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Article Info	ABSTRACT
	Blood donation is the main source of blood resources in the blood banks which is required in the hospitals for everyday operations and blood compensation for the patients. In special cases, the patients require fresh blood for compensation such as in the case of major operations and similar situations. Moreover, plasma transfusions are vital in the current pandemic of coronavirus disease (COVID-19). In this paper, we have proposed a donation system that manages the appointments between the donors and the patient in the case of fresh blood donation is required. The website is designed using the Bootstrap technology to provide suitable access using the PC or the smart phones web browser. The website contains large database including information about the donors and their blood group, available time, and other personal information to facilitate the donation process. This system is designed with unlimited abilities to be used by any hospital, blood bank, or individuals to manage the donation process with no constrains.

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1. INTRODUCTION

Blood donation is an important process to maintain blood storage and prevent it from becoming at a low stock. Blood management systems have been widely considered in the literature [1]-[5], which depends on different technologies and methods. In addition, in some cases, it is essential to provide fresh blood to the patients or to offer an instant blood replacement [6]. Modeling suggests needing increase blood availability in the next five to ten years, meet the requirements of aging people [7]. Furthermore, in the recovery period, the use of plasma transfusions could be of great value to save lives in the current pandemic of coronavirus disease (COVID-19), given the lack of particular therapeutic options [8]-[10]. The management of patient blood is the main strategy to improve patient cases and in this crisis should be a high priority[11]-[12]. In [13], a system is proposed that correlates the previously blood bank systems to a new system that improves the efficiency of the blood bank and upgrades the framework to a portable scheme. In addition, the paper has discussed the enhancement in the prospective of the data storing and donated blood groups. Where referring to stress the importance of the preservation of medical data [14]. Automated blood bank systems have been designed in [15]-[17] utilizing Raspberry Pi B+ kit to gather blood donors with the blood recipients by means of android application. The proposed systems connect both the donator and the receptor using short-message-service (SMS).

On the other hand, a blood bank system that utilizes the cloud has been considered in [18] in which, the users having access to the information that are related to different blood banks locations, hospitals and donors with different types of devices [19]-[20]. As a security check, the system asks the users to provide an identity proof stating their blood group such as a driving license or a similar document. An android application has been used to fulfill this job, which has the ability to track the different blood bank locations to make the process easier for the users to select the nearest blood bank. In [21], the database of the blood bank has been collected from different sources including blood banks, hospitals and national service scheme (NSS), while the communication between the donors and the receptors has been achieved using asterisk hardware. The health status of the donors and the distance from the caller has been taken into consideration in an algorithm that is stored in a central server.

In [22], the receptor sends a text message over SMS to a shared blood bank platform with the required blood group, if the requested group was available at a certain blood bank, then the receptor is directed to that bank, otherwise, it sends the contact details of the donors with the required blood group. A computer-based system for blood management have been designed in [23] to manage, monitor and store the blood records, in addition to improving the medical service by providing a secure medical report. The implementation was achieved utilizing My-SQL database, bar-code technique and a PHP language, and tested with the national blood transfusion center (NBTC), which helped improving the system manipulation compared to the manual systems. A web-based application has been proposed in [24] that solve the issues of low blood resources resulting from several reasons such as uncontrolled blood managements, shortage of some blood groups and low awareness regarding blood donations. The processes of donating, testing, storing and delivering the blood bags are controlled by the proposed application.

A study on the blood biochemical and biophysical characteristics over a specific time has been carried out in [25] to show the effect of time on the blood characteristics while it is been stored in the blood banks. Several samples for different donors have been tested with HB, K+, P50, 2, 3 DPG, ATP, lactate and pH. The result of this work has suggested that the blood quality is more sensitive to be changed due to filterability than the normal biochemical factors. The problem of storing the blood bags for long time in both rural and urban areas has been considered in [26] by seeking the right donor information using a verbal keyword when a specific blood group is in need.

The contribution of this paper is to build a general virtual blood bank that gathers the users who requires a specific blood group with the users who are able to donate. The proposed web-based application can be used on a PC browser or on a smart phone browser without any constrained, and it contains a database for all the users who are willing to donate. The remaining of this paper is organized as follows, in Section 2 a brief description for the bootstrap technology is presented, while the paper methodology is illustrated in Section 3. The results and discussions are shown in Section 4 and the paper is concluded in Section 5.

2. BOOTSTRAP TECHNOLOGY

Bootstrap is an open-source, front-end web development framework that simplifies the development of web pages. It allows developers to design or develop highly responsive websites that works efficiently on various major browsers and devices such as smart phones, tablets and computers without changing the code [27]. It includes various HTML and CSS design based templates, as well as, the support for JavaScript. Bootstrap predefined design templates and classes provide basic UI (User interface) parts such as typography, tables, forms, buttons, dropdowns, navigations, alerts, modals, tabs, accordion and image carousels [28]. The CSS classes within the bootstraps allow further customization to these contents, for example, tables colors or text highlight.

3. METHODOLOGY

The map for the proposed appointment managing system is presented in Figure 1. The admin observes and controls the account of the donors and has the authority to delete and block any account that is not approved due to failing to prove their identity or when a user (the donating/requesting person) writes a negative feedback on a person for a particular reason and send it to the admin shown in the admin page in Figure 2 and 3.

The donors are able to register and have an account but first they need to read and accept the donating consent by checking the box "I have read all this and able to register" as shown in Figure 4. Then providing a proper identity to prevent fraud from registering with fake information and choose Yes or No from the field "Have been exposed to the Coronavirus" then write Date of recovery from Coronavirus as presented in Figure 5. Following the account registering process, the donors now are able to login, edit, report, logout or delete their accounts according to their preference.
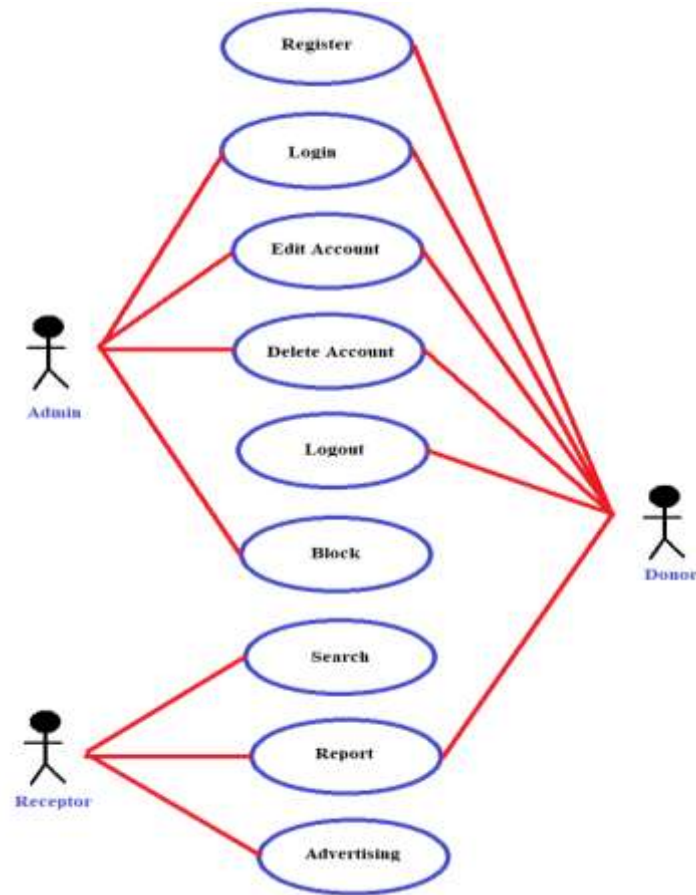
Figure 1. Map for the appointment management system

Figure 2. The admin page

Figure 3. Deletes and block user

If the donor travels or has a specific illness that prevents him from donating, his condition can be changed to unavailable using account information as shown in Figure 6. On the other hand, users can search

for a donor or request donors that match their preferences such as the blood group, the nearest donor location, and the available time that suits both users. This is done through the search tab shown in Figure 7.

If a suitable donor could not be found, the seeker can fill the requested information on the site. Then clicks on the "Send Request" button shown in Figure 8, which will generate a code that must be saved to be used in the login combined with the phone number to be able to modify this information as shown in Figure 9 and 10, respectively. The information will be displayed automatically on the advertisement part of the webpage, which will be displayed on all the pages of the website as shown in Figure 11.
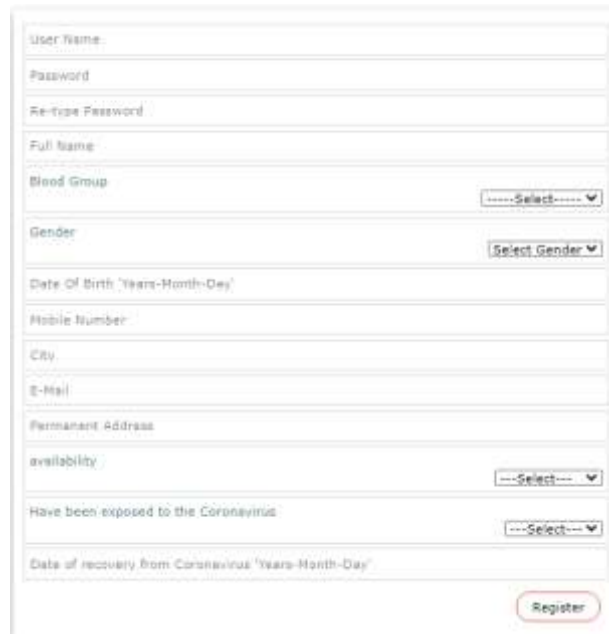

Figure 4. Donation obstacles

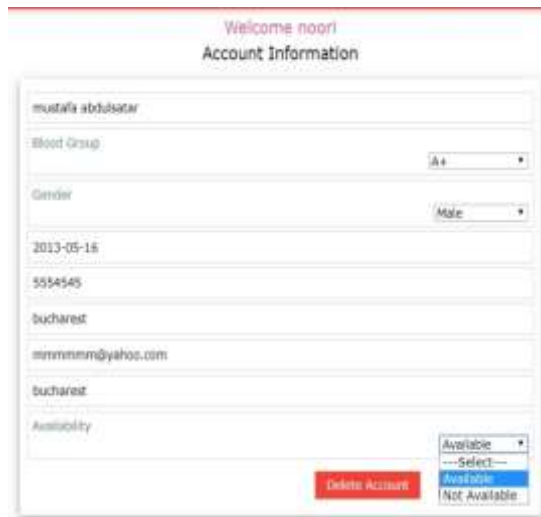Figure 5. Registration form of the donors

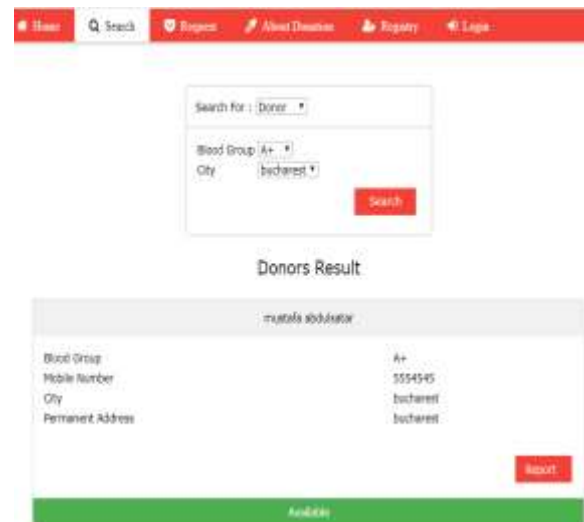Figure 6. Account information to change the donating status

Figure 7. Search donor or request

The patient can delete the advertisement when their need has been fulfilled such as finding the donor. The advertisement will be deleted automatically after a specific time that is set by the patient. When clicking on "Show Request" button in the advertisement, the patient detailed information will be shown.

Any user can write negative feedback about other users for a particular reason and sends it to the admin as shown in Figure 12. The notifications will be shown on the report section of the admin page as shown in Figure 13. The admin can click on the link "Go to" to display the report, then choosing to block or delete the reported users from the application as shown in Figure 14. When a user is blocked, a blocking message will appear to that user asking them to contact the admin as shown in Figure 15. After contacting the administrator and solving the problem, the administrator can remove the block from that user as shown on Figure 16.

Figure 8. Request register

Figure 9. The register code

Figure 10. Sign in to edit request

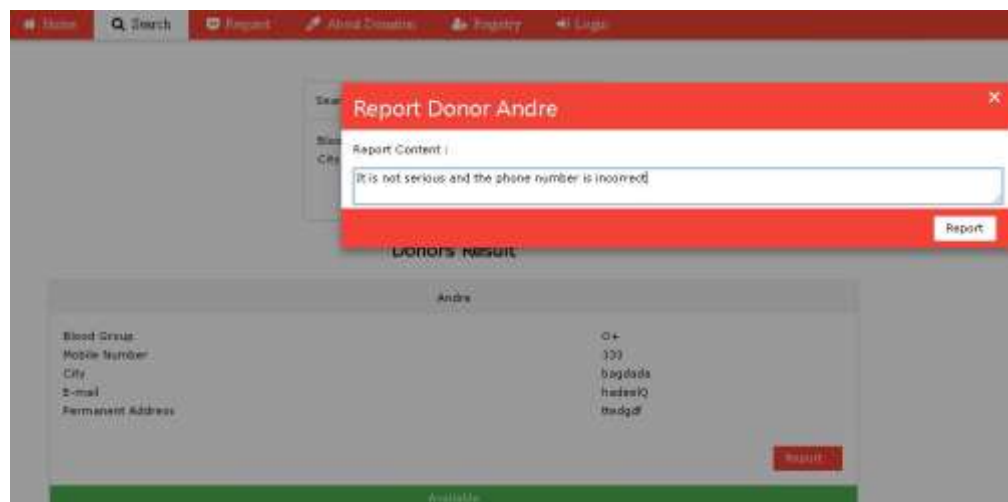Figure 11. Advertisements for patient need your help

Figure 12. The reported user on the Admin page

Figure 13. The report section
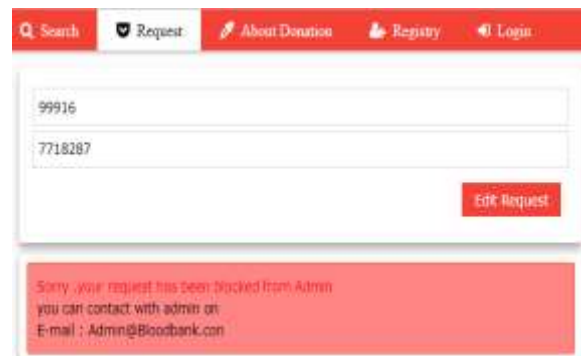
Figure 14. Block or delete user
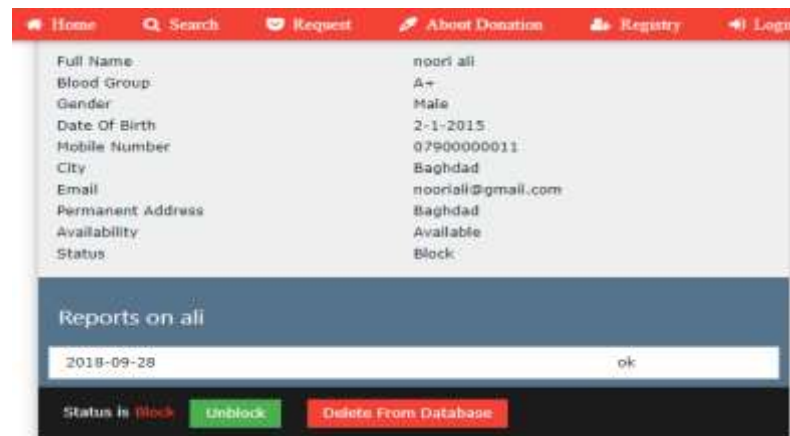

Figure 15. Blocked user message

Figure 16. Unblocking a user

4. RESULTS AND DISCUSSIONS

The mapping diagram of the proposed appointment managing system is presented in Figure 1. The admin observes and controls the accounts of the donors and has the authority to delete and block any account that is not approved due to failing to prove their identity or a reported user. The donors can register and have an account but first they have to provide a proper identity to prevent fraud registration of a scam account with fake information. Once they are registered, the users will be able to login, edit, report, logout or delete their accounts according to their preference. On the other hand, the receptors can search for the required donors that match their preferences such as the blood group, the nearest donor, and the available time that suits both users. The receptors are able to report any abusive user and they can advertise for their requirement of a blood group and quantity. The major advantages of this work can be short listed as:

a) Reducing the time to search for plasma, in the recovery period, the use of plasma transfusions could be of great value to save lives in the current pandemic of COVID-19, given the lack of particular therapeutic options.
b) Reducing the power consumption required by the traditional blood banks to maintain the blood safety.
c) Reducing the expenses of buying and maintaining the refrigeration system in the traditional blood banks.
d) Reducing the number of workers in the blood banks.
e) Reducing the time to search for a specific blood group that could be rare to find.
f) The website has the required guidance and directions on how to use the website, which can make it easy for the user to manage their account.

5.   CONCLUSIONS

This paper presented a high-end system to reduce the gap between the blood donors and the people in need for blood. With the help of the internet, the blood donor's appointment managing system through PC and mobile web browsers can synchronize the donors and the requesters of the blood through a database that gathers their information using My SQL. The webpage is created using Java, Java server pages (JSP) technology, hypertext markup language (HTML) and bootstrap. To check the blood availability through the web application, the blood request sends to the nearest blood donor or by calling the donor directly via the phone. If a certain blood group is not available, the system provides the ability to add an advertisement for that blood group that includes the requested blood information and how to contact the user. This application reduces the time required to search for a specific blood group availability through blood banks and hospitals. Thus, this application provides the required information in less time and cost optimize to reduce the working staff and power by reducing the use of blood storage devices.

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