A Level computing coursework

Reactive web timetable

Centre number: 64690

Candidate number: 4059

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# Analysis of problem

* At Imber court swimming pool near the town of Esher in surrey, there is currently in place a wildly inefficient system to arrange periods of time in which each member of staff will be working (henceforth referred to as ‘shifts’). This system is based on an ungodly and increasingly obsolete combination of paper based timetables that must be printed every week, and the instant messenger ‘WhatsApp’.
* Issues with this system are widespread and varied, and range from small to sometimes catastrophic. Examples of these include at the lower end the difficulty of lifeguards accessing information on which days they are supposed to be working, including the times in between their shifts will be. This is an issue because the timetables may change from week to week depending on the need for cover, and if a lifeguard is unable to work or not aware that they should be working, the could become unsafe. In the case of teachers this could also lead to the loss of money by parents who pay up front for lessons that may not transpire. To combat this, my solution would be accessible online.
* On the other side of the scale, the current system puts too much trust (in my opinion) in the pool staff signing in, leading to the frequent under or over payment of said staff. In the case of under payment, if the member of staff in question happens to rent they may not be able to pay said rent on time which could lead to bad consequences. To combat this my solution would keep back copies of timetables that would be sent to the main office each month for them to compare with sign ins.
* Other problems include a difficult process to arrange cover, in which you must first get the permission of the pool manager, and then either arrange your own cover or leave it to him. Both of these options can be lengthy and long-winded due to the paper based nature of the timetables, usually requiring another table to be printed. Needless, to say these many pieces of paper can quickly become a confusing mess. My solution would automate this whole process and lead to a more streamlined and concise process overall. As well as this, visual confirmation could be shown on the web page.

# Justification of computational methods

* I think this problem is an ideal candidate for being solved through computational methods.
* Firstly, the main recurring theme seems to be a general lack of ability to access the necessary information easily and from multiple locations. The implementation of a web based solution would allow this and would lead to the reduction or removal of this problem. In this example, I think the most obvious solution would be the creation of a server based relational database to keep track of the shifts and staff.
* Secondly, the current solution uses a lot of paper and so reduces the budget of the pool. This also leads to the creation of a lot of waste paper which clutters the swimming pool and leads to confusion as to who is supposed to be working on a given day, as well as reducing the apparent cleanliness of the pool. A computational solution to this problem would do away with the need for such large amounts of paper and make the pool look less cluttered.
* Thirdly, with the introduction of the new GDPR laws set to arrive in 2018, a paper based system poses a security issue as the names and phone numbers of all of the lifeguards are basically freely available for the public to see and so not compliant with the acts ‘safety of data by design’ clause. This could lead to massive issues for the pool as the fine for a lack of compliance is possibly more than £20 million. A computer based solution would be much more secure then this as staff phone numbers would no longer be on a paper list on the wall, and would instead probably be stored on a server with security measures.

# Identification of stakeholders

* The pool manager would be a stakeholder in my solution, and being the senior most individual at the pool would be able to access and edit all information that would be stored on the proposed system. He would use this ability to coordinate the allocation of cover shifts which would allow him the power to authenticate cover shifts at the pool. He would also use the proposed solution to create and edit the databases and tables that would be required for the solution to work. This is appropriate to his needs as it allows him total control over the proposed solution, which as the manager he would need.
* The Lifeguards would also use the proposed solution to see when their shifts were which would let them know if they are supposed to be working on a certain day. They would also use the system to schedule cover. The proposed system would allow them to notify the manager that cover is needed and ask other lifeguards for cover with the click of a button, greatly reducing the effort needed.
* The teachers would use the system in much the same way as the lifeguards, though request for cover would only be sent to other teachers as it is a separate qualification.
* The club management would use the system to verify that the pool staff are getting payed the right amount, the proposed solution would allow them to do this. As well as this, they may use the system to observe that the right practices are being followed at the pool and make sure that it is a safe environment.

# Currently available solutions

## When I work

* ‘When I Work’ is a currently available web based timetabling app that allows managers to create new timetables each week with easy to use templates and drag and drop components.
* This allows even a boss who isn’t technologically savvy to use the software with ease. As well as this, the app will tell you is the person is qualified for the job that you want to assign them to which could be useful as at the pool different jobs require different qualifications. Thirdly, when a table is updated the app will notify its users so they know that there has been a change. This could be useful as it would allow everyone to know what is going on at the pool. Also, its free.
* However, the freedom of access to information on other people means that I doubt the app is GDPR compliant, which could lead to criminal charges being levelled against the pool. As well as this, it does not include a staff portal which removes the ability of the pool lifeguards to initiate cover scheduling from within the app. Also, if I were to add any features such as the calculation of payment for the month in to my solution later, these could not be implemented in ‘When I Work’.
* <https://wheniwork.com/l/cap?ref=capterra&utm_campaign=Employee+Scheduling&utm_medium=Directory&utm_source=capterra>

## Deputy Rota Software

* Deputy is a rota handling software like ‘When I Work’, but it does include a portal. It is pretty much the same as when I work apart from this. It also has the same ability to choose people and put them onto pre-set templates. It also allows the manager of the enterprise to publish the rota and send it to employees in a multitude of formats, however it adds the ability for members of staff to arrange their own leave.
* However, it also gives the information of employees to each other freely and so I don’t think it would comply with GDPR. To add to this it costs money, which the pool at Imber court is unable to spend.
* <https://www.deputy.com/online-staff-rota-software>

# Possible approaches

* From this research as well as more I have a variety of possible solutions to my problem, though they all have some common themes. The first is that the solution should be accessible online and so will need to be based in some type of server. The second is that the solution should be able to send notifications to all members of staff to ensure that they are told of all information that could in some way refer to them. Thirdly the solution should easy to use for both the manager and members of staff to ensure that the solution is put in place. Finally, the solution should be GDPR compliant as this will enable the solution to be used with peace of mind by all stakeholders. This will be achieved by informing users of the purpose of all data required, allowing them to opt out of certain functions of the app, and ensuring that the contents of databases is kept secure. With this in mind I have broken down the approaches into multiple parts.

## Issue 1 – Location of data storage and processing:

* There are two main options for this.
* The first option would be that the necessary software and data would be stored on a computer running as a server in a fixed location, for example the office of the sports club. The advantages of this approach would be that the machine would be easily accessible for repair and would be totally under the control of the club. This would also be the cheapest option as for the limited number of staff at the pool the computer would not need to be very large, so a normal desktop could probably be used. However, this would put a lot of responsibility in the hands of the club and may lead to the need to recruit an IT technician which would lead to more cost in the long run.
* The second option would be to create a virtual server on the cloud. The advantage of this solution is firstly that it would allow for more security as the responsibility would be passed to a large company that would specialise in this area. As well as this, it would allow for the scalability of the solution if the club grew and required more members of staff. Thirdly, this approach would reduce the burden of the club to keep the hardware running and furthermore repair it when needed.

## Issue 2 – Individual sovereignty of staff:

* AKA should the staff decide on cover or should the manager.
* On the one hand, allowing the staff to be active in the process of allocating shift would give them more independence and would probably lead to a healthier and happier workplace. It would also reduce the workload of the manager and would allow him to do more important things.
* On the other hand, if improperly executed this could remove some of the managers ability to govern who does what at the pool and so would possibly create issues if he didn’t know who was supposed to be working.

## Final Approach:

* I think the best approach to solving this problem will be the utilisation of a virtual server, running a piece of code that will coordinate the actions of said server, combined with a database. I think that the staff will be able to arrange cover but that the manager should then be contacted to authenticate this choice allowing him some control over the process.

# Essential functions of the solution

1. The solution should be able to store, edit and display data in the form of a table, and this data should be available to the pool staff through a website.
2. The solution should be GDPR compliant in order to safely and ethically store the data of staff who work at the swimming pool
3. The solution should have an administrator account with access to all data to allow the manager to govern the processes of the pool
4. The solution should be able to have some mean by which it can notify users to changes that may be pertinent to them so that they are informed to anything that may effect the way they would choose to carry out their job
5. The solution will be based on a virtual server to aide security and to reduce the amount of maintenance needed
6. The solution will use a social login to allow an easy sign up, but will allow for an alternative as to be GDPR compliant
7. The solution should be easy to use in order to speed up its adoption

# Limitations

* Due to my novice skills at coding, the proposed solution will most likely not have advanced features such as an attractive UI as building one would require skills that I do not and may not be able to attain.
* As well as this, I will probably not be able to integrate features such as messaging or a phone app as I do not have the skills.

# Requirements

* This project will require me to learn a multitude of coding languages such as Java, HTML and CSS. Also, I will need to learn how to use SQL and how to communicate with a server from a website. Furthermore, it will require a virtual server, a database, a web based UI and a way of communicating with staff.

# Success Criteria

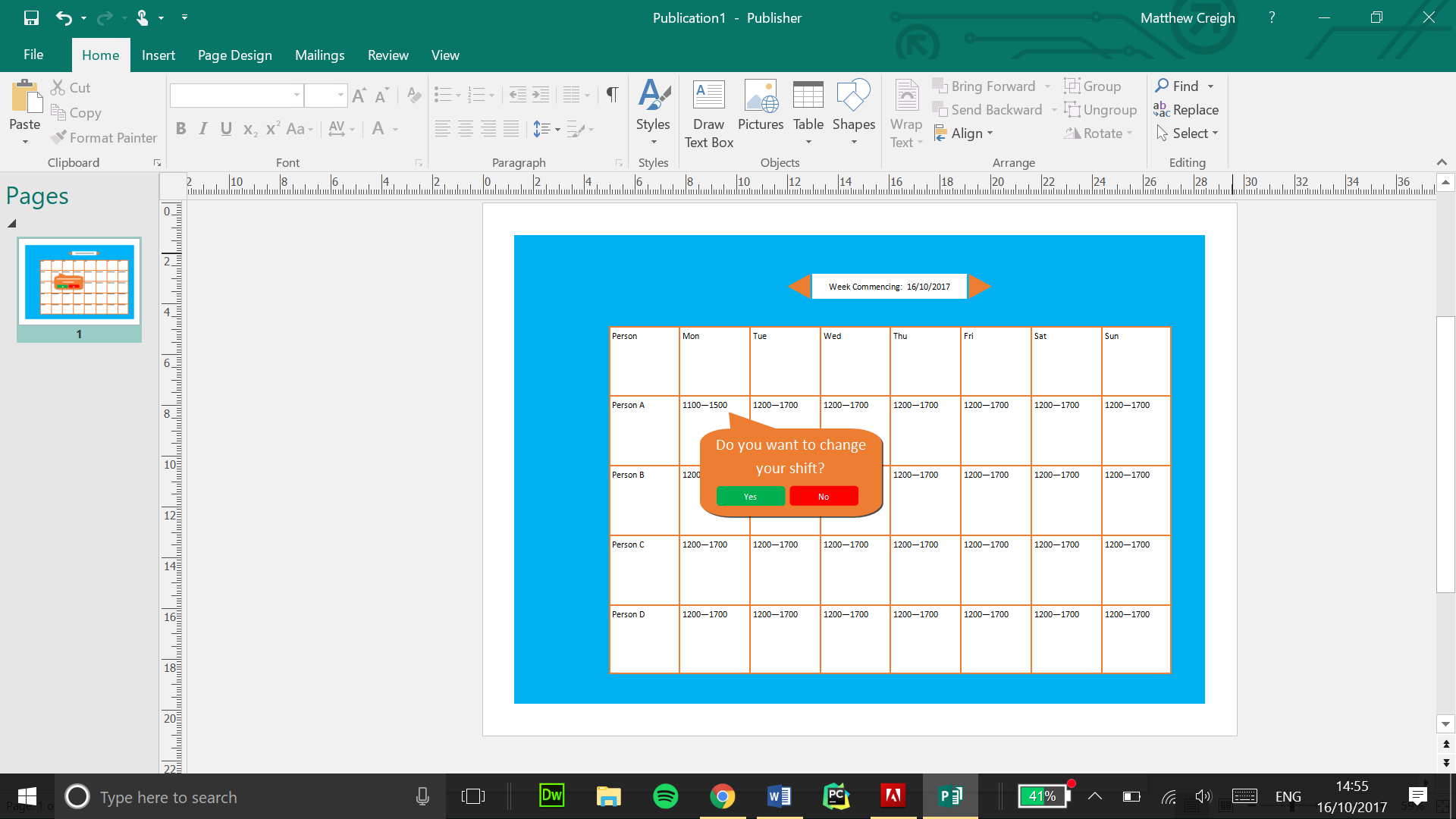
* In order to have been considered successful, the project will need to fulfil all of the basic requirements I outlined earlier, whilst also having been completed in the allotted time frame and with the correct documentation.

# Design of Solution

Decomposition of Problem

In my opinion this problem can be broken down into a series of smaller programs that will work in unison to solve the larger problem.

* The first on these smaller applications would be some form of code that draws data from a database server that would be run on a virtual machine in the cloud.
* The second part would be a program that would be able to alter said database from the internet with the help of a java-script interface and ajax calls
* The third component would be a program running on the cloud to interrupt the second process and allow the manager to verify whether the change to the database was warranted.

These would all rely on a website and cloud server that would also have to be set up.

# Description of solution

The solution would be made up of three parts working together, these would be a web page based human interface, a cloud based data handling program written in a high level language such as php or python running on a web server, and a database hosted on an RDS server which can communicate with the web server through a php script.

This solution in my opinion uses the best possible structure as it enables the application to be available at all times due to the ubiquity of the internet and the availability of web browsers on mobile phones.

## Algorithms?

The first component would work as follows:

*Connect to database*

*Connection successful?*

*Yes:*

*Proceed with program*

*No:*

*Repeat, if does not connect after three times prompt error message*

*Retireve data from database*

*Sort and manipulate data to fit table*

*Display table on website*

*end*

The second component would work as follows:

*Receive command to change data*

*Send command to change data to database handling server*

*Change successful?*

*Yes:*

*Call part of database and display on webpage*

*No:*

*Try again, if fails three times prompt error message*

*end*

The third part would work as follows:

*Is command sent from webpage?*

*Yes:*

*Formulate command to send to RDS*

*Send message to manager*

*Is reply positive?*

*Yes:*

*Send command to RDS*

*No:*

*Delete command*

*Send message to sender to say that command has been denied*

*No:*

*Repeat polling*

## Usability features

The website will be clearly structured to make it easy to use, there will be documentation to help people use the solution, such as an information section on the website.

# Testing

I will use a selection of testing methods to ensure that the solution is performing as it should be. These will include a black box test to show that the nesesscary functions of the application are working as advertised, an alpha test in which I will ask people from my class to test the features of the application, and a beta test in which I will ask some staff from the swimming pool to test the solution.