Project-I Report

on

VACCINATION SYSTEM

submitted towards the partial fulfillment of

the requirement for the award of the degree of

Bachelor of Technology

in

Programming Fundamentals

Submitted by

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CANDIDATE'S DECLARATION

We hereby certify that the work, which is presented in the Project-I entitled 'VACCINATION SYSTEM' in fulfillment of the requirement for the award of the Degree of Bachelor of Technology in Programming Fundamentals and submitted to the Department of Computer Science and Engineering, Delhi Technological University, Delhi is an authentic record of our own, carried out under the supervision of Asst. Prof. Gull Kaur. The work presented in this report has not been submitted and not under consideration for the award for any other course/degree of this or any other Institute/University.

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SUPERVISOR CERTIFICATE

I hereby certify that the project Dissertation titled “Vaccination System,” which is submitted by Saujanya Sood, Shubham Chaudhary (2K20/B11/16, 2K20/B11/26), Delhi Technological University, Delhi, in complete fulfillment of the requirement for the award of the degree of the Bachelor of Technology, is a record of the project work carried out by the students under my supervision. To the best of my knowledge, this work has not been submitted in part or whole for any Degree or Diploma to this University or elsewhere.

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Date

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ABSTRACT

This project is structured around the Indian COVID-19 Vaccination drive. We were under a lockdown for months together hoping a vaccine would someday come to the rescue. Now that we finally have vaccines in circulation, it is necessary to devise efficient methods for vaccine distribution so that the process can be sped up and we can all go back to some kind of normal. This report explains the features and working of our vaccination system right from the roots of our code.

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INTRODUCTION

The COVID-19 pandemic has taken over our lives in the past year. The first case of the SARS-Cov-2 or the Severe Acute Respiratory Syndrome caused by Coronavirus 2 was reported on the 30th of January, and none of us at the time guessed that this would turn out to be a global pandemic not seen in over a century. On 23rd March 2020, the government declared a 21-day nationwide lockdown. Little did we know that this was the first few minutes of a long night to come that would take over all aspects of our lives.

Figure 1: India goes under lockdown

One lockdown after another, we reached the beginning of June, when we finally saw a silver lining as the government slowly started reopening the country in parts. While the world was under lockdown, scientists were researching and slogging hard day and night to find a vaccine and hence, bring us out of this global crisis. Globally, until now, we have three vaccines that are recommended by the Centers for Disease Control and Prevention (CDC) for the prevention of COVID-19. These include vaccines developed by Pfizer-BioNTech, Moderna, and Johnson & Johnson. Two other vaccines are under phase 3 clinical trials. These include the AstraZeneca vaccine which is also being marketed in India by the name CoviShield along with the Indian vaccine Covaxin developed by Bharat Biotech.

The Indian government has come up with a comprehensive plan to execute the vaccination drive in a country with a population of over 1.3 billion people. The outlines of the different priorities given to the various sections of the population are:

1. Firstly, frontline healthcare workers will be vaccinated.
2. This is followed by the second phase of vaccination, in which all citizens over 60 years of age and those over 45 years of age with comorbidities are eligible for vaccination.
3. The third phase of vaccination will include people in the age group 50-59 as the priority group.
4. The fourth phase finally opens vaccination for the general public.

To implement such a strategic plan, it is necessary for the government to have a system that lets the public register for a vaccine. For this project, we created a simple yet efficient system for small sample size, that of people living in a particular society.

This system can be used to do the following:

For residents, it can be used to:

1. Feed their information into a database including their name, contact details, and medical details.
2. Refer to this database, known as the vaccination index to see when their turn for vaccination is.

For healthcare workers:

1. They can access the database which stores all the information fed into it by the residents.
2. They can check for their appointments on a particular date as per that given to the patients by the system.
3. They can choose to complete the vaccination of a particular patient and once this is done, their name is deleted from the vaccination index and the appointment index.

This system has been made assuming that the general public is open to vaccination as there are no filters to prioritize people eligible for vaccination. This system will be useful for smaller local setups which have a limit of a fewer number of vaccine doses per day and can help them efficiently manage their vaccination system. Such computerized systems can save loads of paperwork and help digitalize information even in small-scale setups. In the following pages, we intend to cover the background of the project, our approach towards it, and the learning that came our way through this project.

BACKGROUND

Our inspiration behind this project came from the real-time circumstances around us.
We decided to code in the C language because we found it simpler than the other programming languages as we are only beginners in the field. The compiler we used was Visual Studio Code. It is a free source-code editor made by Microsoft. The reasons why we chose this editor are the following features that it entails:

1. It is available for both Windows and macOS.
2. It has a syntax highlighting feature.
3. It has an intelligent code completion feature.
4. We can make snippets of code, which was helpful in learning C programming without much hassle.

We were enlightened by the views and suggestions our teacher and mentor had to give about our project. We also referred friends and family about this topic and the project. What they had to say has been precisely included in the following points:

1. The topic chosen is very relevant and they can see themselves using a similar software at an authorized vaccination system
2. They wish there was a platform built on similar lines where they can operate through a digitized method. They appreciated the convenience of the system and the fact that the user can directly feed and access information and get instant confirmation of appointment without the help of an intermediary.
3. This instant confirmation feature might not be able to be practically implemented on a large scale that extends to hundreds of millions of people, but the luxury of an automated system that can be used at home without having to stand in lines outside a healthcare center makes the process much safer and time-saving.
4. Our mentor gave us valuable insights into improvements that can be worked out through the code. Her suggestion to include a feature in order to prioritize certain population groups over others is one that we are actively working on. We wish to create a project which resembles real-life situations as closely as possible and works to solve them.

The sources we used during this project mainly included websites providing covid awareness information, and explained the vaccination drive in our country. Other than this, we used websites such as GeeksforGeeks and Programiz to delve deeper into concepts of C programming, especially those of file handling and functions which were slightly difficult to grasp and needed to be explained with an abundance of examples. A majority of our learning of the C language comes from the notes and lectures provided by our mentor, and from the commendable book “Let Us C” authored by Prof. Yashwant Kanetkar. These two curated sources

made it easier to understand the language and develop a thorough understanding of the programming language C. Ample practice questions, both easy and complex were given by our mentor in practical classes as well as in the aforementioned book. All references to the content we used are mentioned In the last segment of this report.

A lot of our classmates made various kinds of management systems, some made hotel management systems while others made library management systems to name a few. All of these were commendable projects which garner a lot of appreciation for all the hard work that has been put into them. The basic principle of most management systems is that the user feeds in information, and this information is stored in a database, from which can be accessed at any given time. The records stored in this database can also be deleted if the user wants to. What we found differences in our project is that we provide a feature for both kinds of users to login, unlike most management systems which only allow one to do so. In these systems, the customer cannot access information regarding the subjects. This might not be necessary or safe in systems of Hotel management, but form an integral part of something like a library management system, where making more information digitally available to the consumer can make the task of the employees easier and the functioning of the library fast and easier. We have hence tried to use the same/similar system for both doctors and patients, hence providing a multi-login feature. Other than this, most features we entail in our vaccination system are similar to those provided in other management systems.

PROJECT

We approached the problem in a comprehensive way and created a different system with different options for both patients and doctors. In the next session, we have used screenshots of our code to highlight the main features of the project.

We used two libraries and their predefined functions. These are:

1. The stdio.h header file: the header file stdio.h stands for Standard Input Output. It has information regarding input and output functions. Some of the predefined functions we used from this library are:
    1. printf() : It is used to print the strings, integer, character etc on the output screen.
    2. scanf() : It reads the character, string, integer etc from the keyboard.
    3. fopen() : It opens the file and all file handling functions are defined in stdio.h header file.
    4. fclose() : It closes the opened file.
    5. remove() : It deletes the file.
    6. rename() : It renames a file.
    7. fflush() : it flushes a file.

2. The stdlib.h header file: the header stdlib.h stands for Standard Library. It contains information of memory allocation/freezing functions. We used two very important functions from this library:

2. exit() : It causes the program to terminate normally.
3. system("cls"): This command is used to clear the output screen

We used the concepts of structures and file handling widely throughout the source code.

Structures

A structure is a user defined datatype in C language. A structure creates a data type that can be used to group items of possibly different types into a single user created datatype. Structures are similar to arrays except that in arrays, we can group only one kind of items together, whereas in the case of structures. This can be done with different kinds of items.

```
struct res
{
    char fname[15];
    char lname[15];
    char add[5];
    char phone[11];
    int age;
    char occupation[15];
    char cmd[15];
    int ptID;
    int apt;
};
```

Figure 2: Structures in C

Here, we have declared a structure by the name of *res* and added 9 items inside it. This structure was created to store the information of a particular patient. These include the basic information such as name, address, contact number, occupation, and medical information such as comorbidities of the patient. It also include the patient ID and appointment date of the patient which are provided by the system according to well defined functions.

File handling: Binary files

In the C programs we learnt before file handling, the operations are done on a prompt / terminal which is not stored anywhere. An important feature we required during the course of this program was to store the information provided by the users. For this, we were required to create a database which could directly be accessed by the users. File handling is what we used to perform this. Using files with the extension *.dat*, we were able to create databases.

```
void remove_res()
{
    system("cls");
    int pt;
    bool check=true;
    printf("\nEnter the PATIENT ID of the person you want to vaccinate\n");
    scanf("%d",&pt);
    FILE *ft;
    ft=fopen("temp.dat","wb+");
    FILE *fp;
    fp=fopen("database.dat","rb+");
    struct res rr;
    while(fread(&rr,sizeof(rr),1,fp)==1)
    {
        if(pt!=rr.ptID)
        {
        fwrite(&rr,sizeof(rr),1,ft);
        }

        else
        check=false;
    }
    fclose(fp);
    fclose(ft);
    remove("database.dat");
    rename("temp.dat","database.dat");
    if(check==true)
    {
        priintf("\nPerson not found!!\n");
        return;
    }
    printf("\nSuccesfully vaccinated!!!\n");
}
```

Figure 3: File handling in C

The following file I/O functions were used through the course of this program:

1. **fopen()**: This function has two parameters, one that specifies the name or the path of the binary file, and the second which specifies the mode in which the file is to be opened.

Here we have first opened it in the write mode, which essentially creates the file. Next, we opened it in the read mode, through which we can read the information in it.

2. **fclose()**: as the name suggests, this function is used to close the open file.
3. **fread()**: This function is used to input structures from a file.

   Declaration -

   size_t fread(void *ptr, size_t size, size_t nmemb, FILE *stream)

   where -

   ptr - This is the pointer to a block of memory with a minimum size of size*nmemb bytes.

   size - This is the size in bytes of each element to be read.

   nmemb - This is the number of elements, each one with a size of size bytes.

   stream - This is the pointer to a FILE object that specifies an input stream.

4. **fwrite()**: This function is used to write structures to a file.

   Declaration -

   size_t fwrite(const void *ptr, size_t size, size_t nmemb, FILE *stream)

   ptr - This is pointer to array of elements to be written

   size - This is the size in bytes of each element to be written

   nmemb - This is the number of elements, each one with a size of size bytes

   stream - This is the pointer to a FILE object that specifies an output stream

These two concepts proved to be extremely useful along with the remove and rename functions that we used in order to remove the names and information of the vaccinated patients from the vaccination index.

The user defined functions we used are as follows:

User defined functions for patients:

- res_menu() function where the resident can choose to sign up for vaccination or to see the vaccination index
- insert_res() function is used to let the user input their information in the form of
  1. Name
  2. Address
  3. Contact number
  4. Age
  5. Occupation
  6. Health problems
  7. Date

It then gives the patient the patient ID and date of vaccination.

- viewres() function lets the resident see the vaccination index which includes their names and their IDs.

User defined functions for healthcare workers:

- login() function asks the healthcare worker for a password to log into the system.
- admin_menu() is executed only if the user enters the correct password. It shows a menu of operations that users can perform.
- remove_res() function removes the information of the vaccinated patients from the vaccination index so that the healthcare no longer sees it.
- viewapt() function lets the healthcare worker see his/her appointments for a particular date.
- viewadmin() lets the user see all the patients that have signed up for vaccination.

DESIGN

The project was built from scratch. Some inspirations were taken from healthcare management systems. We intended to make a system that would cater the needs of both residents and healthcare workers. Even though the program is used by residents and healthcare workers simultaneously, it doesn't reveal any sensitive information to fellow residents. At the same time, we wanted to make sure that the system was easy to use for both the parties. Selecting various options is easy and efficient and does not require any prior knowledge.

RESULTS

The code resulted in a seamless program that systematically asked the user to input information and stored it into the .dat file database.dat. The snapshots of the terminal while the program was running have been included further in the report.

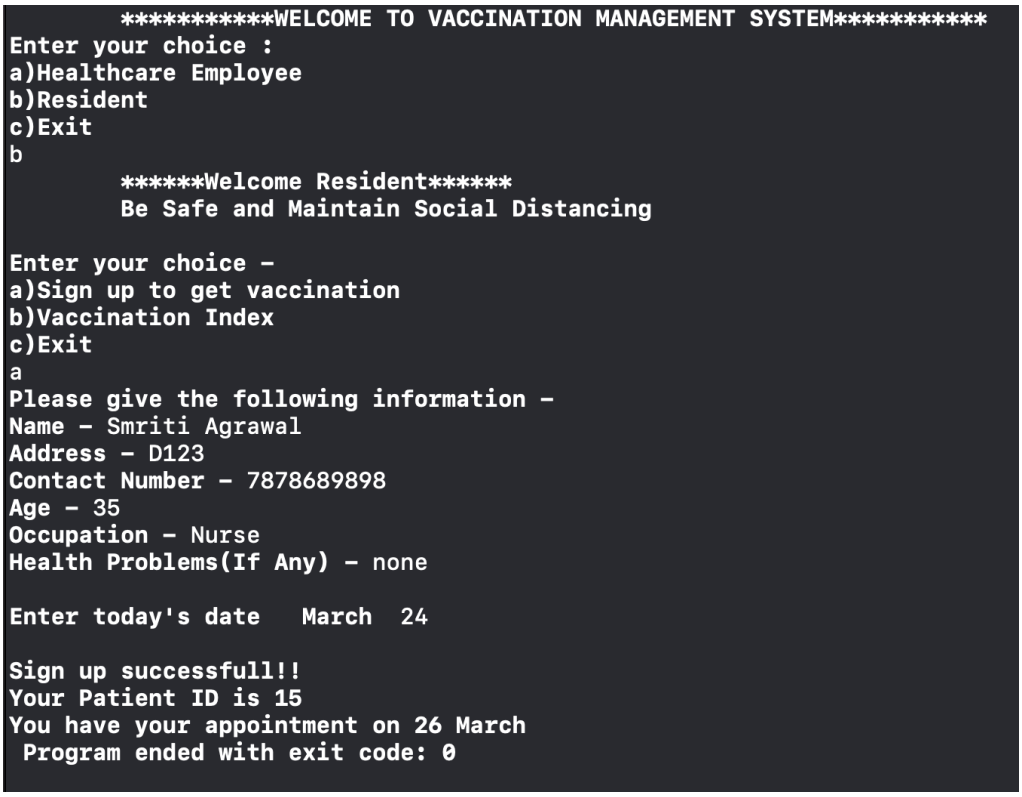

Figure 4: Choices for Residents (I)

Here, the user has logged into the system as a resident. This is where the res_menu() function comes into play and shows the resident a list of actions they can perform. Here, the user has chosen the first option, which is “Sign up to get vaccination”. When this is done, the program starts asking for information from the user and this is then stored in a binary file. Once the user has entered the information, the same structure provides them with a patient ID and a date for their vaccination. The date assigned also follows a certain algorithm. On a given day, a limit of 10 patients has been placed on the number that can be vaccinated. Hence, if say, the date of 24th of March is entered in today’s date, the program allots the date of 25th of March to the user until there are 10 vaccinations taking place on that date already. After that, it allots the next date, which is that of the 26th of March in this case.

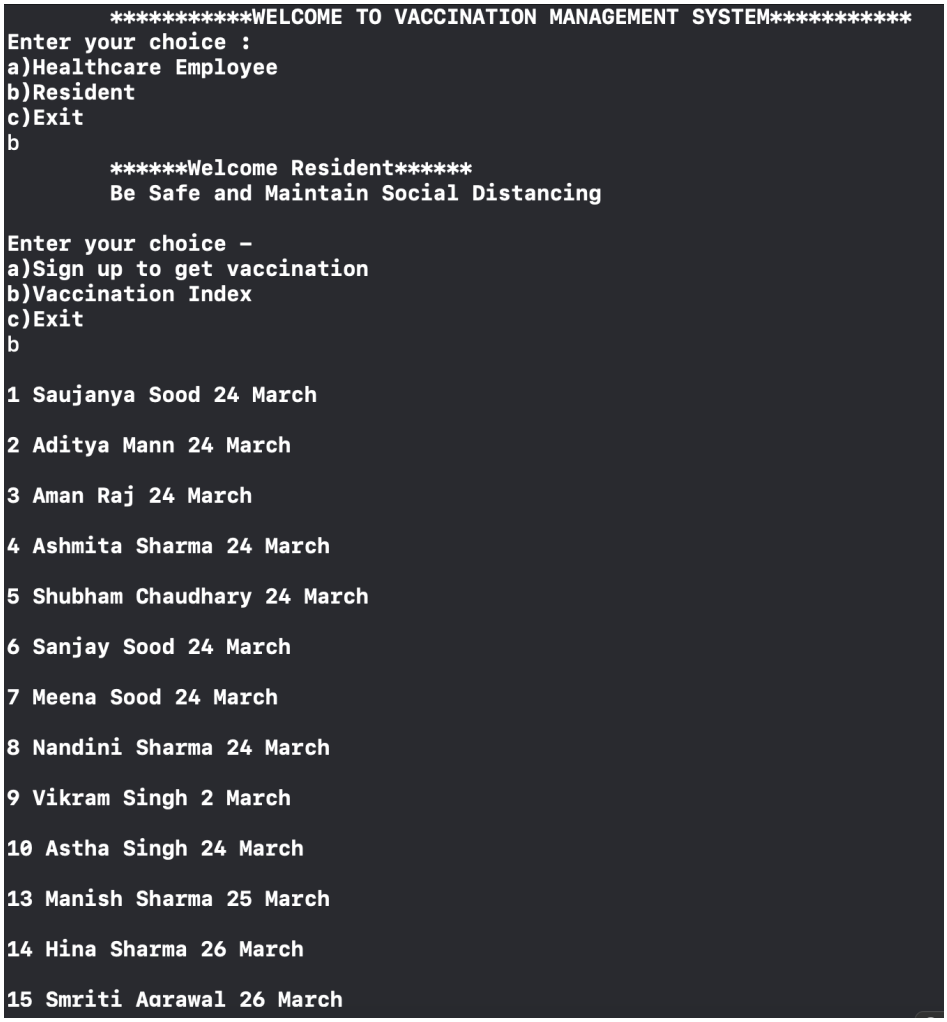

Figure 5: Choices for Residents (II)

This is the output screen which appears when the resident selects the option to see the vaccination index. Here, the viewres() function is being used. The functions meant to view the list of patients are different for patients and doctors since patients do not need to see other patients' medical information. They are able to access only the ID and the dates of vaccination of the other patients.

Now, coming to the output screen a healthcare worker comes across,

```
        ***********WELCOME TO VACCINATION MANAGEMENT SYSTEM***********
Enter your choice :
a)Healthcare Employee
b)Resident
c)Exit
a
Enter your name and password -
Srinivas
2134
        ******Welcome Dr.Srinivas******
          Thank You For Your service

Enter your choice -
a)Vaccination Index
b)Your Appointments
c)Vaccinate a resident
d)Exit
a

1 Saujanya Sood A123 9354123773 18 Doctor none

2 Aditya Mann A124 9999999999 18 Engineer none

3 Aman Raj A125 9770117978 25 Engineer Diabetes

4 Ashmita Sharma A122 9528367454 20 Intern Diabetes

5 Shubham Chaudhary A126 7474689098 18 Engineer none
```

Figure 6: Choices for Healthcare workers (I)

When a user enters the system as a healthcare employee, the login() function is implemented which allows them to log into the system using their name and a predefined password. It then checks for the password condition, and if so, it goes on to use the admin_menu() function which provides the user with three options. In order to access the vaccination index, they use ‘a’ option which gives the entire list of people along with all the information they fed into it.

```
Enter your choice -
a)Vaccination Index
b)Your Appointments
c)Vaccinate a resident
d)Exit
b
Enter the date for which you want to see the apppointments - 24

1 Saujanya Sood A123 9354123773 18 Doctor none

2 Aditya Mann A124 9999999999 18 Engineer none

3 Aman Raj A125 9770117978 25 Engineer Diabetes

4 Ashmita Sharma A122 9528367454 20 Intern Diabetes

5 Shubham Chaudhary A126 7474689098 18 Engineer none

6 Sanjay Sood A123 9836363525 61 Doctor Diabetes

7 Meena Sood A123 9835362524 53 Doctor none

8 Nandini Sharma A134 8474647384 62 Professor Thyroid

10 Astha Singh A243 8674657634 45 IAS Officer
```

Figure 7: Choices for Healthcare workers (II)

If the ‘b’ option is chosen, the user is asked to enter the date for which they want to see their appointments. Accordingly, the system sorts out and displays the information of all the patients who are scheduled to get vaccinated on the particular date as entered by the user.

```
Enter your choice -
a)Vaccination Index
b)Your Appointments
c)Vaccinate a resident
d)Exit
c

Enter the PATIENT ID of the person you want to vaccinate
2

Succesfully vaccinated!!!
```

Figure 8: Choices for Healthcare workers (III)

Finally, if the user enters ‘c’ when asked for a choice, the system will ask them for the ID of the patient that they want to vaccinate. This way, they can complete the vaccination process and the details of the vaccinated patients are deleted from the system.

If the doctor wants to check for remaining appointments or wants to see the vaccination index, they will find that the record has been deleted from the database as can be seen below.

```
Enter your choice -
a)Vaccination Index
b)Your Appointments
c)Vaccinate a resident
d)Exit
b
Enter the date for which you want to see the apppointments - 24

1 Saujanya Sood A123 9354123773 18 Doctor none

3 Aman Raj A125 9770117978 25 Engineer Diabetes

4 Ashmita Sharma A122 9528367454 20 Intern Diabetes

5 Shubham Chaudhary A126 7474689098 18 Engineer none

6 Sanjay Sood A123 9836363525 61 Doctor Diabetes

7 Meena Sood A123 9835362524 53 Doctor none

8 Nandini Sharma A134 8474647384 62 Professor Thyroid

10 Astha Singh A243 8674657634 45 IAS Officer
```

Figure 9: Choices for Healthcare workers (The vaccinated patients' records are deleted)

SUMMARY AND CONCLUSION

By means of this project, we have been able to learn about various C functions and concepts and applied this knowledge to the best of our efforts to solve a real life problem. This activity helped us understand the pandemic and the vaccination model being followed in the country in greater detail. We came to recognise the use of such management programs in tackling problems. With simplicity, we have been able to create a computerised system which is capable of storing data and connecting different forms of data.

FUTURE WORK

Since we were not able to sort and prioritise patients on the basis of their age and comorbidities and assumed that everyone was equally eligible for vaccination. In future work, we will try to use sorting algorithms to sort them on these basis and create a more efficient system that can be better implemented in the real world.

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Learning about the pandemic and the Indian Vaccination drive

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