8,416.89	£20,416.89
11	£1,200.00	£2,158.87	£13,200.00	£10,575.76	£23,775.76
12	£1,200.00	£2,503.23	£14,400.00	£13,078.99	£27,478.99
13	£1,200.00	£2,882.90	£15,600.00	£15,961.89	£31,561.89
14	£1,200.00	£3,301.49	£16,800.00	£19,263.38	£36,063.38
15	£1,200.00	£3,763.01	£18,000.00	£23,026.39	£41,026.39
16	£1,200.00	£4,271.83	£19,200.00	£27,298.22	£46,498.22
17	£1,200.00	£4,832.83	£20,400.00	£32,131.04	£52,531.04
18	£1,200.00	£5,451.33	£21,600.00	£37,562.38	£59,162.38
19	£1,200.00	£6,133.25	£22,800.00	£43,715.63	£66,515.63
20	£1,200.00	£6,885.09	£24,000.00	£50,600.72	£74,600.72
21	£1,200.00	£7,714.06	£25,200.00	£58,314.72	£83,514.72
22	£1,200.00	£8,627.90	£26,400.00	£66,942.62	£93,342.62

[9]

The Calculator Site has the most comprehensive compound interest calculator of those reviewed. Their tool utilises graphs and text-based graphics to display investment returns and has multiple currencies to pick from and variables to edit. I especially like the option to increase the monthly deposit by a percentage annually, as many employers give cost of living pay increases annually, this could be an option that many find useful. There is no option to select from historical interest rates.

Problem Statement

Given the review on similar products on the market, there is certainly a lack of tools currently on the market which allow the user to select from a predefined list of historical indices, allow users to do reverse or 'what if' calculations, and save their calculations for future reference. There is an overall lack of focus on educating the user in the reviewed tools.

My project idea will build on the similar basic compound interest calculators we have looked at, amalgamating the best features from each into a web-application. By allowing users to input custom variables, visualise the results in multiple engaging formats as researched by Hubbard et al. [3, No. 2], and allowing users to save calculations, I hope to create a web-application which will keep users engaged and in turn encourage users to invest early to maximise the potential of compound interest, as well as educate users on the benefits of compound interest through clear and concise descriptions and explanations throughout the app.

Aims and Objectives

Aim

To design and develop an interactive, web-based compound interest calculator which educates users by demonstrating the potential growth of investments based on historical data, or user defined interest rates.

Objectives

- Design and develop a compound interest calculator web-application which will allow users to modify inputs such as interest rate, initial investment, length of investment and monthly contributions, if applicable. APIs will be used to obtain historical interest rates for popular index funds such as S&P 500, NASDAQ, Dow Jones, and the FTSE 100. Users can also opt to enter their own custom interest rates if preferred to test out hypothetical interest rates etc.
- Implement different data visualisation methods (for example text based and linear graphs) within the web-app to clearly communicate the effects of compound interest and the growth of investments over time.
- Implement a reverse calculation feature which will enable the user to input a target investment amount and reverse calculate the required monthly contributions required to reach said figure in a given timeframe, either based on historical interest rates (obtained via API) or custom interest rates.
- Enable a register/log in system which will allow users to create accounts to save select calculations for future reference.
- Ensure an engaging user experience by providing clear navigation, simplicity, accessibility and responsiveness. Tooltips will be used where necessary to ensure the user has a thorough understanding.

Project Design (Product Development)

Requirements Specification

Category	Requirement	Description
Must have	Basic calculator	Base calculator which takes an initial investment amount, monthly contributions, interest rate and displays the results
Must have	Data Visualisation	Include text-based tables and graphs to ensure the calculation results are easy to understand. Should clearly show growth over time and the effects of compound interest.
Must have	API integration	Ability to dynamically pull historical interest rate data from an API such as Yahoo! Finance to calculate returns based on historical indices.
Must have	Login/Register Option	Implement new user registration and log in system. This will allow users to save important calculations and reload previous states of the calculator for review or amendment.
Must have	Data Security	Implement encryption and authentication methods to ensure user data, and saved calculations are stored securely.
Must have	Responsive Design	The web-app needs to be responsive, reacting to different screen sizes (including mobile phones/tablets), ensuring a smooth user experience on all devices.
Want to have	Reverse Calculator	Similar to basic calculator but works in reverse, users can input an initial amount, target amount, length of term OR interest rate and the reverse calculator will fill in the blanks.
Want to have	Educational Popups	Small pop-ups to appear, containing key pieces of information to educate the user. Should be able to turn off if user wishes.
Want to have	Educational Writeup	I want to have a blog-style post below the calculator, giving an overview of investing and compound interest, to motivate any readers to invest.

Basic Wireframe Design

I have created a basic wireframe of my potential web-app, focusing on the three main features/calculators. I have created this using MockFlow (<https://www.mockflow.com>).

Site Title

LOGO

[Compound Interest Calculator](#)
[Retirement Calc](#)
[Interest Calculator](#)

Calculator
Retirement Calc
Interest Calculator

Currency:

£
€
\$

Initial Investment:

Select Index Fund:

S&P 500 (9.8% annually) ▼

- OR -

Custom Interest Rate:

Investment Duration:

Years

Months

Additional Contributions:

monthly ▼

Calculate

Summary

Projection	Amount
Initial Investment Amount	€0
Additional Contributions	€36000
Total Interest Accrued	€181,997.71
Total Projected Value	€218,997.71

Graph
Table
Bar Chart

Note the large difference in total amounts, €36,000 with 0% interest, over €200,000 with compound interest!

Saved Calculations

€100 psm/9% years NASDAQ

€100 psm/9% years Dow Jones

€950 psm/24 years S&P500

2. Retirement/Long-Term Calculator

Site Title

LOGOCompound Interest CalculatorRetirement CalcInterest CalculatorSign upSign in

CalculatorRetirement CalcInterest Calculator

I want to retire in ____ years and ____ months.
In retirement, I want to have £ ____ per _____. I
want to base my investments on historical data
from OR ____ %.

Based on the information you have provided, you should aim to
invest £ ____ per month for ____ years and ____ months,
to save a total of £ ____.

Using the 4% rule, you could withdraw (& spend) £ ____ per
month indefinitely.

3. Interest Calculator

Site Title

LOGOCompound Interest CalculatorRetirement CalcInterest CalculatorSign upSign in

CalculatorRetirement CalcInterest Calculator

I have been invested since . My portfolio
initial amount was ____ and the total value of my
portfolio is now ____.

Based on the information provided, your
investments have returned ____% annually.

Development Methodologies

I am going to use a personal Kanban for solo development methodology to manage my development project. Some steps I will take include:

- Maintain Kanban Board. Will have columns "To-do", "WIP", and "Done" for ease of visualising task tracking/workflow [11].
- WIP limits to ensure I do not have too many tasks running concurrently, this will stop me from becoming overwhelmed.
- By regularly monitoring the Kanban board, I will have a good overview of the project and timelines, ensuring timely completion of the project.

Development Technologies

I am planning on using the following technologies to develop the web-app.

Frontend Development

HTML, CSS & JavaScript will be used for the main UI of the website. React.js will enable me to create dynamic and responsive content. I may use Bootstrap to ensure the app is responsive across various devices.

Backend Development

To ensure efficient handling of requests, I will use Node.js to execute JavaScript on the server while Express.js will manage routing, retrieving data from APIs and managing dataflow between the frontend and backend.

Database

I will use PostgreSQL database for my project as it is reliable and scalable. PostgreSQL also offers robust data encryption which is necessary for storing user data. If the project were to scale, a NoSQL approach using MongoDB may be more suitable.

Application Programming Interface (API)

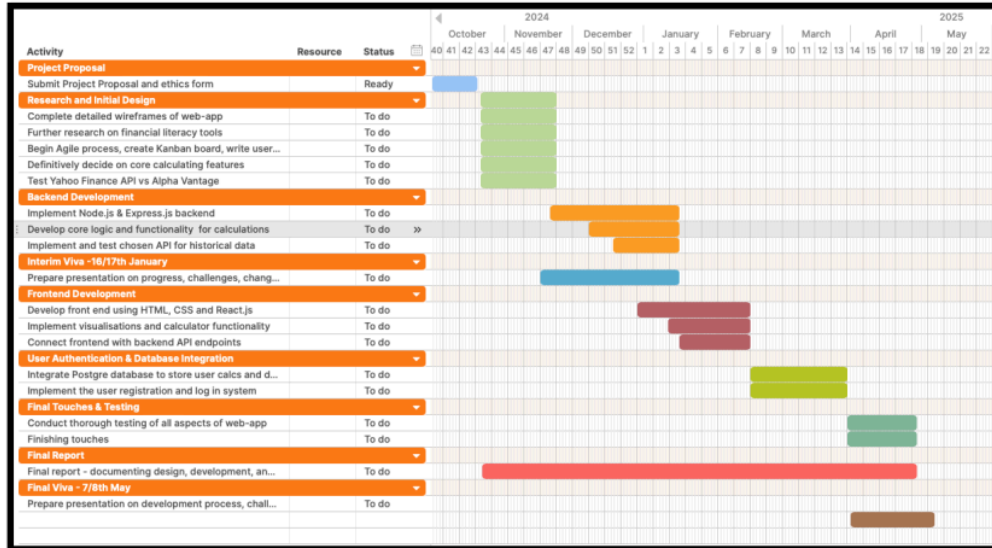
In 2017, Yahoo! shut down it's official API [10], fortunately there are third party APIs which continuously scrape Yahoo! Finance to maintain an up to date, unofficial Yahoo! Finance APIs. Alpha Vantage offers an API which provides all the functionality I will need.

Version Control

I will use Git and GitHub to manage the code and track version, as well as performing roll backs if necessary.

Timeline

I have used Tom's Planner to create a gantt chart for a timeline for my project.



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Ryan Morris Project Proposal

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

78/100

Intro / A&O (400 words)		
Project title; Identification of a specific problem to be investigated; Well-defined aims and SMART objectives; Explaining why this project is worth doing; Discussion of what the project needs to do in order to be a success; Description any deliverables that will be produced at the end of the project Good introduction shows a clear idea and how the idea came about. Clear title shows intent. Good clear aim describes a clear outcome. Objectives feed into the aim well. It would have been advantageous to use objectives that were more succinct and more SMART.	20	16
Background to the Project / Literature Review (400 words)		
Description of how the work to be done by in the project relates to the work identified in the literature review; Discussion of any ethical issues raised by the project Identifying what has already been done within the field; Topic familiarity; Brief literature review using appropriate sources – 6-8 journal papers and book chapters	20	18

rather than just websites; Selection of relevant models & concepts A good clear literature review justifying the idea and project base. Good use of literature sources and well used through the text to highlight and back up points made. Good use of a summary to the literature review to bring it all together and justify a project idea. Good analysis of similar tools on the market currently		
Project Design (500 words)		
Clear statement of which development methods are to be used and why they are appropriate; Clear statement of which tools are to be used and why they are appropriate; Clear description of how data collected will be analysed Clear project statement showing the gap that can be filled. Shows consideration for the current state and what could be added to. Good requirements analysis showing thought into what needs to be done. Reasonable discussion around methodology. More recognition of academic	30	19

research and research methodologies and philosophies leading to a more detailed discussion around methodology would have been beneficial.		
Resources / Planning (200 words)		
List of any deliverables; Clear diagram showing both timing and resource use; Completed ethics form; Limited and relevant appendices Good understanding of the frameworks to be used. Good discussion and understanding of resources and tools to be used. Good comprehensive Gantt chart shows good consideration of workflow and timelines for the project.	15	13
Document Presentation		
Correct spelling, grammar and punctuation; Flow of narrative/fluency; Coherence; Word processed ; Correct use of referencing with bibliography; Strict word limit Well laid out report with clear heading, cover page, contents and sections.	15	12

It would have been desirable to use third person terminology rather than 'I' in the report. A good use of figures through the report although captioning is desirable here.		
TOTAL	100	78

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