Project Report

for

RFID for Blood Banks

Prepared by

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Prepared for

Course	TCSS559 Services Computing
Instructor	Universal RFID Inc. & Eyhab Al-Masri (PhD)
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1. ABSTRACT

RFID for Blood Banks is a project which aims in developing a computerized system to provide an automated means through RFID in labelling the blood samples and keeping track of the sample details, temperature maintenance etc. which is currently a manual process done by the laboratory technicians.

2. INTRODUCTION

One of the major challenges the Blood Banks face is to keep track of the blood samples collected over time and to avoid any errors during this process. A simple error in recording the details of the blood sample can cost a human life.

In our system, RFID Tag is attached to each blood sample and an RFID Reader is used to keep track of the intricate details of the blood samples all at once, like the donor details, the time the sample was collected, the temperature of the sample which otherwise would have to be read manually by a human operator. Using RFID technology for tracking the blood samples would not only make the process easier but also reduce the occurrence of human error.

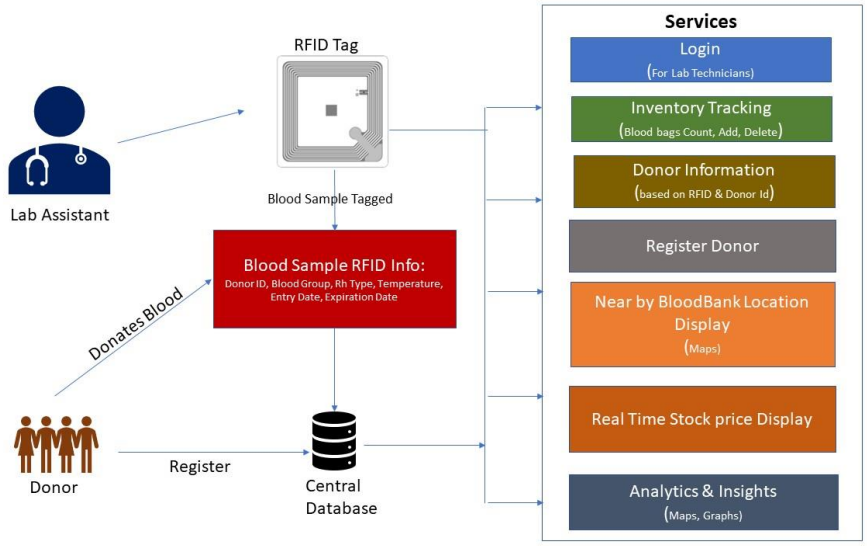
3. OBJECTIVE & SCOPE

The scope of this product is to provide an automated means through RFID in labelling the blood samples and keeping track of the sample details, temperature maintenance etc. which is currently a manual process done by the laboratory technicians. This would require each blood sample to have an RFID tag that would have the details of donor – Name, Blood group, Blood Component Type(Red Blood Cell count, platelets, and plasma), the date when the sample is collected, the temperature at the time of collection. We also need to keep track of the blood sample distribution in the blood bank as it would help in better replenishment of the blood bags as and when they get used up. The temperatures of the blood bags can also be maintained using the RFID when there is any change in the temperature within the refrigerators where these blood bags are placed thereby avoiding wastage of blood bags due to improper temperature maintenance. Feature to locate the hospitals near to the blood bank has also been provided with the help of Bing maps. Additionally, real time stock prices of the top five medical firms are also featured in this system. Some of the obvious benefits of using RFID in Blood Banks are the improved and efficient Inventory Management, security, scalability, nearby hospitals/blood banks, easy maintenance and less errors.

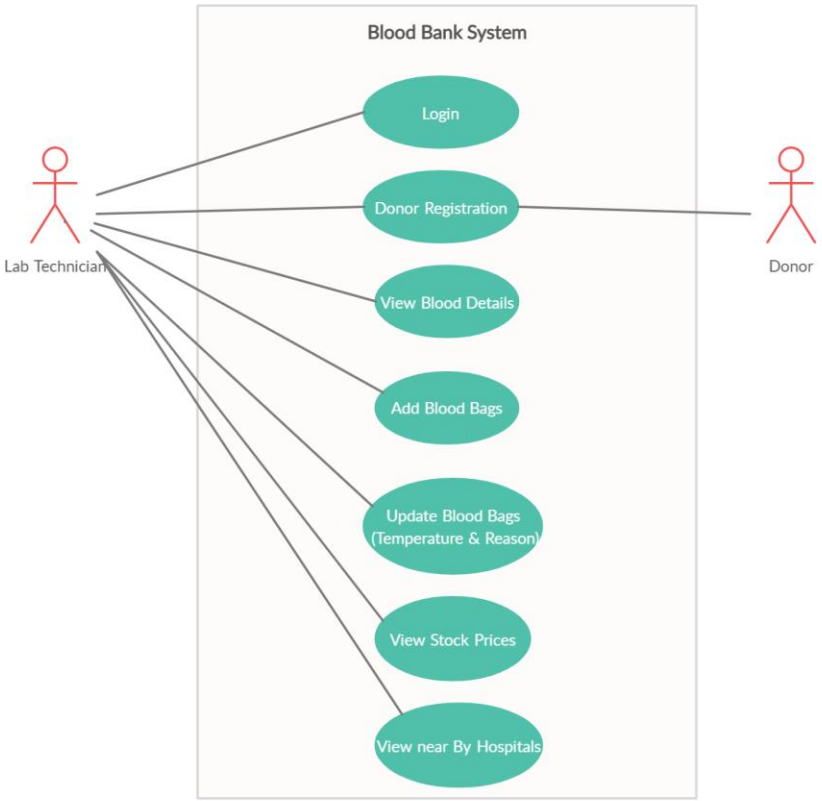
4. ARCHITECTURAL DESIGN

Below is a conceptual/ design view of the RFID for Blood Bank System. The picture below depicts the different types of end users and the various functionalities of the RFID System.

a. HIGH LEVEL DIAGRAM:

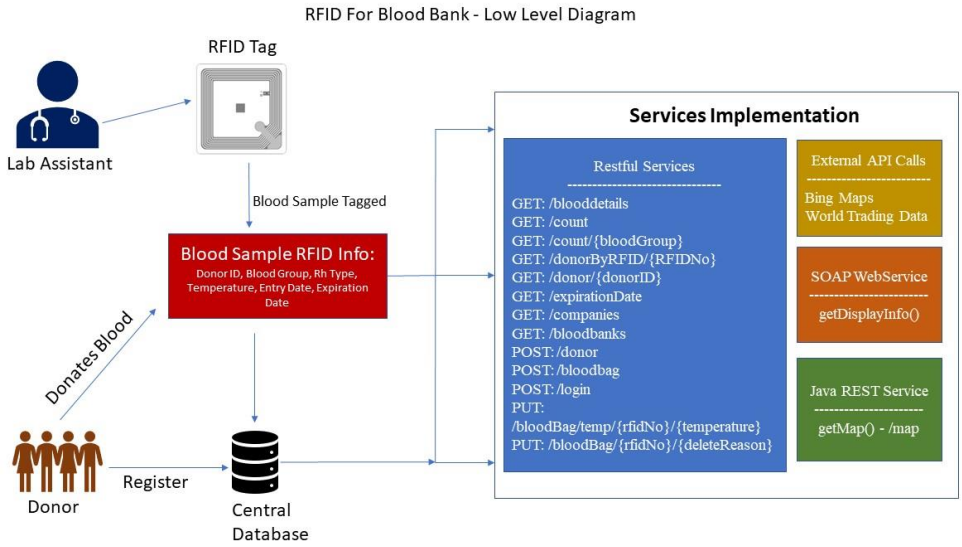


b. USE CASE DIAGRAM:



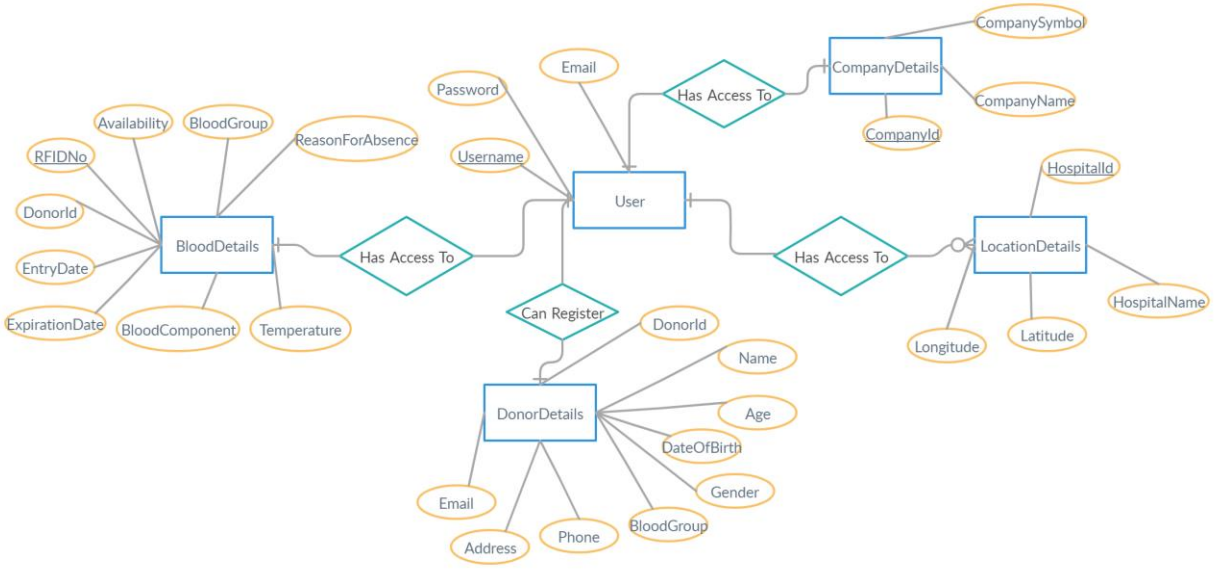
c. LOW LEVEL DIAGRAM:

Shown below is the low-level design diagram - which details all the service methods that are implemented in the RFID for blood bank system.



5. DATABASE AND SAMPLE DATA

a. ER DIAGRAM:



b. SAMPLE DATA:

Below are some sample data of the Blood Bank System.

- Donor Details Table:

donorId	name	age	gender	dateOfBirth	phone	email	bloodGroup	address
10001	Monica Geller	29	Female	12/1/1990	4132763845	monica@geller....	A+	Warner Bros., B...
10002	Rachel Green	29	Female	11/4/1990	4631732937	rachel@green.c...	B+	Warner Bros., B...
10003	Ross Geller	41	Male	10/25/1978	7182563927	ross@geller.com	A-	Burbank, Califor...
10004	Chandler Bing	42	Male	4/17/1977	8172634976	chandler@bing....	O+	Walt Disney, Ca...
10005	Phoebe Buffay	32	Female	2/25/1987	9172634018	phoebe@buffa...	B-	Walt Disney, Ca...

- Blood Details Table:

RFIDNo	donorId	bloodGroup	entryDate	expirationDate	bloodCompon...	temperature	availability	reasonForAbse...
100001	10001	A+	10/1/2019	11/30/2019	RBC	23	False	'Transfused'
100002	10003	A-	10/4/2019	10/17/2019	Plasma	15	False	'Expired'
100003	10003	A-	10/4/2019	10/31/2019	Platelets	2	False	'Transferred'
100004	10003	A-	10/4/2019	11/29/2019	RBC	22	False	'Transfused'
100005	10002	B+	10/4/2019	11/29/2019	RBC	22	False	'Transferred'

Location Details Table:

hospitalId	hospitalName	latitude	longitude
1	St. Josephs Me...	47.2456	-122.4481
2	MultiCare Taco...	47.2594	-122.4530
3	Bio Mat USA	47.225259	-122.504258
4	Bloodworks No...	47.333051	-122.316974
5	St. Clare Hospital	47.183009	-122.501851

Company Details Table:

companyId	companyName	companySymbol
1	Res Med Inc.	RMD
2	Conmed	CNMD
3	Edwards Lifesci...	EW
4	InMode	INMD
8	MedTronic	MDT

User Details Table:

username	password	email
anup	1234	anup@gmail.co...
eyhab	1234	eyhab@gmail.c...
jack	1234	jack@gmail.com
jane	1234	jane@gmail.com

6. WEB API

a. PROGRAMMING LANGUAGES USED:

We have used C# and Java to develop the Service Endpoints. The UI is developed using ASP.NET Technology.

b. VERSION CONTROL:

We have used Bitbucket (Git) for version control to collaborate different sets of code developed by the team members.

c. SERVICES IMPLEMENTED:

- RESTful Services:

  Below are the RESTful Services developed in the blood bank system. These services are invoked from the User Interface to achieve different functionalities.

BloodBank		Description of the services
GET	/blooddetails	Returns all the available blood bags
GET	/count	Returns the count of all available blood groups
GET	/count/{bloodGroup}	Returns the count for the specific Blood Group
GET	/donorByRFID/{RFIDNo}	Gets the information of the donor based on RFID
GET	/donor/{donorId}	Gets the information of the donor based on donorID
GET	/expirationDate	Gets all the RFIDs that are expired
POST	/donor	Adds the donor information
POST	/bloodBag	Adds a new blood bag
PUT	/bloodBag/temp/{rfidNo}/{temperature}	Updates the blood bag temperature
PUT	/bloodBag/{rfidNo}/{deleteReason}	Sets availability of a blood bag to false.
POST	/login	Authenticates user login
GET	/companies	Gets the Top 5 medical firms
GET	/bloodbanks	Gets the near by blood bank information

- SOAP Web Service:

  Visualization of all the previous months blood data is done by SOAP Webservice. SoapWS.asmx.cs is the source code file used for this purpose. The method **getDisplayInfo()** is the Web Method exposed to be invoked via Soap.

- Java REST Service:

  The Bing Maps API method to retrieve the static map is done in Java. The Location Map Project holds classes that implements the REST Service. **getMap()** can invoked by the path - "/map" and is a GET service Invocation. This would call the Bing Maps API and returns the response(image/jpeg) to the client.

d. EXTERNAL APIS:

The two External API calls done by the blood bank system are:

1. **Bing Maps API:** This service Invocation is done for retrieving a static map of the nearby blood bank/hospital locations.
2. **World Trading Data API:** This service Invocation is done to retrieve real time stock prices for the top 5 medical firms. This also included an implementation using AJAX, to automatically retrieve real time data & update the grid view every 10 seconds.

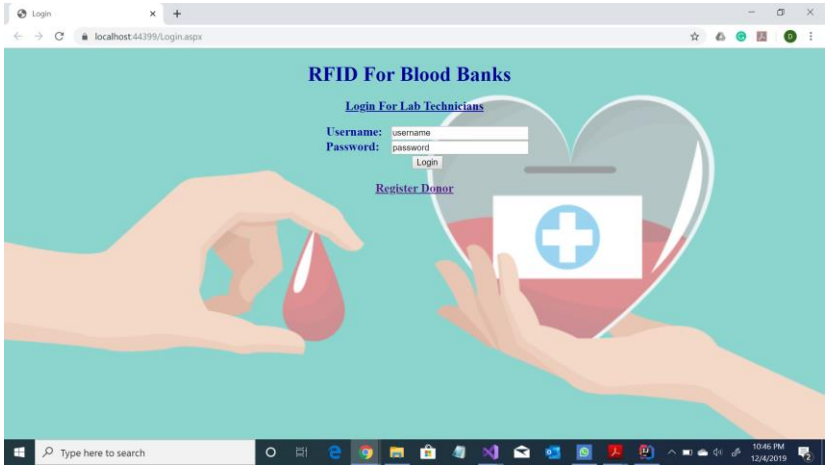
e. DOCUMENTATION OF THE SERVICES:

The web service implementation documentation is generated using Swagger and is added as separate document along with the report.

7. FRONT END INTERFACE:

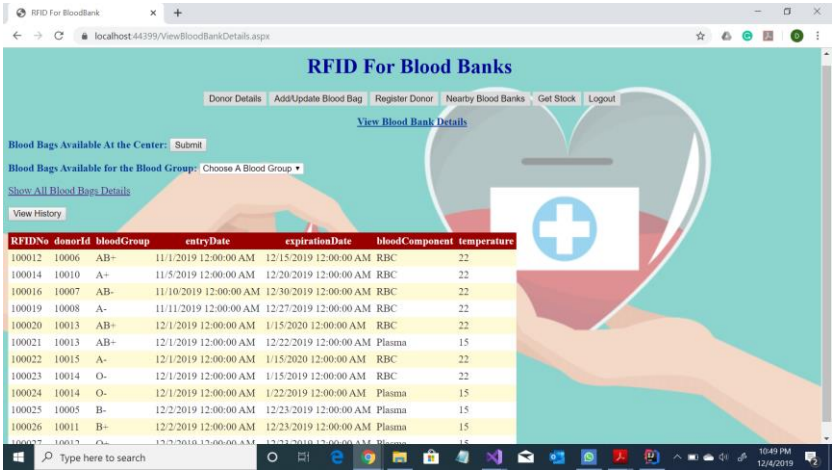
The front-end user interface is kept simple and user friendly for the client to access. Below are the screenshots of the RFID for Blood Bank System.

1. LOGIN PAGE:

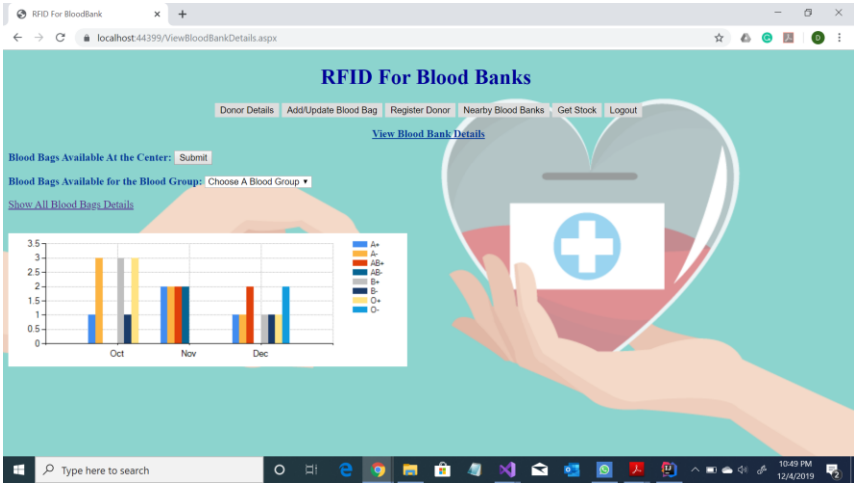


2. VIEW DETAILS PAGE:

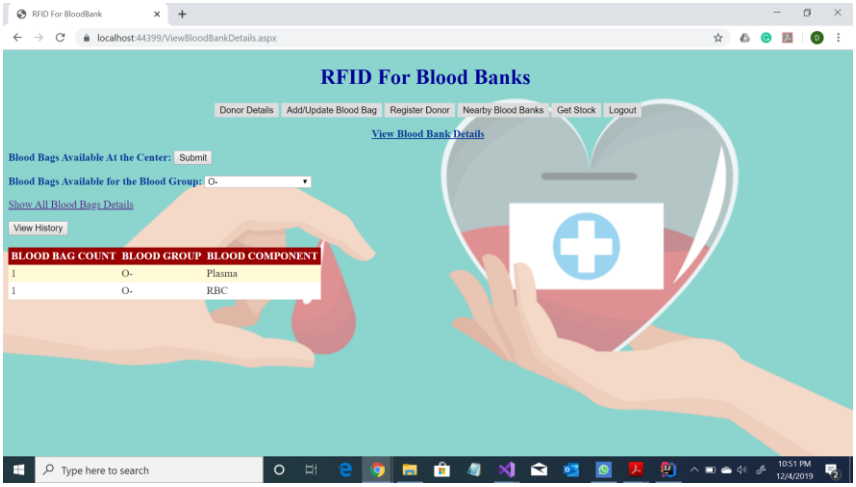
a. Display of All Blood Details:



b. Visualization of Previous Months blood data:

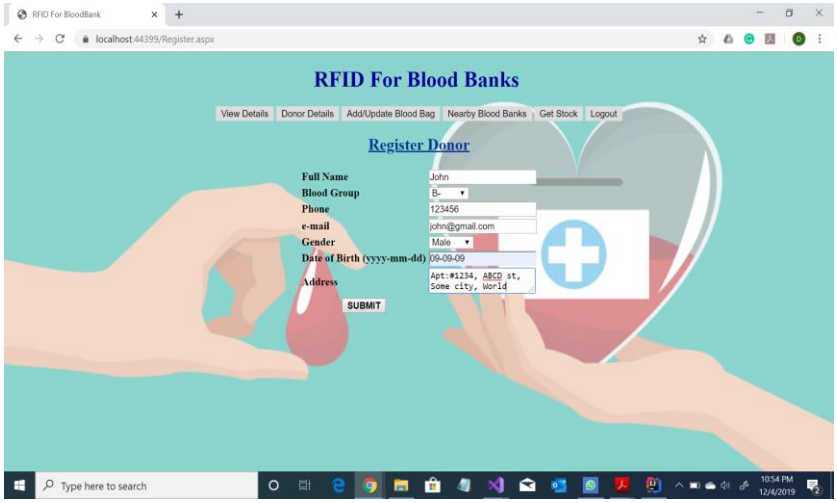


c. Display of blood count for the individual blood groups:

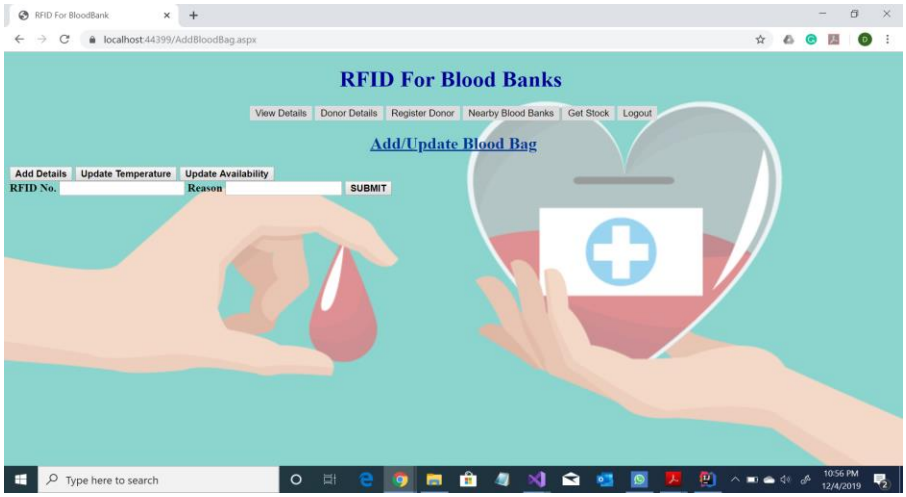


3. DONOR DETAILS PAGE:

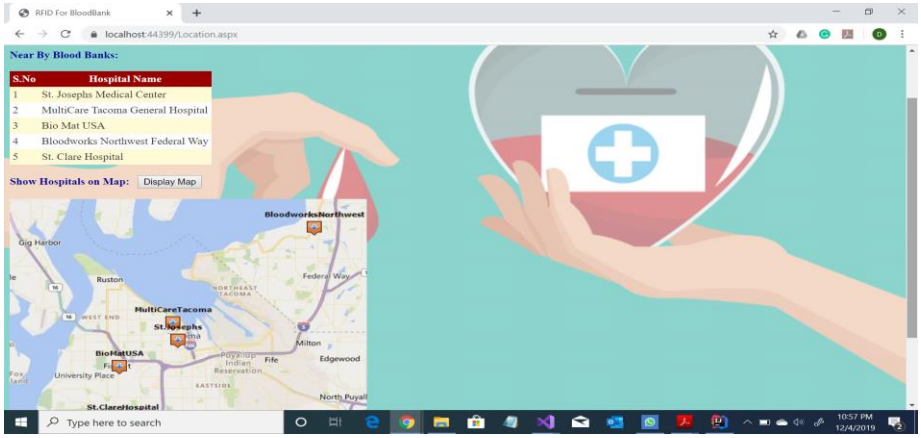
4. REGISTER DONOR PAGE:



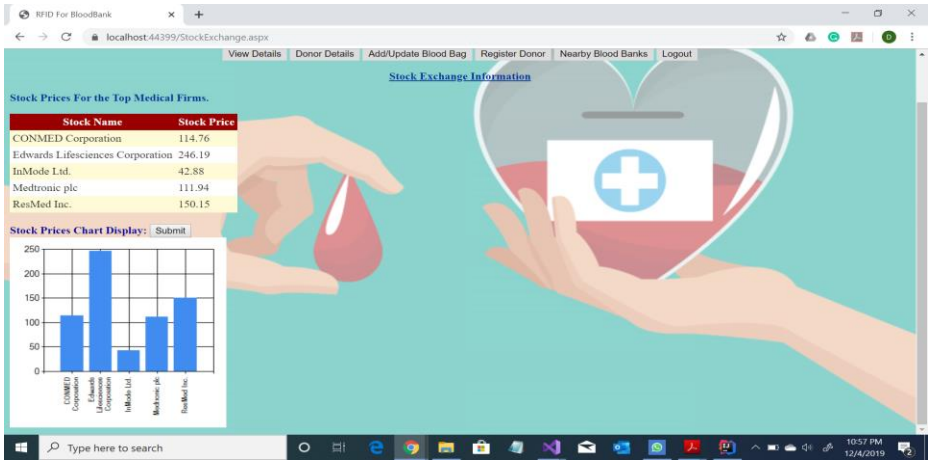
5. UPDATE BLOOD BAG PAGE:



6. NEARBY BLOOD BANKS:



7. GET STOCK:



8. FUTURE WORK:

1. Real time tracking of the blood bags when they are getting transported from one blood bank facility to the other.
2. Mouse over option on each hospital and blood banks to display the blood data available in each center.
3. A more user-friendly User Interface for the clients to interact with the system.
4. Send notifications to donors in case there is a requirement of blood belonging to a group.

9. REFERENCES:

1. Class activities provided by Dr. Eyhab Al-Masri.
2. Stack overflow for some minor issues.

10. ACKNOWLEDGEMENTS:

We would like to express our gratitude to Dr. Eyhab Al-Masri for allowing us to work on this project, which helped us to learn a lot in the field of Services Computing.

Secondly, we would like to thank the students of course TCSS-559A Autumn 2019 for creating such a positive learning and collaborating environment in class.