**A Level computer Science**

Component 3

Physics Homework App

Perhaps a Logo / Picture

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# Chapter One: Analysis of the problem

## Problem Identification

While studying Physics at A-Level, we used multiple websites to do our homework. This was due to the fact that all of the different websites had their own flaws. The main flaw that I found is that no website that is available to us allows for both calculations and long answers to be entered as answers.

This is an example of a website allowing to answer a calculation question. As you can see in this example, you can only enter a value as an answer and then the website tells you if it is right or wrong. This is a big problem because, if you get the question wrong, you and your teacher will not be able to see where the problem in the calculation is and how to fix it.



As shown in this example, this particular website allows for a long answer to be entered as an answer. However, the limitation of this is that when you are marking your answer, it can only be marked as right or wrong. The solution to this problem is to allow the student to give their answer a mark, by checking their answer against the mark scheme, out of the number of marks that the teacher set. This will allow the student to see what they would score in the real exam.

## 1.2 Possible Computational Methods

## 1.3 Stakeholders analysis

1.3.1 Stakeholder Introduction

The demographic for my project is for teachers and students in the Physics A-Level. For my stakeholders I picked one Physics teacher and three Physics students. The teacher stakeholder is Mina and my student stakeholders are Ali, Jahin and {INSERT REST LATER}. I picked a teacher and three students for my stakeholders because I wanted to have many different perspectives where I can take ideas from.

I asked each group of stakeholders seven questions. I asked the teacher group the following questions:

1. What resources do you currently use to set physics homework?
2. What are some good features of the current resources that you use?
3. What are some bad features of the current resources that you use?
4. If a new homework website was made, what would you like to see included in it?
5. As a teacher, what are the biggest challenges when setting and marking homework?
6. What would make the website easier to navigate for you?
7. Anything you would like to add that wasn’t included in the questionnaire?

I asked the student group the following questions:

1. What resources do you currently use for your physics homework?
2. What are some good features of the current resources that you use?
3. What are some bad features of the current resources that you use?
4. If a new homework website was made, what would you like to see included in it?
5. What would make the website easier to navigate for you?
6. How can the website motivate you to do your homework?
7. Anything you would like to add that wasn’t included in the questionnaire?

1.3.2 Stakeholder Interviews

My teacher stakeholder interview was with Mina, an A-level Physics teacher. She answered my questions as follows:

What resources do you currently use to set physics homework?

“I use SENECA and Bromcom”

What are some good features of the current resources that you use?

“SENECA provides active learning which can be very beneficial for a student. Bromcom allows for the parents to easily check their kid’s progress, homework and behaviour at school.”

What are some bad features of the current resources that you use?

“Both websites have too many steps when setting a homework”

If a new homework website was made, what would you like to see included in it?

“I’d like to see a feature allowing the teacher to check a student’s progress”

As a teacher, what are the biggest challenges when setting and marking homework?

“Time. Setting a homework can be very time consuming because it involves a lot of steps”

What would make the website easier to navigate for you?

“Limiting the number of clicks required to reach important pages and actions. Also, a clean and uncluttered design”

Anything you would like to add that wasn’t included in the questionnaire?

“No”

My first student stakeholder interview was with Ali. He currently does Computer Science, Maths and Physics at A-Level. His responses were as follows:

What resources do you currently use for your physics homework?

“I currently use Isaac Physics and Carousel Learning for my homework”

What are some good features of the current resources that you use?

“I really like that there is a menu that allows you to review new and completed assignments. I also really like that there are hint options for when I am struggling with a question”

What are some bad features of the current resources that you use?

“One thing I dislike about Carousel Learning is that if I accidently go to the next question, I can’t go back to the previous question. I also really dislike that I can’t do theory questions on Isaac and calculations on Carousel which makes it really inconvenient to do my homework. Another thing I dislike about my current resources is that I don’t get notifications when new homework is set.”

If a new homework website was made, what would you like to see included in it?

“I would really like to see a feature that show how much progress I am making on my homework and how much progress I am making overall.”

What would make the website easier to navigate for you?

“My current resources have a bunch of useless stuff on the screen which makes it hard to navigate so I think a clean UI and design would make the website easier to navigate for me.”

How can the website motivate you to do your homework?

“A point reward system or a praise system when I get a question right and also a class leaderboard to see where I am compared to my classmates”

Anything you would like to add that wasn’t included in the questionnaire?

“No”

My next student stakeholder interview was with Jahin. He is studying Physics, Computer Science and Further Maths. His responses were as follows:

What resources do you currently use for your physics homework?

“I use past papers, Isaac Physics and Carousel Learning”

What are some good features of the current resources that you use?

“They let me work at my own pace, there’s no timers that rush me and stress me out”

What are some bad features of the current resources that you use?

“Some resources don’t have hints on how to solve questions I am stuck on”

If a new homework website was made, what would you like to see included in it?

“An option for hints for when I am stuck on a hard question”

What would make the website easier to navigate for you?

“A simple UI with no over-the-top styling”

How can the website motivate you to do your homework?

“Maybe a leaderboard comparing you against classmates”

Anything you would like to add that wasn’t included in the questionnaire?

“I would like to see that the app has a low bandwidth usage because the Wi-Fi in some places is really bad”

{INSERT LAST INTERVIEW}

1.3.3 Stakeholder Conclusion

## 1.4 Research of solutions for similar problems

1.4.1 S**imilar existing solutions**

Seneca Learning

How does it work?

A screenshot of a video game

Description automatically generatedOne similar solution to my problem that I found is a website called Seneca Learning. This website has pre-made modules for many subjects and exam boards. The layout for homework does not allow students to do calculations. When completing a homework on Seneca Learning, the answer is given to you as an explanation and you are then given a question to answer (usually a complete the sentence question). This is website would be really good for students at the GCSE level but for A-Level students it would not be useful.

What components and features can be borrowed?

Seneca learning has many features that are very useful for a student to have. It has a class system that allows for teachers to create their own classes and then set homework for all the students in those classes. This feature will be borrowed because it will make it easy for teachers to set homework for their classes and it would allow teachers to group their students in their respective classes.

One feature that I find to be a bad feature, is the ability for a student to create their own account. I think this is bad because, when students are signing up, they can choose if they are a student, teacher or parent. Having access to this feature means that a person with malicious intentions can create multiple teacher accounts and cause a big problem in a school system. Due to this, for my solution, I will only allow teacher to create student accounts and then having the system send the student an email with their details.

Physics & Maths Tutor

How does it work?

This solution does not help my problem but it is a good example to use. How this solution works is that it allows a student to choose a subject, exam board and topic and then do past papers and questions on that topic. It doesn’t allow for any answers to be entered as it only gives the student access to pdf files which they can print out and write on.

What components and features can be borrowed?

I think the only feature that I can borrow from this website is the ability to choose exam boards. When incorporating this feature in my solution, I will allow the teacher to pick what exam board an assignment would go under when setting a homework assignment. I will be borrowing this feature because, if the students know what exam board a question is from, they can see how an answer is structured in that specific exam board and they can see what structure they would need in the exam.

## 1.5 Hardware and software requirements

My solution will require a computer with the standard I/O devices (keyboard, mouse and monitor) so the user can interact with the application. My solution is a python based application. However, the user will not need to have python installed as the application will be compiled into an executable file. An internet connection will also be required so the application can access the database. This will be needed so the user can log in and see their assignments. The following requirements are the minimum requirements needed for the application to run. Most computers and laptops will already meet the requirements as python executable files are not very demanding when it comes to hardware and software requirements.

Hardware:  
- Processor: Multicore, 2.5GHz or above. This will allow for faster computations and more efficient multitasking.

- RAM: At least 1GB as the application has a GUI and it will run slow with less RAM.

- Storage: At least 100MB to store the executable file and any temporary files.

- I/O devices: Keyboard, mouse and monitor. This will allow the user to use and interact with the application.

Software :

- Operating System: Windows 7 or above, macOS or a Linux based system. These are the current operating systems supported by python.

- Other software will not be needed as all the libraries used will be already bundled with the executable file.

## 1.6 The requirements of the solution

## 1.7 Features of the solution

## 1.8 Success Criteria

## 1.9 Limitations of the solution

# Chapter Two: Design

## 2.1 Introduction

## 2.2 Decomposition of the problem

2.2.1 Decomposition Diagram

2.2.2 Flow Charts / Data Flow Diagram

2.2.3 Input Process Output

## 2.3 How All Solution Parts are Linked

2.3.1 State Diagram of the different forms/parts

2.3.2 How different functions /classes are connected

## 2.4 Database Design

### 

Normalisation

### 

Data Dictionary For Each Table

Table name: admin\_acc

This table will store all the admin and teacher accounts. More rows can’t be added to this table unless the database is accessed directly in the database website.

It will store the following information:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data Type | Length | Rules | Comments |
| id | Integer | One digit and above | N/A | Primary key. Generated by the database |
| email | Varchar | N/A | Must be in the form: example@domain.com | Stores the user’s email |
| password | Varchar | N/A | N/A | Stores the user’s hashed password |
| name | Text | More than 5 characters | Must have a space in the middle | Stores the user’s name |

Table name: main\_acc

This table stores all the student accounts. This table can be changed by any admin or teacher when creating an account.

It stores the following information:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data Type | Length | Rules | Comments |
| Id | Integer | One digit and above | N/A | Primary key. Generated by the database. |
| name | Text | More than 5 characters | Must have a space in the middle | Stores the user’s name |
| password | Varchar | N/A | N/A | Stores the user’s hashed password |
| email | Varchar | N/A | Must be in the form: example@domain.com | Stores the user’s email |
| teacher\_id | Integer | One digit or above | N/A | Foreign key. Links with the id column in the admin\_acc table |

Table name: stud\_classes

This table stores all the class names and which teacher own them. This table is updated when a class is created or deleted.

It stores this information:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data Type | Length | Rules | Comments |
| Id | Integer | One digit and above | N/A | Primary key. Generated by the database. |
| class\_names | Text | More than one character | N/A | Stores the name of the class |
| teacher\_id | Integer | One digit or above | N/A | Foreign key. Links with the id column in the admin\_acc table |

Entity Relationship Diagram

SQL Pseudocode

## 2.5 Design of other Parts of the Solution

2.5.1 Part ONE: ………………………..

### 

Form/Screen Design and Layout

Validation rules

Key Variables/Data Structures /Classes

Algorithms and PseudoCode

Test Plan for PART ONE ….

2.5.2 Part TWO: ……………………

Form Design and Layout

Justification of Validation rules

Key Variables/Data Structures /Classes

Algorithms and PseudoCode

Test Plan for PART TWO

2.5.3 Part THREE: …………………….

Form Design and Layout

Validation rules

Key Variables/Data Structures /Classes

Algorithms and PseudoCode

Test Plan for PART THREE

2.5.4 Part FOUR: …………………………

Form Design and Layout

Validation rules

Algorithms and PseudoCode

Key Variables/Data Structures /Classes

Test Plan for PART FOUR

## 2.6 Stakeholders involvement

Testing plan to inform evaluation

# Chapter Three: Iterative Development and Testing

## 3.1 Introduction

## 3.2 Stage 1: Building the Database

Explain the section of code (e.g. SQLITE3 Code)

Show it (e.g. Screen printouts)

Test it (e.g. test the databases)

Comment on the result

Show changes/correction and further testing

Feedback from Stakeholder (if appropriate)

Review

## 3.2 Stage 2: Building Part Three ……………..

Explain the section of code (e.g. SQLITE3 Code)

Show it (e.g. Screen printouts)

Test it (e.g. test the databases)

Comment on the result

Show changes/correction and further testing

Feedback from Stakeholder (if appropriate)

Review

## 3.2 Stage 3: Building Part Three ……………..

Explain the section of code (e.g. SQLITE3 Code)

Show it (e.g. Screen printouts)

Test it (e.g. test the databases)

Comment on the result

Show changes/correction and further testing

Feedback from Stakeholder (if appropriate)

Review

## 3.2 Stage 4: Building Part Four ……………..

Explain the section of code (e.g. SQLITE3 Code)

Show it (e.g. Screen printouts)

Test it (e.g. test the databases)

Comment on the result

Show changes/correction and further testing

Feedback from Stakeholder (if appropriate)

Review

## 3.3 Final Review, Improvements and Corrective Actions

# Chapter Four: Evaluation

Evaluation

## 4.1 Introduction

## 4.2 Testing to inform evaluation

## 4.3 Evaluation

Evaluating usability features

Evaluating Robustness

Limitations and Maintenance