Contents

Introduction:

The process of climbing up and down of the step in order to evaluate the fitness of the user through manipulation of the readings of their heart rate is known as step test. I am trying to develop a step test program to maintain the records of the staff, user and their history of test. The main programming language used to develop this programme is C#. The tools that are used to develop this programme are Microsoft Visual Studio and Microsoft SQL Server 2014 for the database used in this programme.

System Analysis and Design process:

I have used SDLC also known as system development lifecycle to develop this programme. First of all the requirements of the programme were generated, then it was modelled and designed. It was then implemented practically on both Microsoft visual basic and MS SQL server. After this the programme was tested to figure out if the programme developed was able to meet the requirement outlined in requirement analysis and design process.

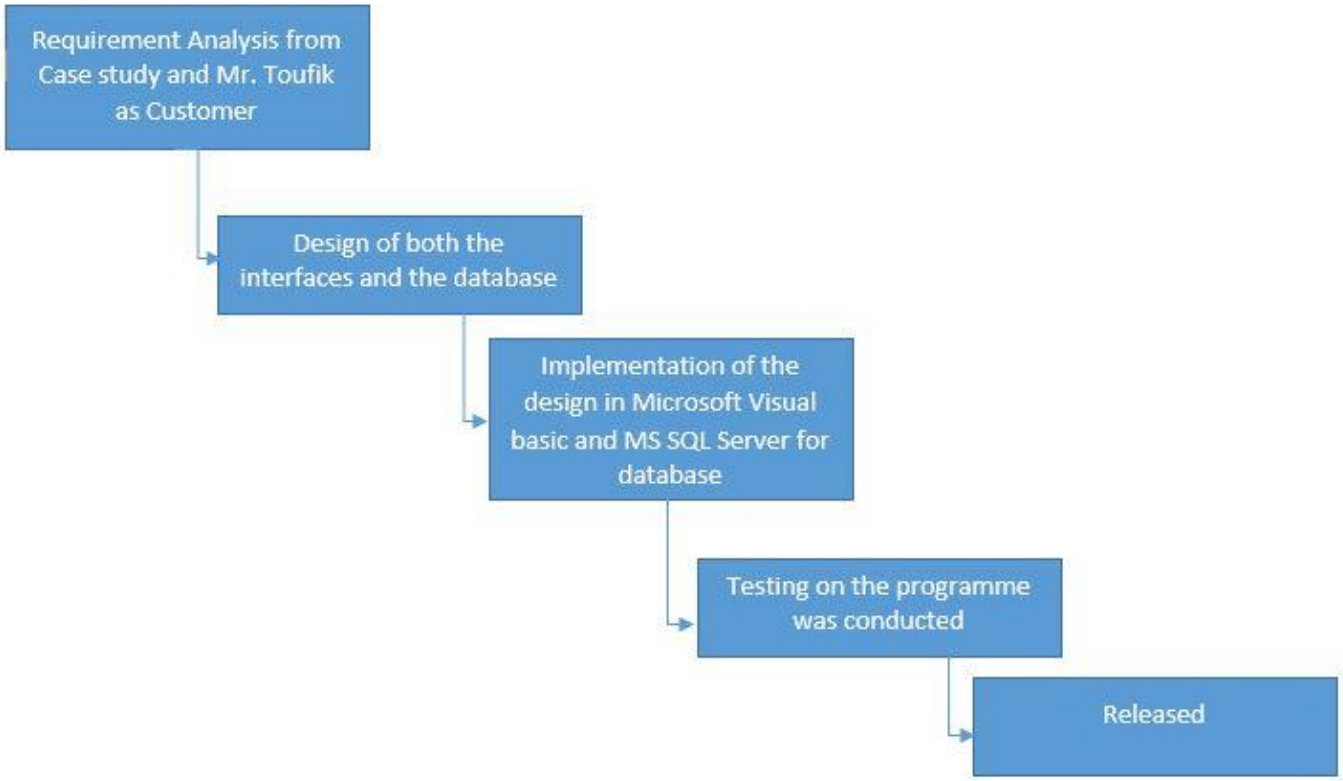


Fig 1: Figure showing the development phases of Chester step test.

Collecting and Understanding the requirements:

The case study was mainly used to collect the requirements of the developing software. Further to that lecturer Mr. Boufenissa Toufik acted as a customer and he was also interviewed to find out the requirements of this solution. Various online materials were also studied and analysed to get the concept of the programme being developed.

Following all these study and analysis I came out with the following functional requirement of the system:

- Staff login and registration
- Staff should be able to update, delete and perform test on customer
- Customer log in and registration
- Test can be performed by individual and also as a group.
- Readiness of the customer for the test should be checked before starting of the test.
- Step height specified should be fixed for the whole test
- Customer takes the test for 2 min each on each level and on completion heart rate is recorded.
- Test should automatically conclude once the heat rate is over 80% maximum heart rate.

- Any record below 50% of maximum heart rate should be ignored while doing final calculation
- All the readings of the test should be saved in the database.
- System will need to deal with special exceptional cases like entering invalid reading etc.

User Interface design:

During the first analysis of the Chester step test program, I developed a simple one user interface that was a joint interface for both staff and customer.

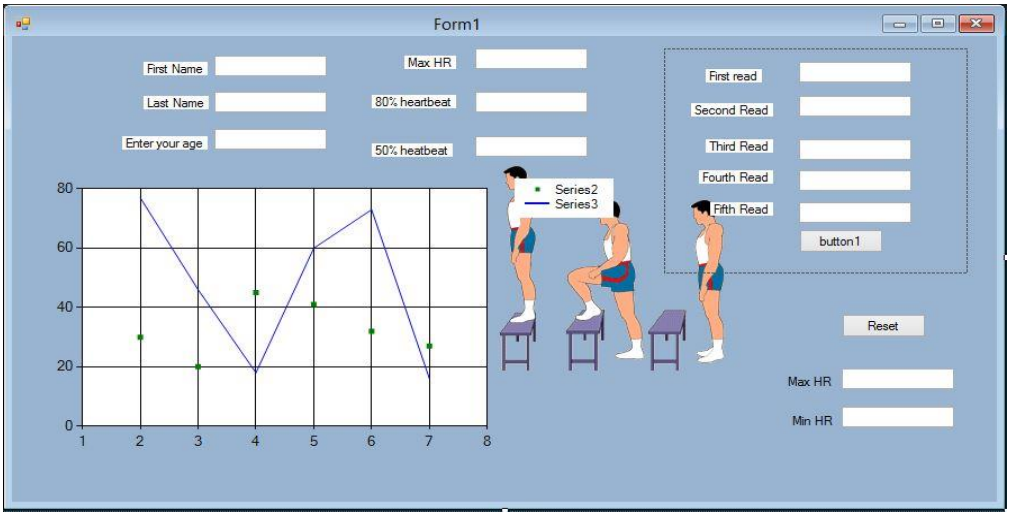


Fig 2: Initial design of the user interface.

Then gradually going forward with the requirement analysis of the Chester step test, I realised that the initial design of the user interface would not meet all the requirement of the Chester step test program being developed. So I broke the single user interface into different user interface so that it meets the requirement.

User Interface for Staff:

User Interface 1:

This user interface is for the staff that allows staff either to log in using their user id or go to the windows form that registers the staff by clicking the Register button.

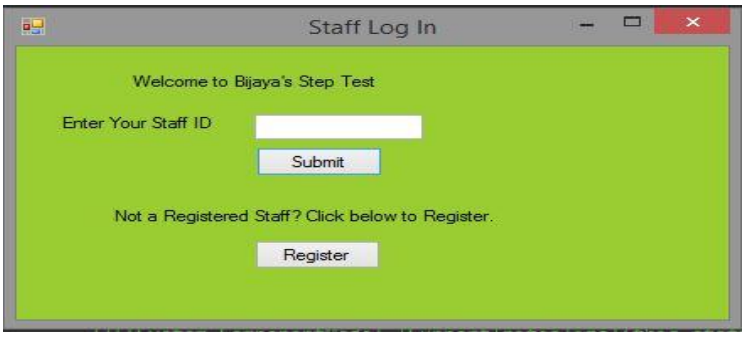


Fig 3: First final user interface for staff

User Interface 2:

This user interface for the staff allows user to register with the system with their first name and last name , while their user Id will be automatically generated and will be displayed to the customer. Log in button directs the staff to User interface 1.

Fig 4: user interface for user to sign up

User Interface 3:

This user interface comes up after successfully entering the correct staff id. This windows form allows staff to enter the customer number to view their details or also allows staff to create or register new customer to the system by clicking “Register” button.

Fig 5: user interface for staff to enter customer ID

User Interface 4:

This is also designed for staff to enter the customer detail of the new customer and register them with the system. Clicking the button “submit” will add the details of the customer to the database.

Fig 6: interface for customer to register the customer

User Interface 5:

This user interface is designed for the use of staff for updating, deleting or initialising the test. Clicking on “update2 button will update the information of the user, “delete” will delete the user information from the database and “perform test” button will take to the windows from where details of the test are entered.

Fig 7: User interface for staff to manipulate customer details

User interface 6:

This user interface is also designed for the staff. While a customer performs the test all the test details are entered to this form. Customer information is automatically generated from user interface 5. Once the “plot the graph” button is clicked then the details of the test will automatically be saved to the database and graph will be plotted. Similarly clicking the “get result” button will generate a new user interface with the details of the result.

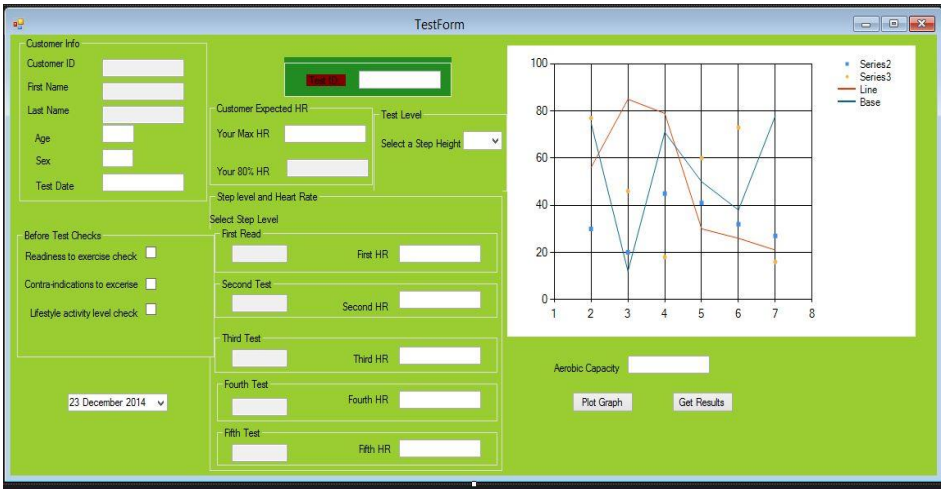


Fig 8: user interface for staff to enter test data

User interface 7:

This user interface is designed for the both staff and customer. While the staff use this interface for giving the remarks on the level of fitness and customer use it to get the results about their fitness.

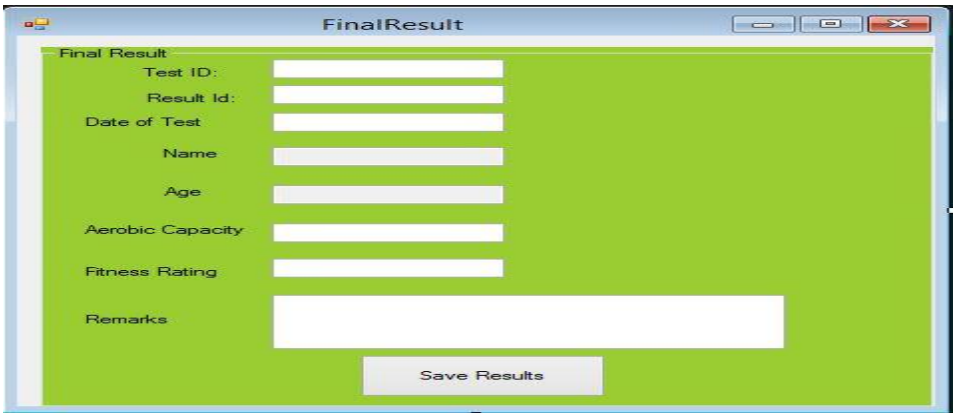


Fig 9: User interface for customer to view their final result

Design process:

Software design can be defined as the process of creating the specification of the software to be developed that fulfils all the specifications and requirements outlined during the requirement analysis process. [1]

The main designs that are used to design this Chester Step Test programs are:

- Use-case Diagram
- Class diagram
- State chart diagram

Use-case Diagram:

Use case diagram can be defined as the graphical representation of the interaction among the different elements of the system. Use case is generally used for defining and clarifying the system requirement. Use case diagram generally consists of following elements: [2]

- The boundary of the system.
- Actors generally the users involved with definition of their role with the system.
- Use-cases, generally the activities done by the actors within the system
- The relationship between all the users identified and the use cases defined.[2]

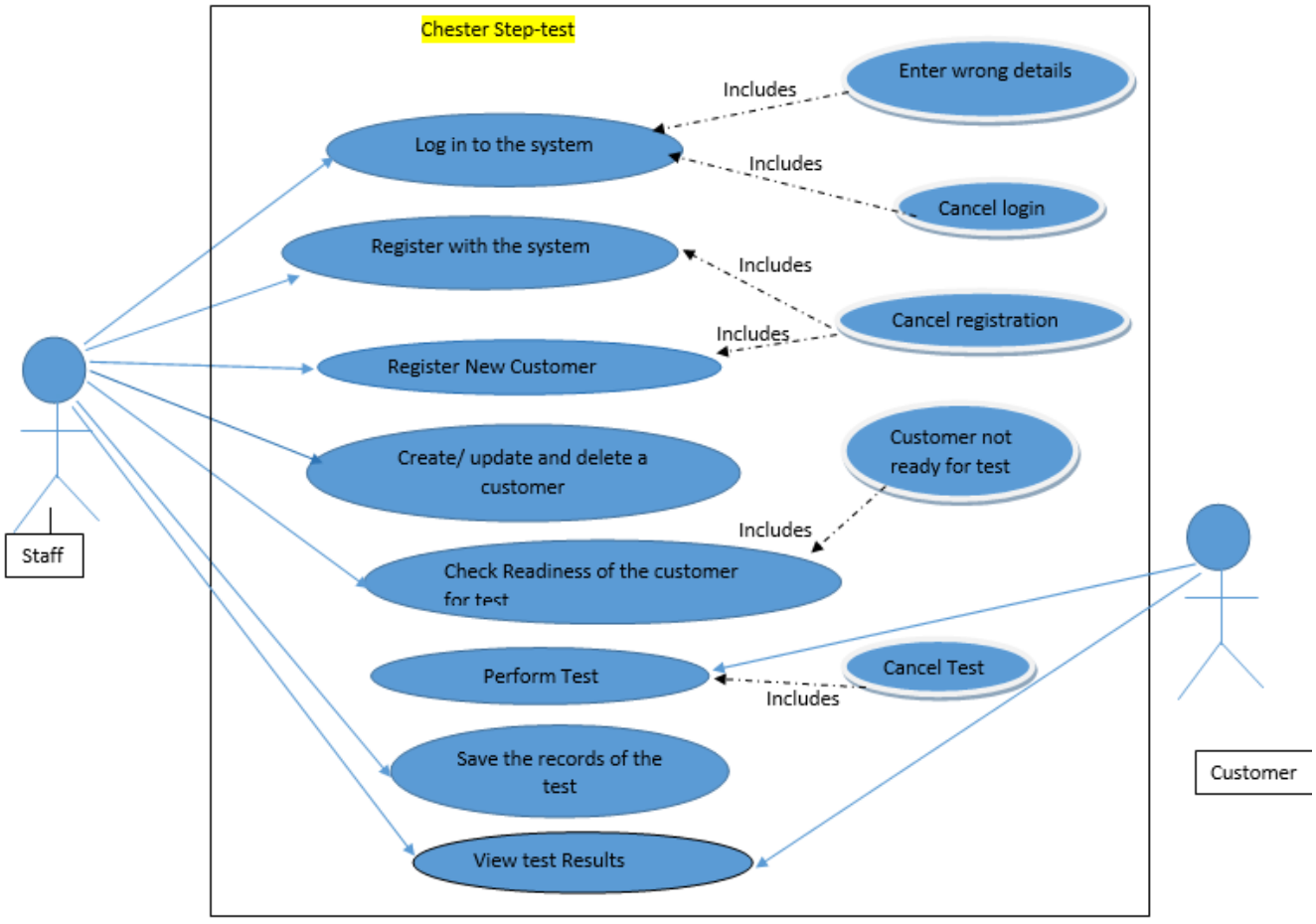


Fig 10: Use-case diagram of the Chester Step Test Program.

The figure above is the use case diagram of the Chester Step Test system/program that I am developing.it has got two actors: Staff and Customer. It also defines what functionality are they going to user while this system is develop.

Staff can log into the system, they can also create a new staff account. They might enter the wrong details or opt to cancel the process. The system will be able to handle this process. Staff can also register new customers, update and delete the customer details. Staff can check the readiness of the customer before the start of the test. If customer aren't ready for the test the system will be able to stop the testing process. Customer take part in testing process.

This system will be able to cancel the test at any point as necessary. The test results are stored in the database by the staff and Customer will be able to view the test results.

Class diagram:

Class diagram can be defined as the static diagram that represents the static view of the application. Class diagram are used to define and document the different aspect of the system. [3]Not only that, it is also used to generate the base for the codes that can be executed of a programme. Class diagram generally represents all the attributes and operations of the every class of a programme or system. [3] Class diagrams are only the UML diagram that can be mapped directly with the object oriented languages. That is why it is the most preferred UML diagram used in object oriented system development environment. [3]

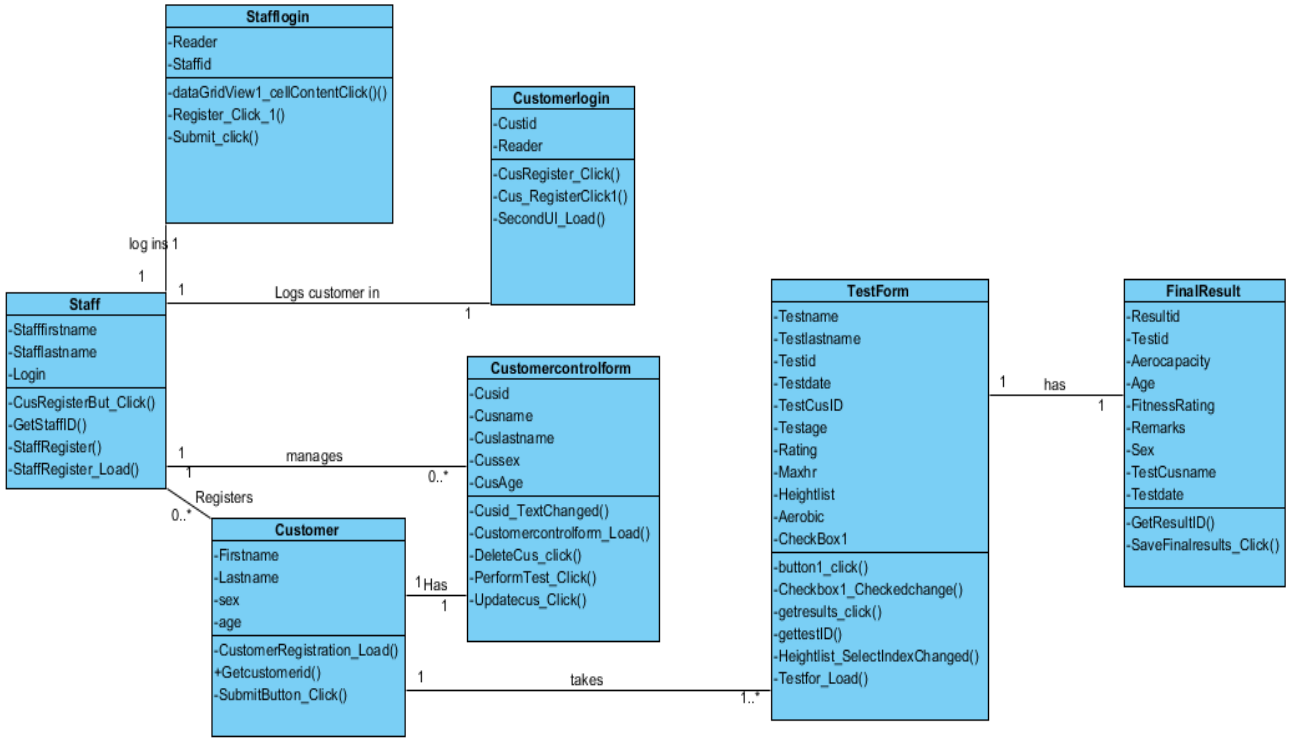


Fig 11: Class- diagram of the Chester Step program.

The above figure represents the class diagram of the Chester Step test system. All the classes represents its own set of attributes and the methods used within it. Above class diagram represents the association within themselves. Staff registers 1 or more customer and also manages 1 0r more customer information. One staff logs in at one time and also logs one customer at a time. One customer can take one or more test while each test has only one result.

Sequence diagram:

A sequence diagram can be defined as the diagram that represents the order of the process. It also represents how the process occur within the system. The sequence diagram generally represents the whole logical views that is being set out in the use-case diagram. [4]

The following two figures are the sequence diagram of the Chester step test program. First of all staff registers with the system and is notified back with the Staff id. If the staff has already been issued with the Staff id then he/she can log into the program using staff id. Once he/she is in the system he/she can register a new customer. While doing so the staff will be notified with the customer id. That customer id is used to log the customer in the system. Once the staff logs customer into the system, the staff can update or delete the customer details. On update or deletion the

staff is notified if the update or deletion is successful or not. Staff can also initialise the test with the customer id and customer takes part in test. Once the test is completed the results are displayed.

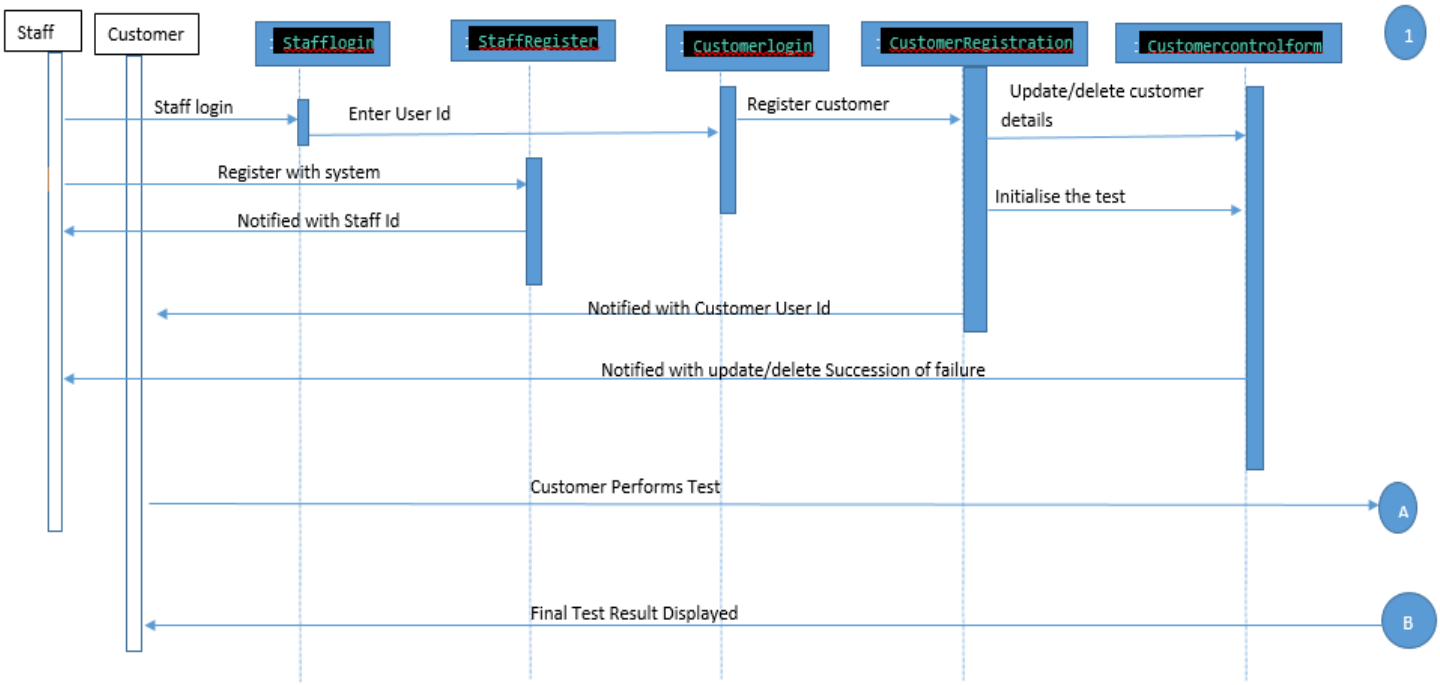


Fig 12: Sequence diagram of the Chester step test (I)

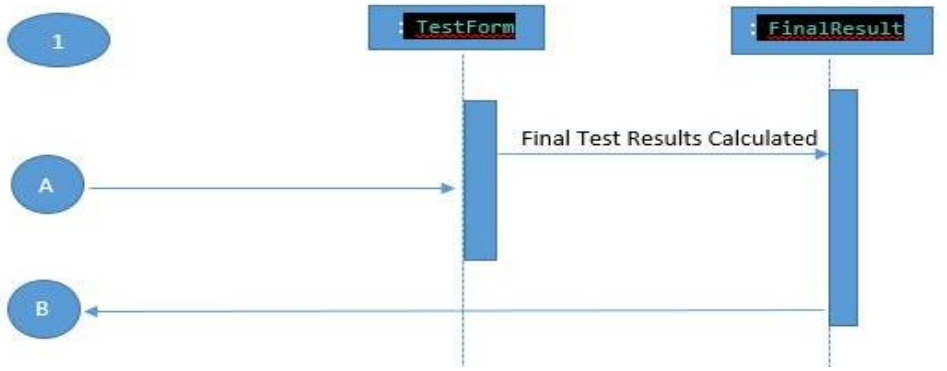


Fig 13: Sequence diagram of the Chester Step test (II)

Database Design for Chester Step Test: [5]

The process of design the tables, its entities, attributes and their respective datatypes is known as database design. It is the process designing the model of the database in detail. As Chester step test requires the data to be stored we require database to be added in the system. As mentioned in introduction My SQL server 2014 was used to design and create the data base. Generally data base design has two models:

- Logical design
- Physical design

Logical design of a database can be defined as the design that consist of the table and the relation between the tables. During the development of logical design/logical schema all the necessary tables are identified and a relation is figured out to construct a relationship between the tables. Similarly in the development of the database for Chester step test following tables were identified with relation.

- Staff
- Customer

- Female_agegroup
- Male_agegroup
- Aerobic_rating
- Test
- Test_result

Relationship between the entities:

- Staff manages 1 or many customers
- Customer can have one or many test
- Customer can be of male_agegroup or female_agegroup
- One male_agegroup/female_agegroup can have one or more aerobic_rating
- Every test has one Test _result

The figure below is the logical design of the database for Chester step test.

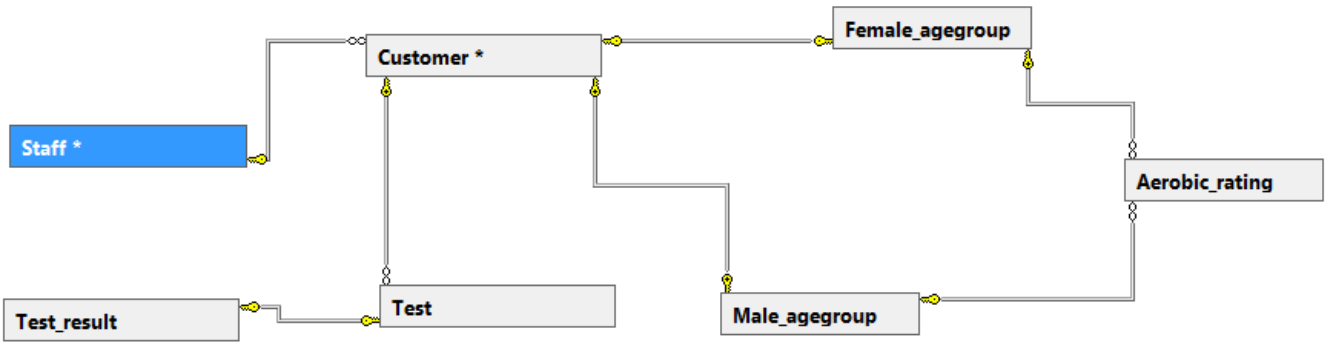


Fig 14: Logical design of the database (steptest) for Chester step test.

Physical design of the database is defined as the identifying all the attributes and its datatypes along with the entities, name of table and their relation. Following figure represents the entity relationship diagram of the steptest database. Entity relationship defines the graphical representation of the entities and its attributes and the relationship between the entities.

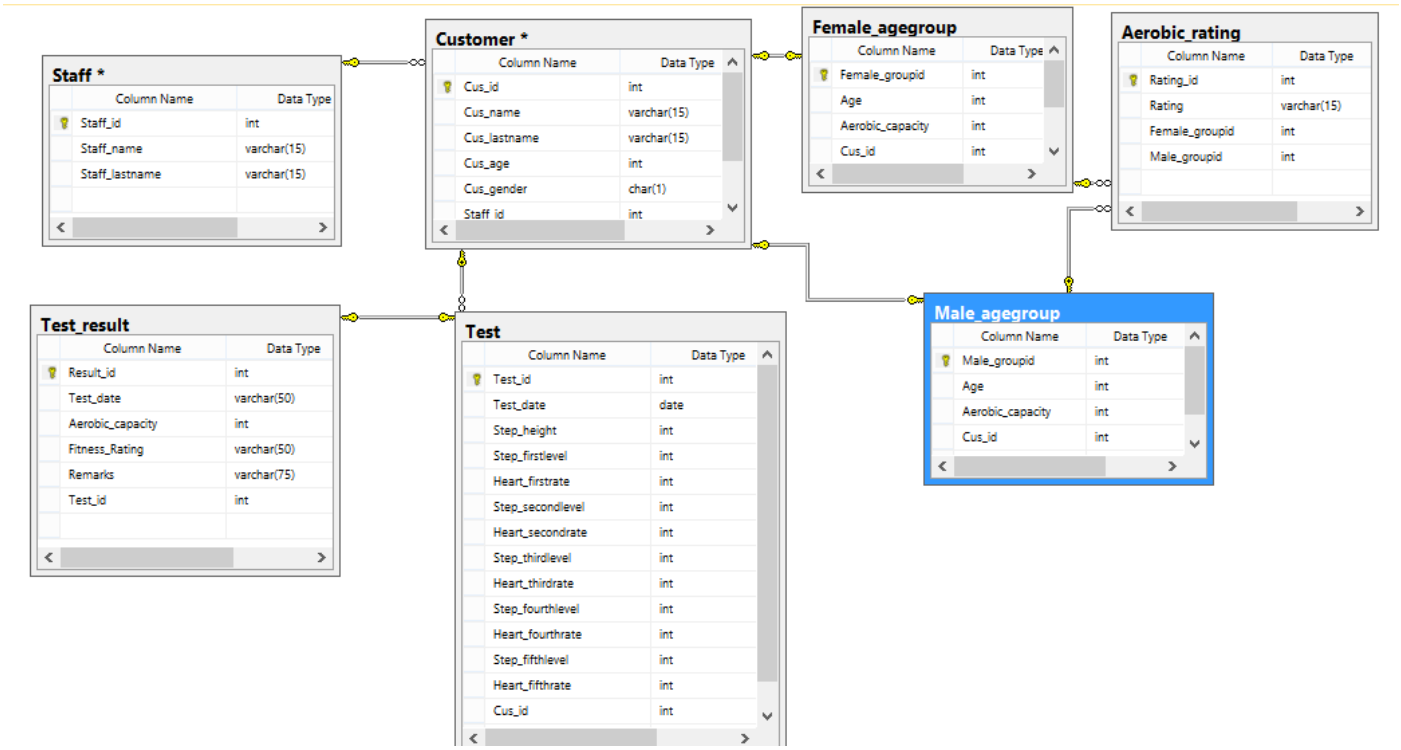


Fig 15: Entity relationship of the steptest database.

Software Testing:

The process of executing or examining the software to find any defect/any bugs in it is known as software testing. It is generally conducted to determine whether the software meets the requirement specified. [6]

There are many kinds of software testing techniques. Some of them are unit testing, integration testing, connectivity testing, debug defect testing, white box testing, black box testing.

Test plan:

Test plan be defined as the approach of testing the system of software (in this case) to typically define the scope of the software, its reliability, its functionality and its limitations. [7]

Strategy and approach to the testing and justification:

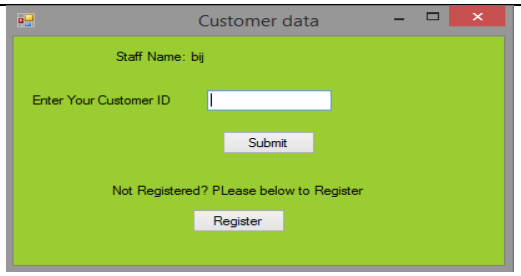
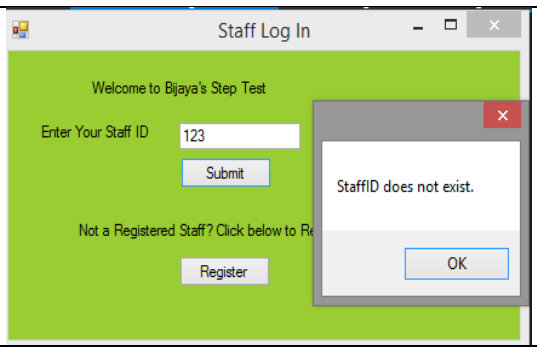
Within the various technique of the testing, all types of software testing doesn't suite all kinds of software. It is always good to find out which software technique will be the best solution for testing the software. Similarly through research I decided to use unit testing, integration testing, database connectivity testing and debug defect testing.

I decided to use the unit testing for testing Chester step test because it has got many units. It is necessary to make sure that each unit functions properly to get the Chester step test system free of error. Similarly as it has got many units it is also necessary to determine that these units are working together and their integration is good. I also decided to carry out database connectivity because it is highly important to determine that the Chester step test system is connected to the database. As data are being recorded to the database if the connection is not correct then storage of data will not be possible. Similarly debug defect testing will help to figure out if there is any errors in the code.

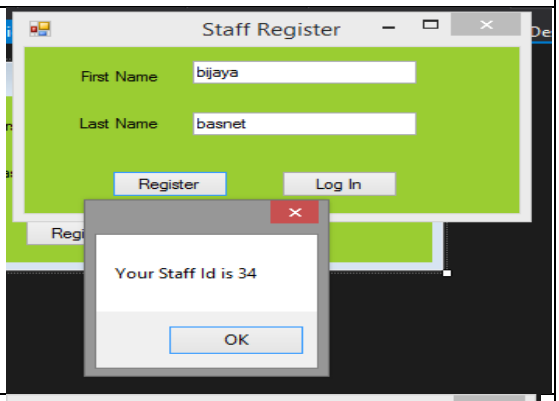
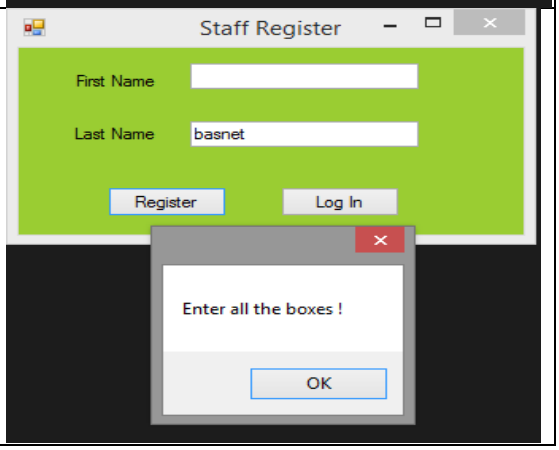
Unit testing of Chester Step Test and validation of login details:

During the unit testing each and every functionality of the each form within the Step test will be tested will be tested:

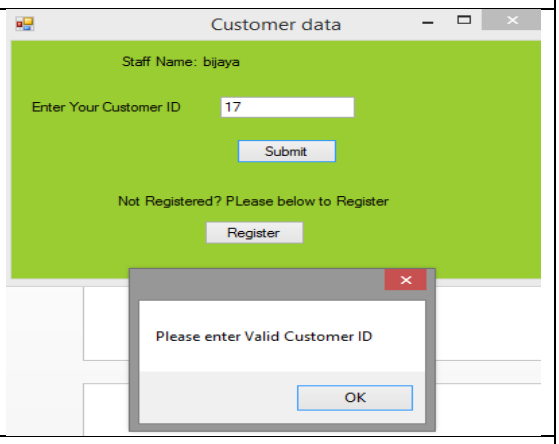
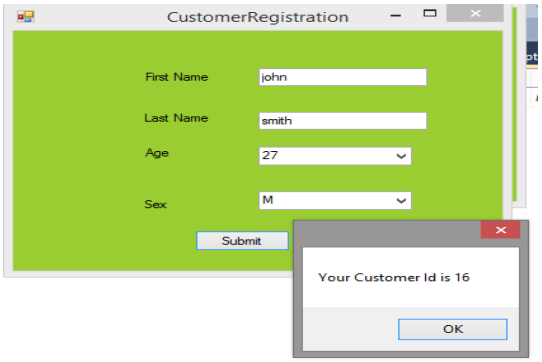
Testing of Staff log in form:

Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	If validation of user id is done, User id "1"	Should be directed to Second UI form (Customer Data). It should display staff name.	Validated the user ID and directed tot the second UI form. Displayed staff name	
ii)	If validation of user id is correct , User id "123"	Should display error message	Error message displayed	

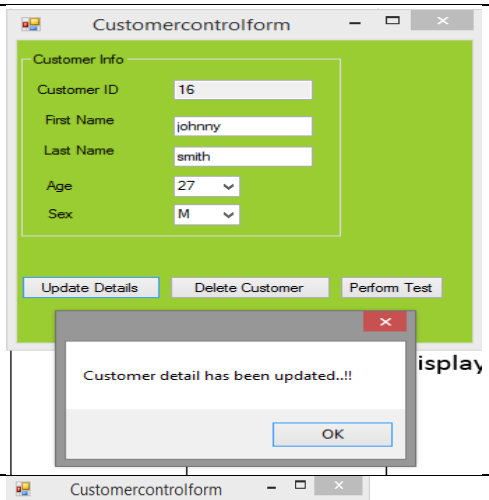
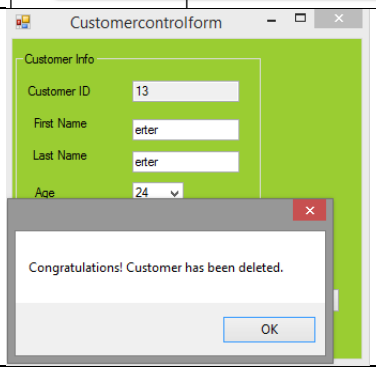
Testing of StaffRegister Form:

Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	Entered first name as “bijaya” last name as “basnet”	It should display Staff Id	Staff Id displayed	
ii)	First name box was left empty	Error message should be displayed	Error message displayed	

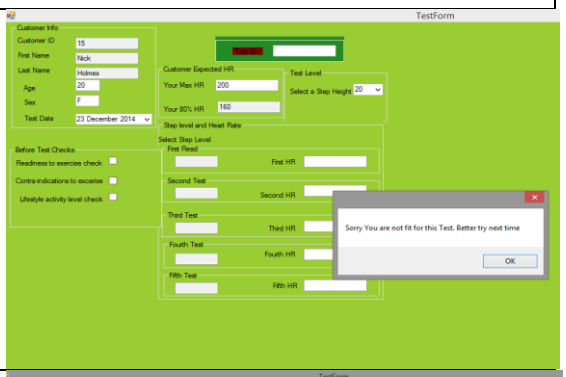
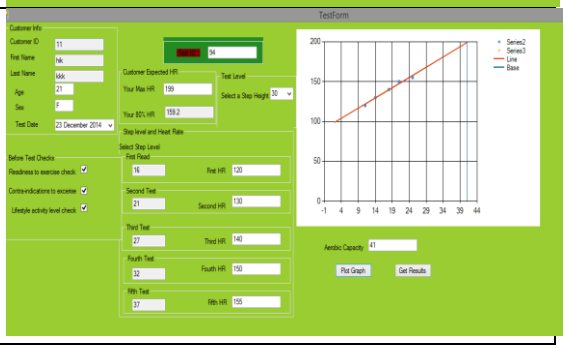
Testing of Customer data Form:

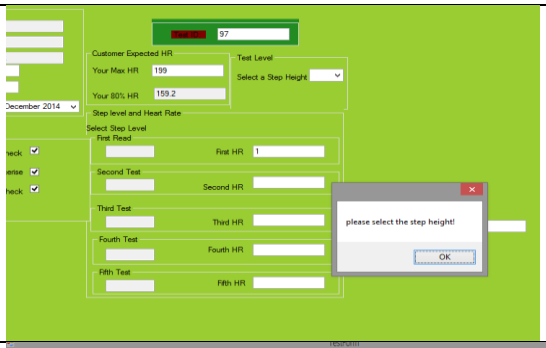
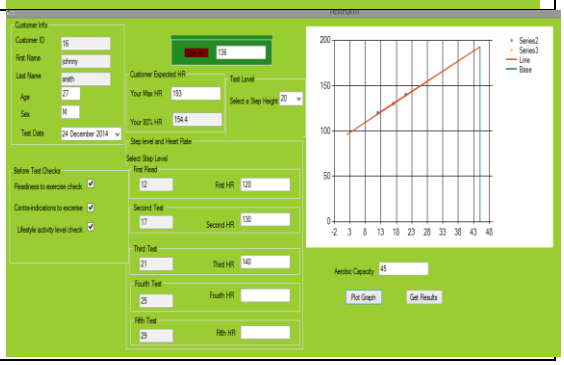
Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	Entered customer Id as “17” to validate the user Id	Error message should be displayed	Error message displayed	
ii)	If validation of customer ID is correct, user id used “16”	It should display customer details	Customer details displayed hence validated	9 

Testing Customer control form:

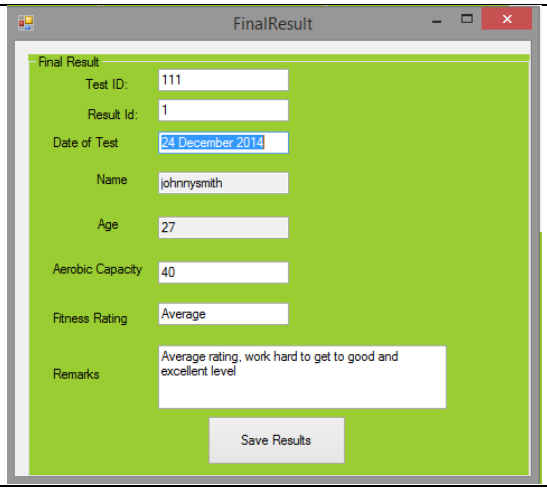
Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	If clicking “update” button, updates the details of user Id “16”	Success message to be displayed	Success message displayed	
ii)	If clicking “Delete” button, deletes the details of user id “13”	Deletion success message to be displayed	Deletion success message displayed	

Testing Test Form:

Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	Before checks box not checked	Error message should be displayed	Error message displayed	
iii)	Clicking on plot graph button	Graph should be plotted	Graph plotted	

iv)	Step height left empty	Error message should be displayed	Error message displayed	
v)	Entering maximum of three Heart reading only	Graph should be plotted	Graph was plotted	

Testing the Final result form:

Test Number	Test Condition	Expected result	Actual result	Screenshot as a proof
i)	On loading The form	Should display the aerobic capacity , fitness rating and Remarks	It displayed the aerobic capacity , fitness rating and Remarks	

Integration testing:

Integration testing is the process of finding how to units collaborate with each other. In Chester step test, links of each form to the other form will be tested.

Test Number	Form tested	Button clicked	Expected result	Actual result
1)	Staff register	Log In	Should direct to Staff log in form	Staff log in form was displayed
2)	Staff log in form	Register	Staff register form should be displayed	Staff register form was displayed
3)	Staff log in form	Login with correct user id	Customer data form should be displayed	Customer data form was displayed

4)	Customer data form	Log in with correct customer id	Customer control form should be displayed	Customer control form was displayed
5)	Customer data form	Register	Customer Registration form should be displayed	Customer Registration form was displayed
6)	Cutomer Control Form	Perform test	Test form should be displayed	Test form displayed
7)	Test form	Get Results	Final results form should be displayed	Final results Form displayed

Debugging, Defect testing:

Defect testing is the testing procedure defined to detect the errors in the system. Once the defect are found then it is pinpointed in the system and removed. [8]

Similarly defect testing was conducted through Chester step test program. One error in the code was pointed out as follows and were corrected:

i) Testdate was typed instead of Test_date:

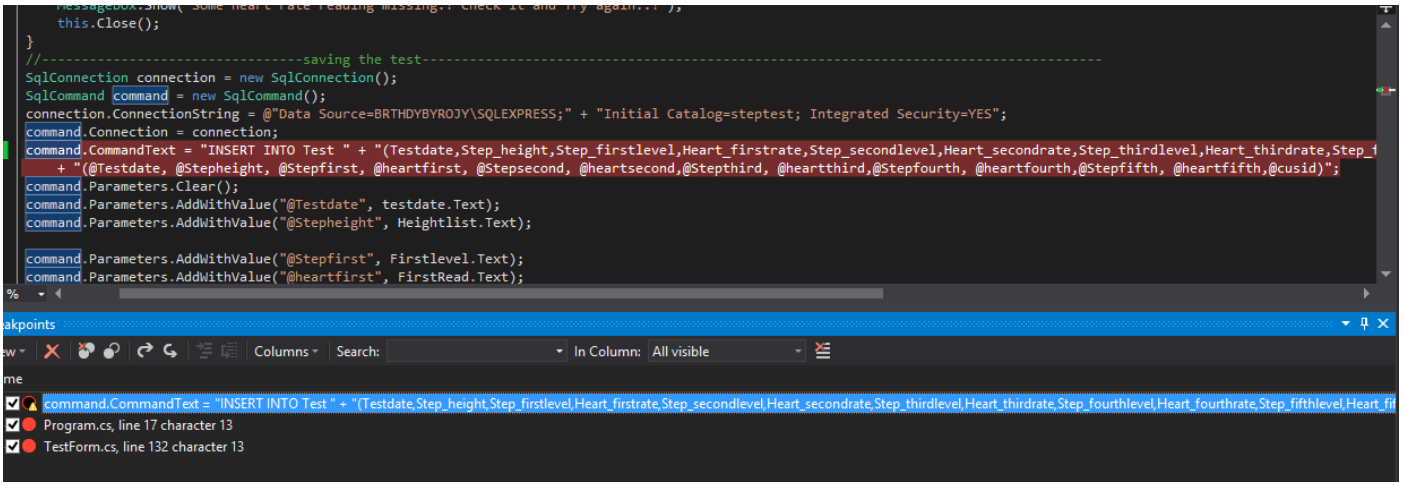


Fig 16: figure showing error at line 132 character 13.

It was highlighted while debugging was being done. The above screen shot clearly stated where the error was. Testdate was changed to Test_date and the error was solved.

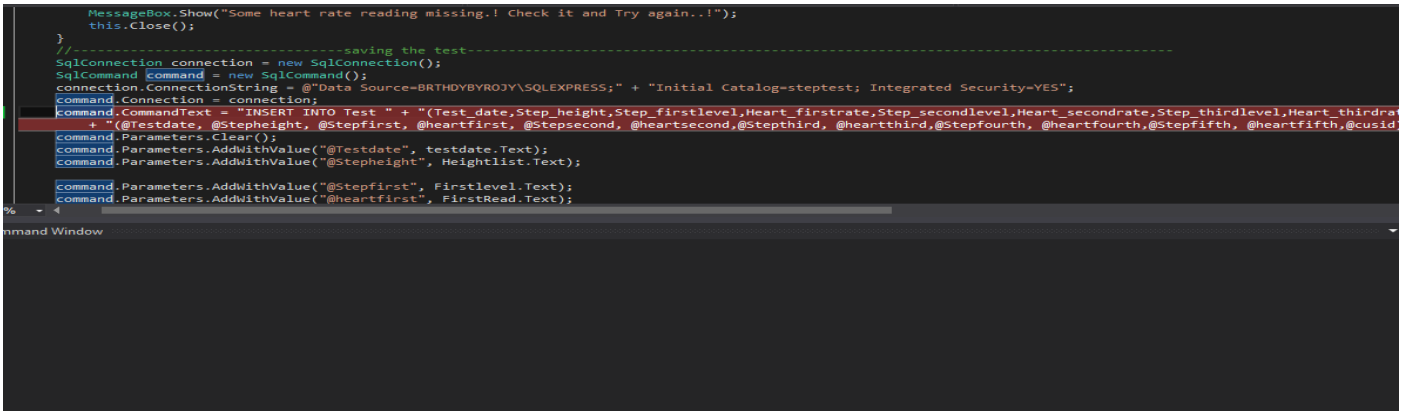


Fig 18: Screenshot showing no error once the issue has been solved.

Database connectivity test:

To test the database connectivity with Chester Step test program, customer details were used to delete, update and add to the database. New customer was added to the database, hid details were updated and was finally deleted.

Inserting to customer table:

Step 1: Customer Registration form was filled, with all required data.

Step 2: Clicked on “Submit”.

Customer Id number 17 was issued.

Step 3: opened the customer table in steptest database

Result: the record of customer was found:

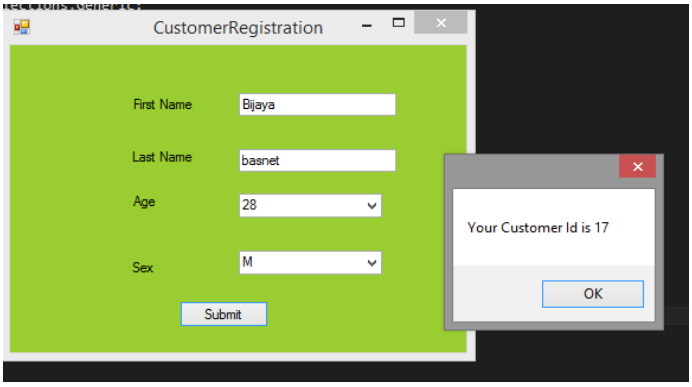


Fig 19: screenshot showing the data entered and onfirmation of Cutomer id.

BRTHDYBYROJY\SQL...t - dbo.Customer X | BRTHDYBYROJY\SQL...est - dbo.Table_1

Cus_id	Cus_name	Cus_lastname	Cus_age	Cus_gender	Staff_id
16	johnny	smith	27	M	NULL
17	Bijaya	basnet	28	M	NULL
NULL	NULL	NULL	NULL	NULL	NULL

Fig 20: Screenshot of table customer with the details of the customer id “17”.

Updating to customer table:

Step 1: Customer details for customer id “17” were pulled out in the screen.

Step 2: first name was changed to “Andrew” from Bijaya.

Step 3: “update” button was clicked.

Update successful message was displayed

Step 3: opened the customer table in steptest database

Result: the name of the customer was changed from “Bijaya” to “Andrew”.

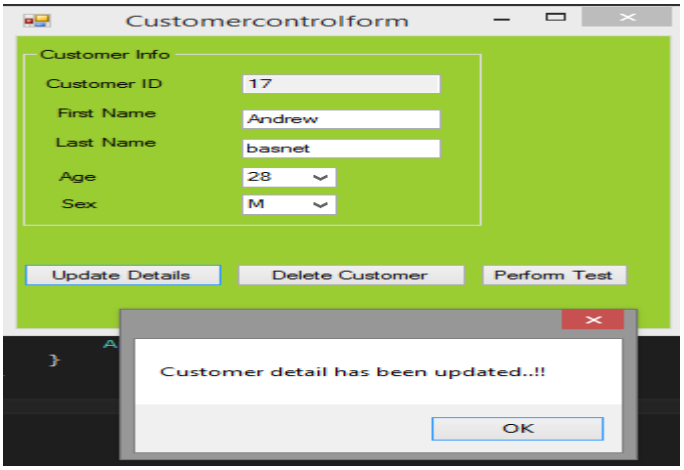


Fig 21: screen shot displaying the update being successful.

BRTHDYBYROJY\SQL...t - dbo.Customer | BRTHDYBYROJY\SQL...est - dbo.Table_1

Cus_id	Cus_name	Cus_lastname	Cus_age	Cus_gender	Staff_id
16	johnny	smith	27	M	NULL
17	Andrew	basnet	28	M	NULL

Fig 22: screenshot of customer table with update being displayed in user id “17”

Deleting from customer table:

Step 1: Customer details for customer id “17” were pulled out in the screen.

Step 2: Clicked on “delete customer” button.

Delete successful message was displayed

Step 3: opened the customer table in steptest database

Result: Customer Id “17” no longer exists.

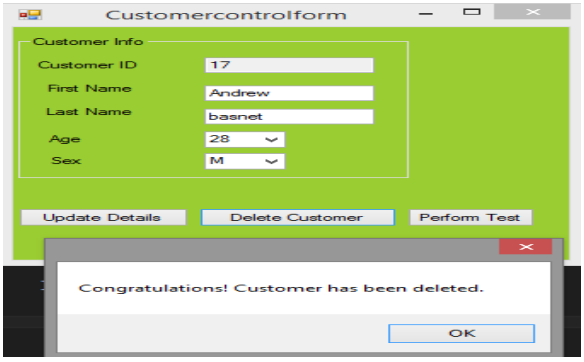


Fig 23: Screenshot showing the deletion of Customer as successful

BRTHDYBYROJY\SQL...t - dbo.Customer | BRTHDYBYROJY\SQL...est - dbo.Table_1

Cus_id	Cus_name	Cus_lastname	Cus_age	Cus_gender	Staff_id
16	johnny	smith	27	M	NULL
NULL	NULL	NULL	NULL	NULL	NULL

Fig 24: Screenshot of customer table, customer id “17” no longer exists.

So from the above test it was concluded that the database connection test to the Chester step test is successful.

Inserting the data to Test table:

Step1: all the required fields were filled up

Step 2: clicked on “plot graph”

Message displayed with successful data storing.

Step 3: Opened the test table in steptest database

Test records were found.

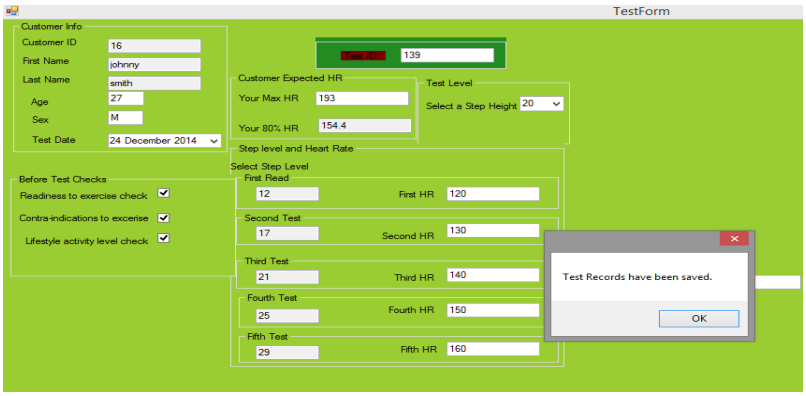


Fig 25: Screenshot of Chester test showing that the test data were saved.

BRTHDYBYROJY\SQL...eptest - dbo.Test

Test_id	Test_date	Step_heiqht	Step_firstlevel	Heart_firstrate	Step_secondle...	Heart_secondr...	Step_thirdlevel	Heart_thirdrate	Step_fourthlevel	Heart_fourthrate	Step_fifthlevel	Heart_f
134	2014-12-24	20	12	110	17	120	21	130	25	140	29	150
135	2014-12-24	15	11	110	14	120	18	130	21	140	25	150
136	2014-12-24	15	11	110	14	140	18	150	21	160	25	170
137	2014-12-24	20	12	120	17	130	21	140	25	0	29	0
138	2014-12-24	15	11	120	14	130	18	140	21	150	25	160
139	2014-12-24	15	11	120	14	140	18	150	21	160	25	170
140	2014-12-24	20	12	120	17	130	21	140	25	150	29	160
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Fig 26: screenshot of the test table with the data stored to it.

Inserting data to Test_result table:

Step 1: Clicked the save record button on final result Form.

Error message displayed.

Step 2: Opened the test_result table

No data found

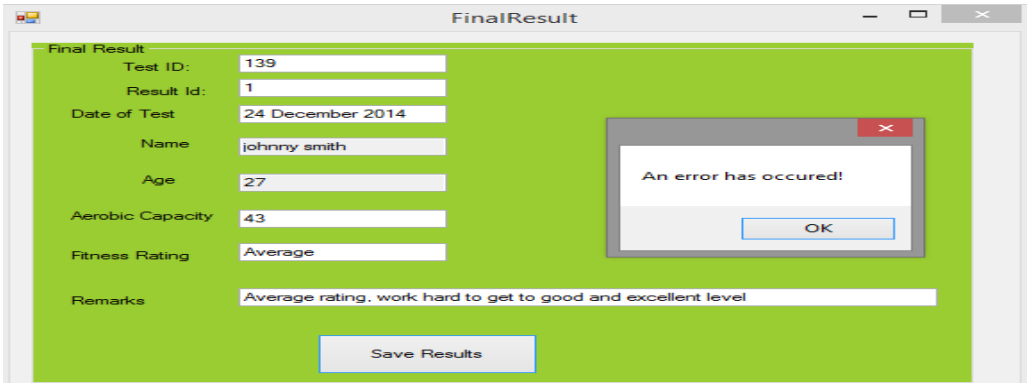
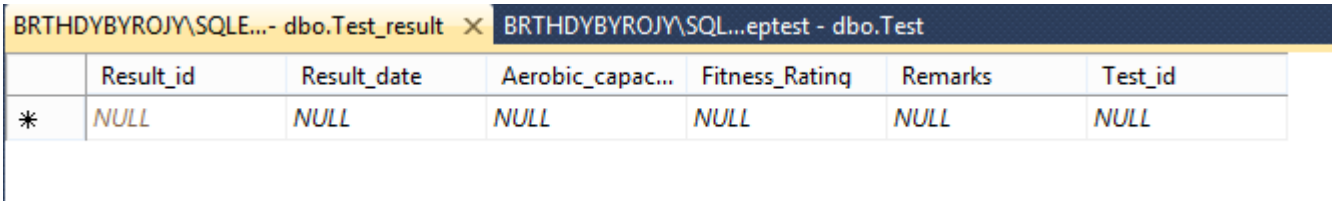


Fig 27: screenshot of the Chester step test system showing error message.



BRTHDYBYROJY\SQLE...- dbo.Test_result | BRTHDYBYROJY\SQL...eptest - dbo.Test

	Result_id	Result_date	Aerobic_capac...	Fitness_Rating	Remarks	Test_id
*	NULL	NULL	NULL	NULL	NULL	NULL

Fig 28: Result_test table showing no records.

Conclusion: Thus it was identified that connectivity of database to the Insert, update and deletion to the "Customer" table was successful. It was also successful in inserting the test data to "Test" table but unfortunately the Inserting the result data to "Test_result" was unsuccessful. Data set was tried to insert data to "Test_result2" table but it didn't work out. Also I assumed that the "date" data type might be creating a problem in writing to the Test_result table. So I changed the Test_date to varchar (50) but also it didn't allow writing/saving to the Test_result table.

Limitations of Chester Step Test program & Recommendation:

As every program has some weakness, Chester step test also has got some weakness. Chester Step Test cannot save/store the final test result to the database. Various ways of storing was tried to store the data but it didn't work out. While storage of customer information, staff information and test was successful, test results weren't being able to be saved to the database. Dataset was also tried to store these results but storage wasn't possible. It also cannot remove any heart rate less than 50% of the maximum heart rate but it does conclude the test if any of the heart rate reading is above 80% of maximum heart rate. It can still be successful if these recommendations are taken implemented to this current Chester step test system:

- Any heart reading less than 50% can be discarded from the scenario.
- Test data can be saved to database.
- Modification of user interface to look more professional.

Conclusion:

Thus all the requirements were identified, designs were developed and they were implemented to develop Chester step test. Even though there are some limitations on Chester Step test, I think it can be a successful system if above recommendation can be implemented to this system.

References:

[1] Ralph, P. and Wand, Y. (2009). A proposal for a formal definition of the design concept. In Lyytinen, K., Loucopoulos, P., Mylopoulos, J., and Robinson, W., editors, Design Requirements Workshop (LNBIP 14), pp. 103–136. Springer-Verlag, p. 109 doi:10.1007/978-3-540-92966-6_6.

[2] http://whatis.techtarget.com/definition/use-case-diagram [electronically accessed on 20/12/2014]

[3] http://www.tutorialspoint.com/uml/uml_class_diagram.htm [electronically accessed on 20/12/2014]

[4] http://en.wikipedia.org/wiki/Sequence_diagram [electronically accessed on 20/12/2014]

[5]] http://searchcrm.techtarget.com/definition/entity-relationship-diagram [electronically accessed on 21/12/2014]

[6] http://istqbexamcertification.com/what-is-a-software-testing/ [electronically accessed on 21/12/2014]

[7] http://www.onestoptesting.com/test-plan/ [electronically accessed on 21/12/2014]

[8] http://www.sqa.org.uk/e-learning/SDM05CD/page_06.htm[electronically accessed on 21/12/2014]

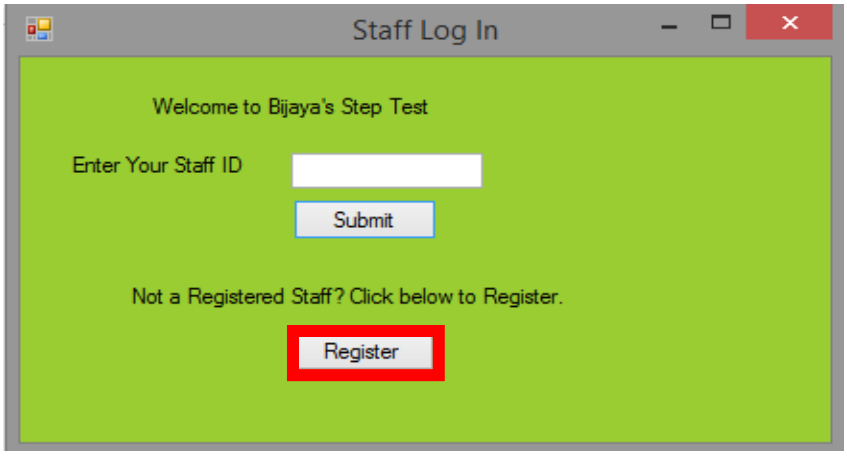
Appendix 1:

User Manual:

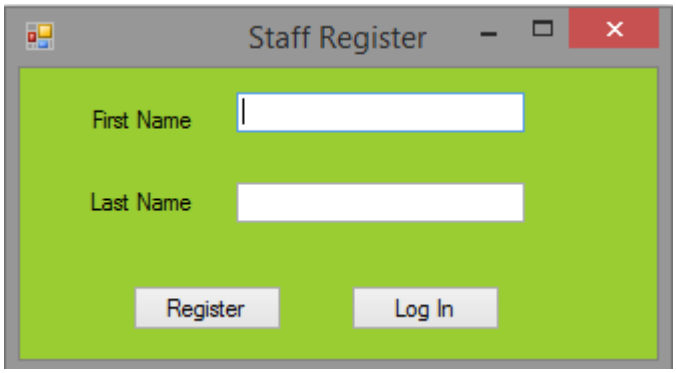
Staff registering with the system:

Step 1: Run the Chester Step Test Program

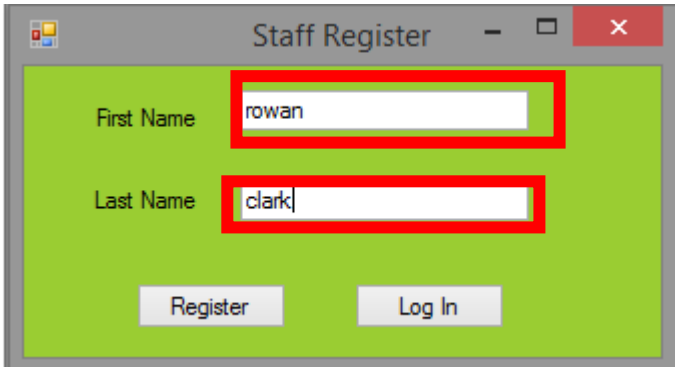
Step 2: Click Register



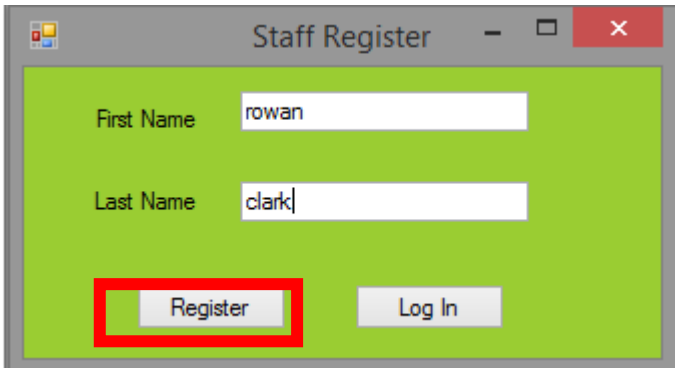
(Note a new Form will open up)



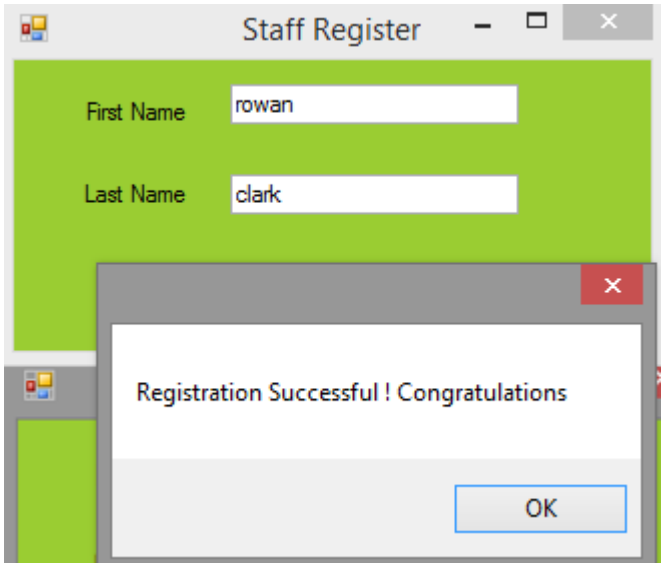
Step 3: Enter your First Name and Last name

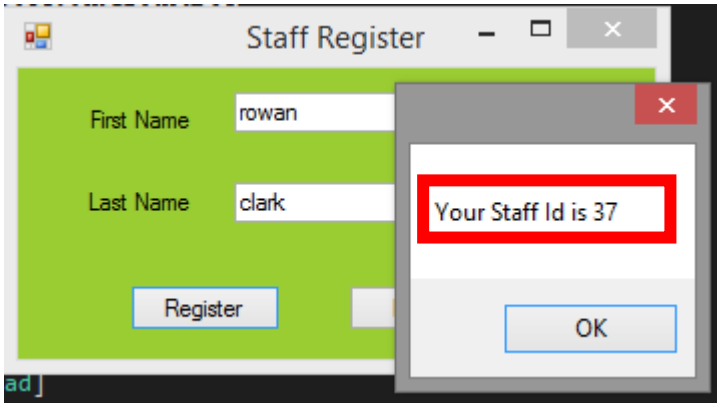


Step 4: Click Register.



[Note as you click Register you will be given successful message followed by your staff Id. please keep it safely as it is going to be ur username to log into the system]

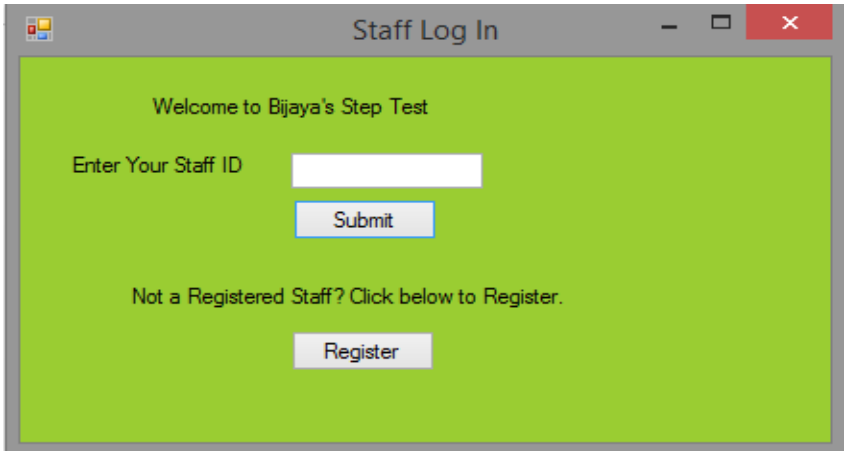




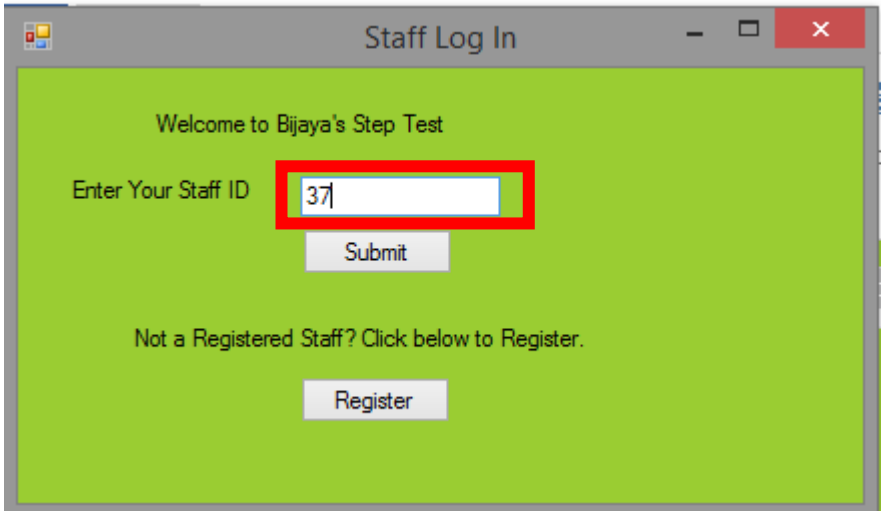
Step 5: Click Ok. Click “Login” button to go to the log in form.

Staff logging on to the system

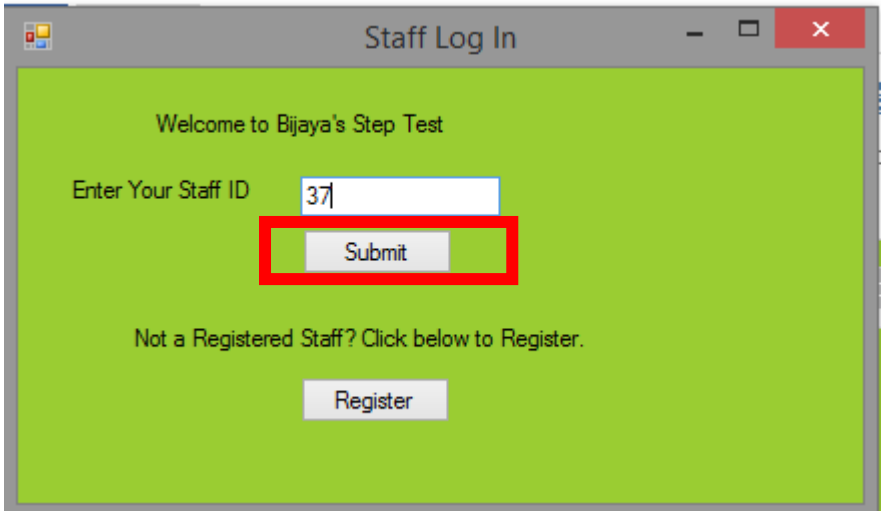
Step 1: Run the Chester Step Test Program



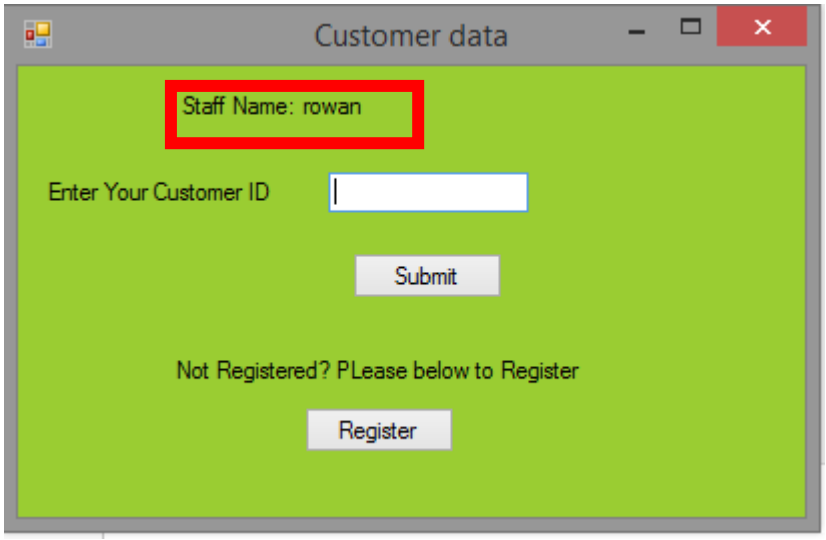
Step 2: Enter Your Staff Id



Step 3: Click “Submit”



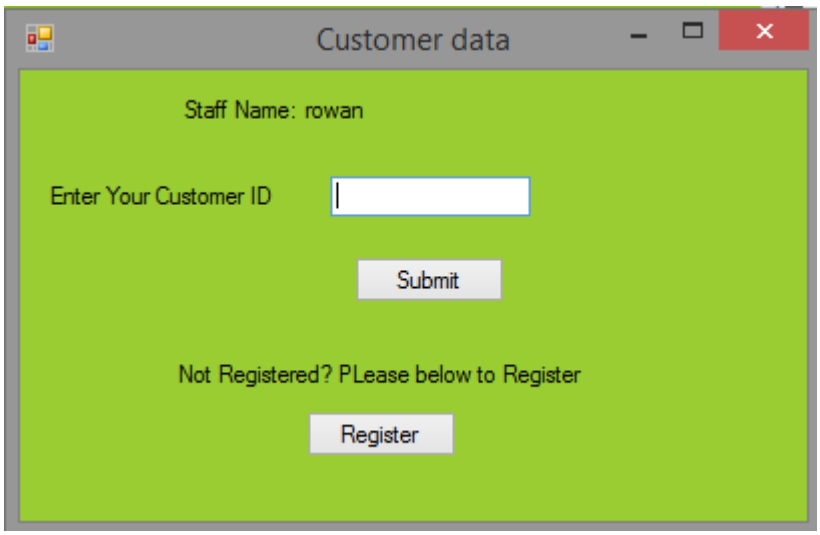
(A new form will open)



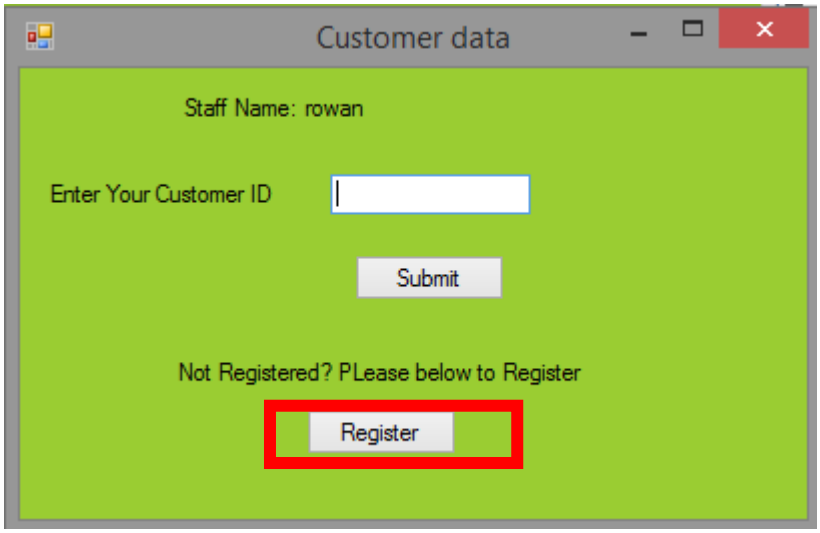
(New form will be displaying your first Name)

Registering the customer by staff

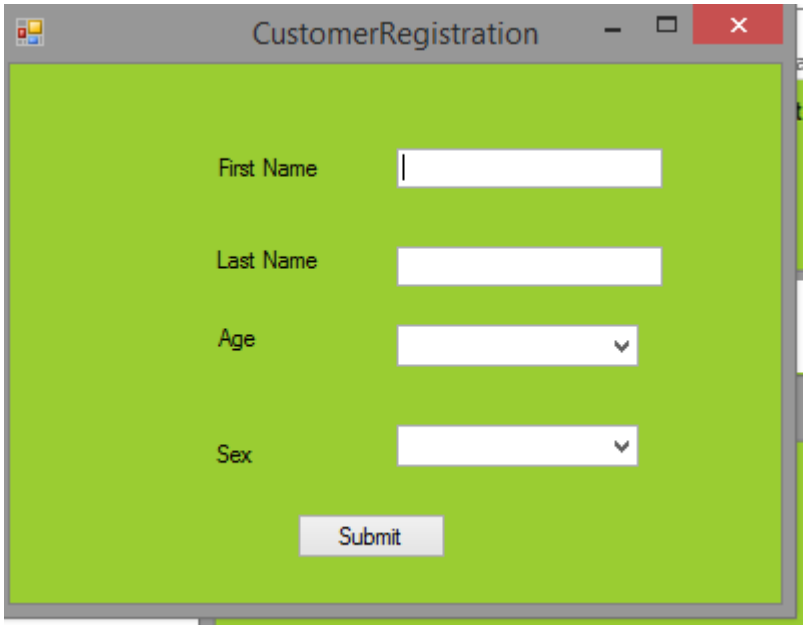
Step 1: Log in using your Staff ID [please check staff logging section to see how to login to system]



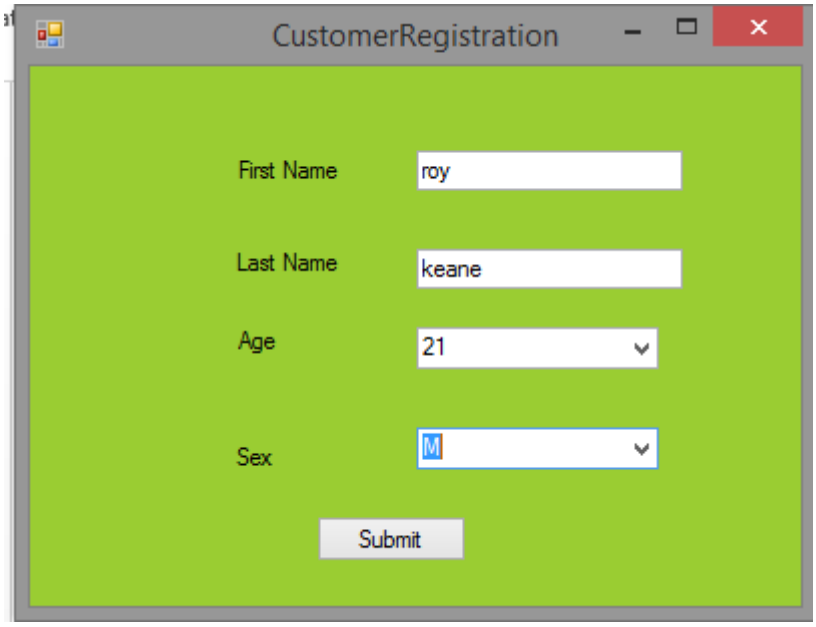
Step 2: Click Register



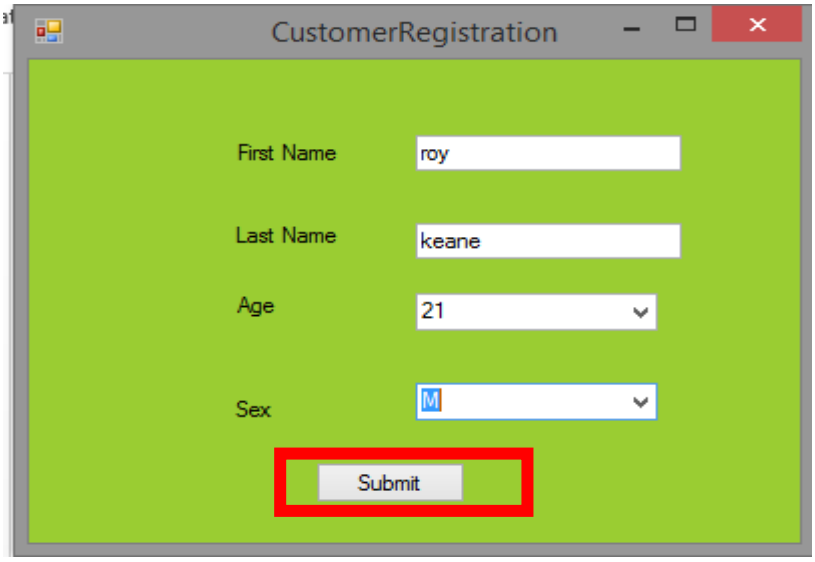
(Note a new form will open up)



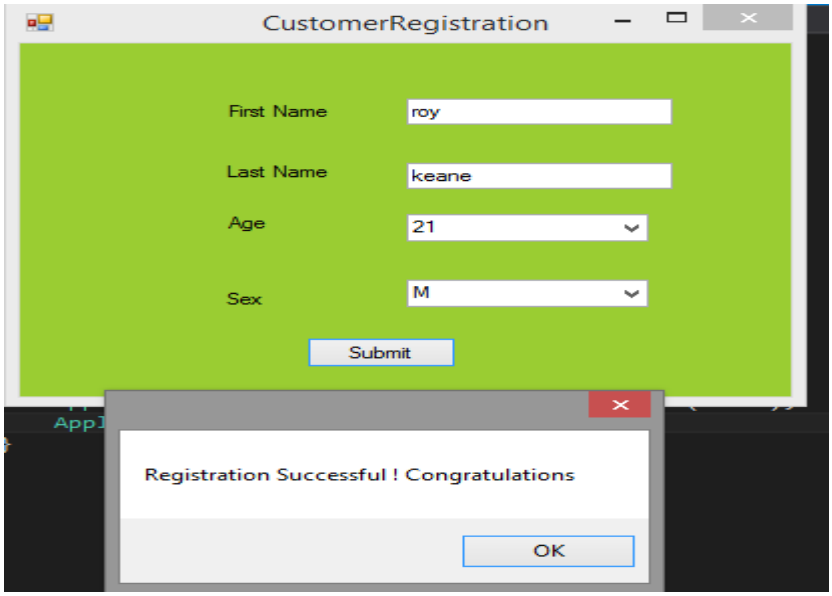
Step 3: Fill all the details in the form.



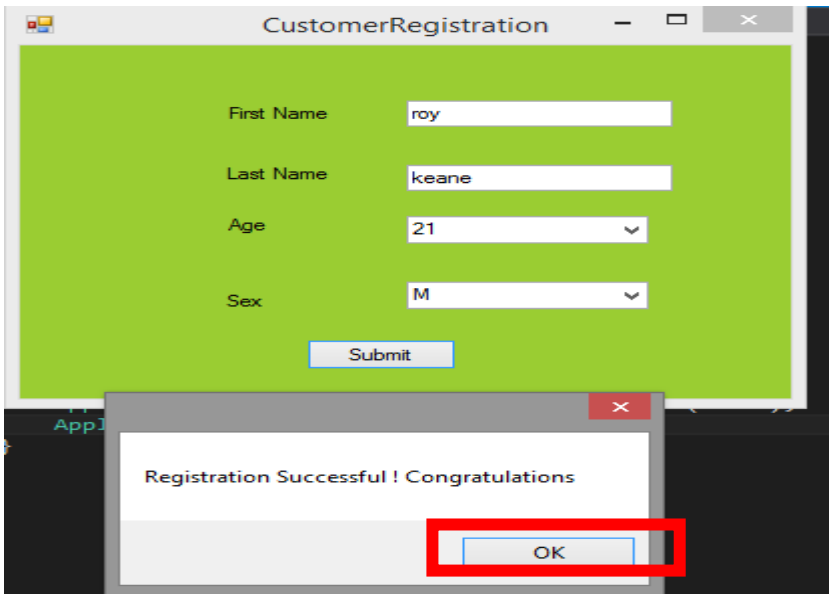
Step 4: Click Submit



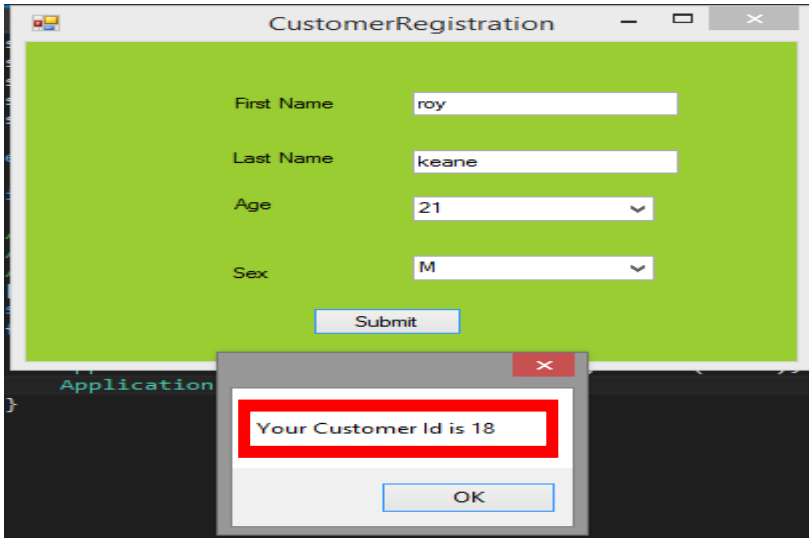
[You will be grated with a successful message]



Step 5: Click ok



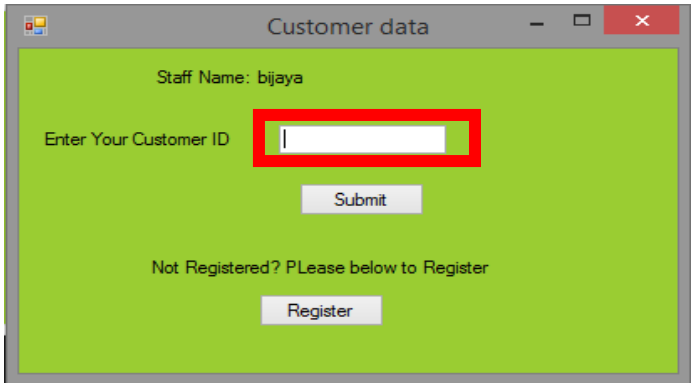
[Your Customer id is issued, keep the customer ID safe as it will serve as a username for using Chester Step Test]



Updating / deleting Customer Details (staff only):

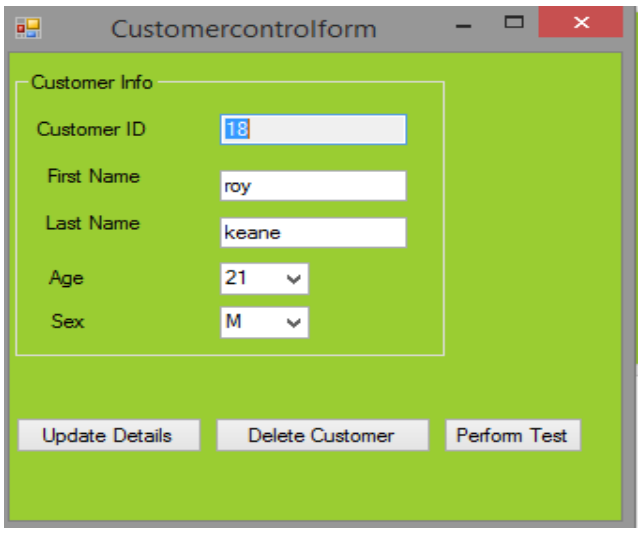
Step 1: Log in to the system as a staff [please refer to logging in as a staff to learn more about it]

Step 2: Enter Customer ID you want to update or delete

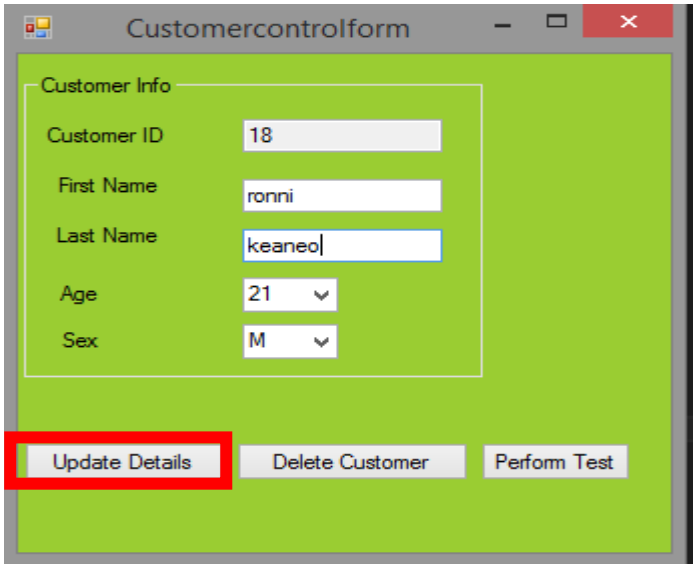


Step 3: click Submit

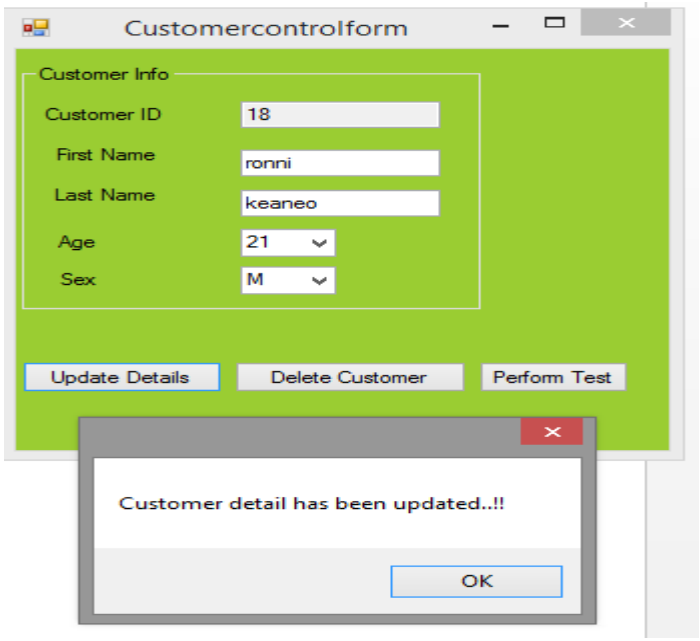
[new form will pop up with the information of the customer]



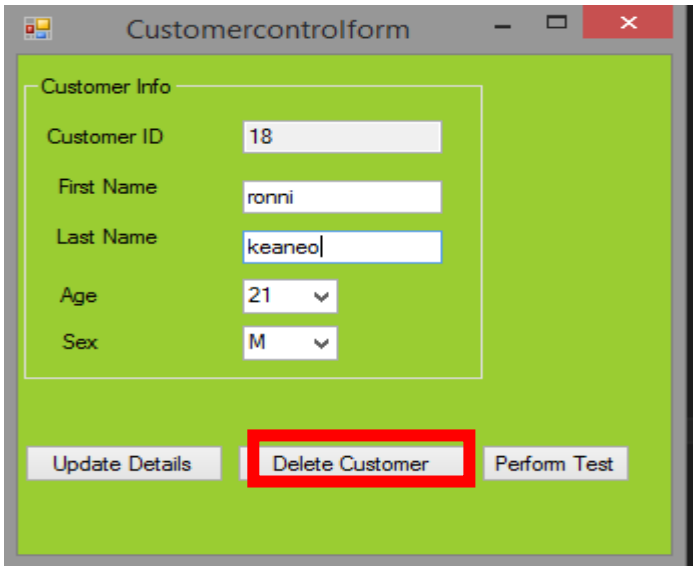
Step 4: Change any details you want to update [Customer Id is read only] and click “Update details” button.



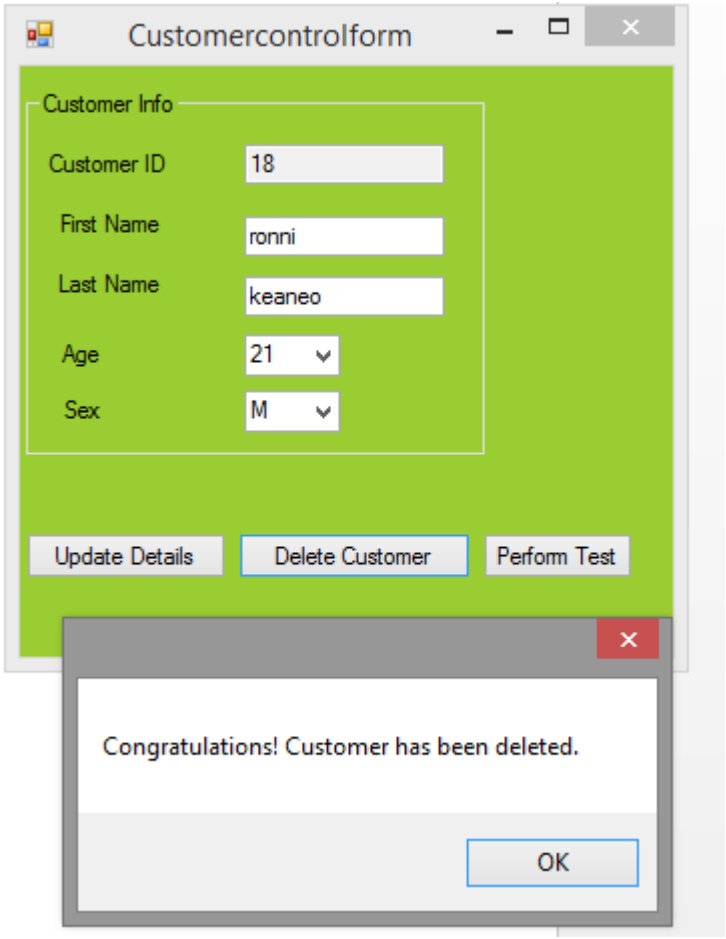
[You will be displayed with successful message]



Step 5: Click ok and Click Delete Customer to delete the customer.



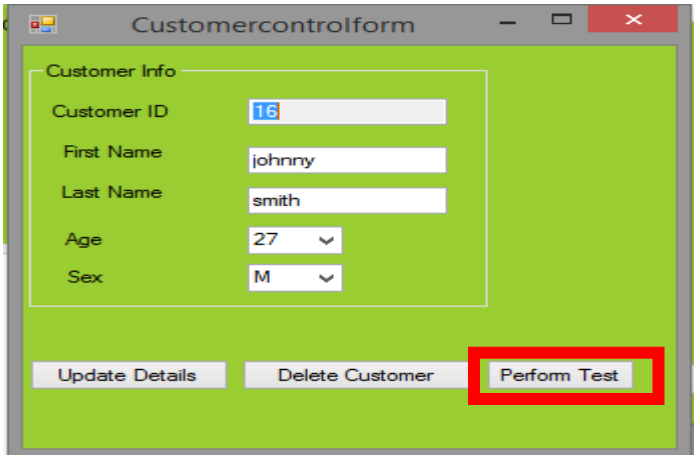
You will be followed by delete successful message.



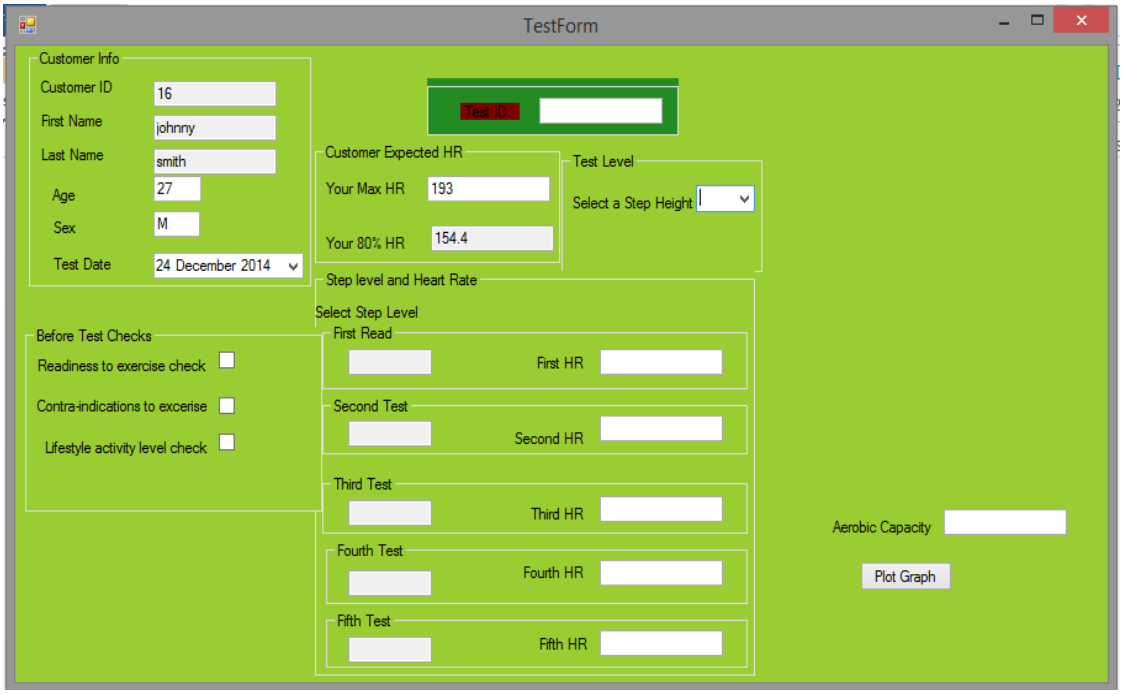
Performing Test / Plotting the Graph

Step 1: Go to customer control form [Refer to Updating / Deleting Customer Details (staff only) section]

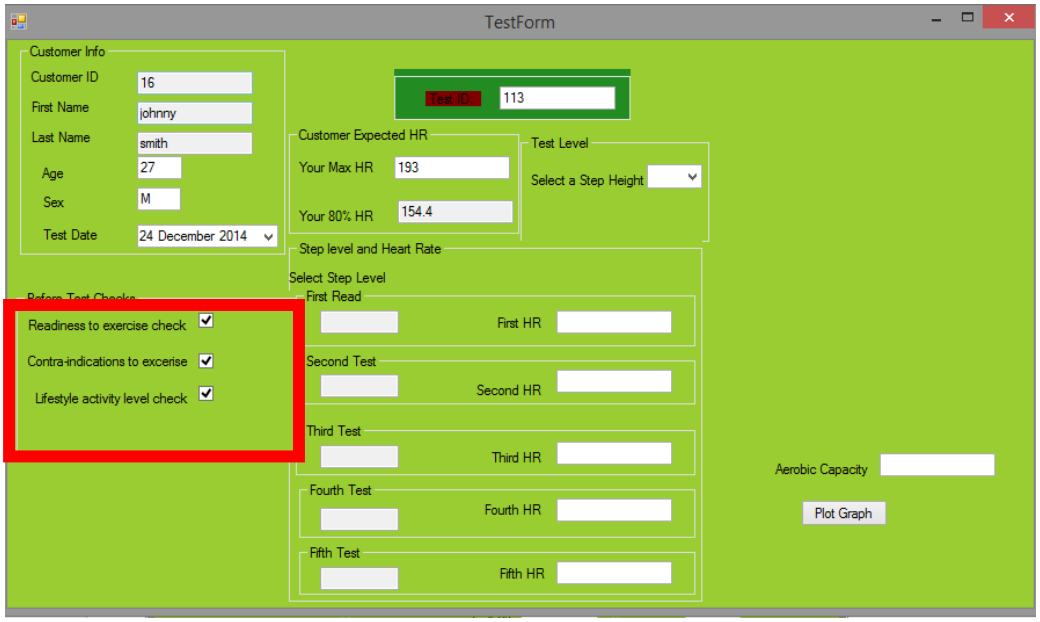
Step 2: Click "Perform test" button



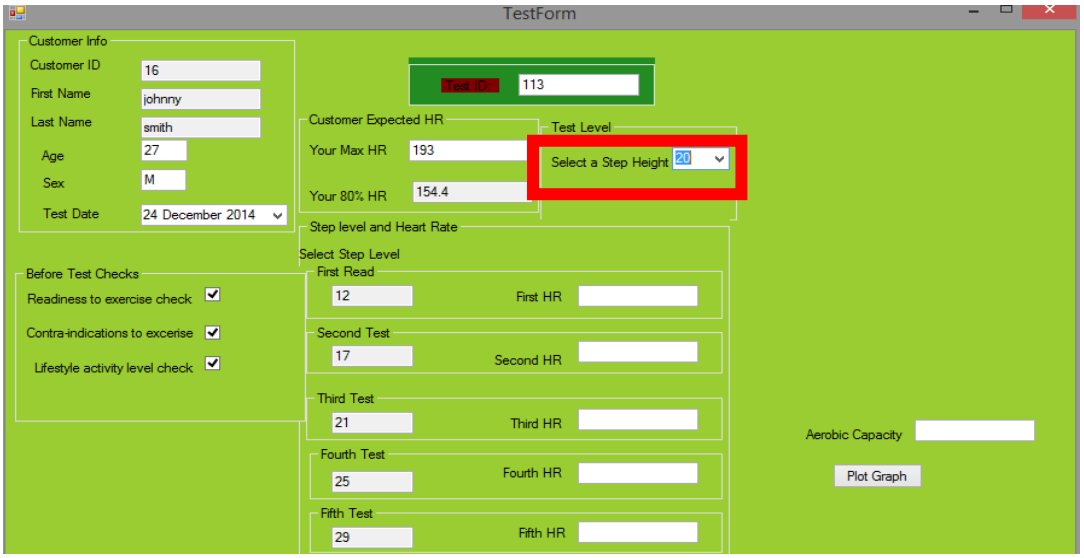
[A new form will pop up]



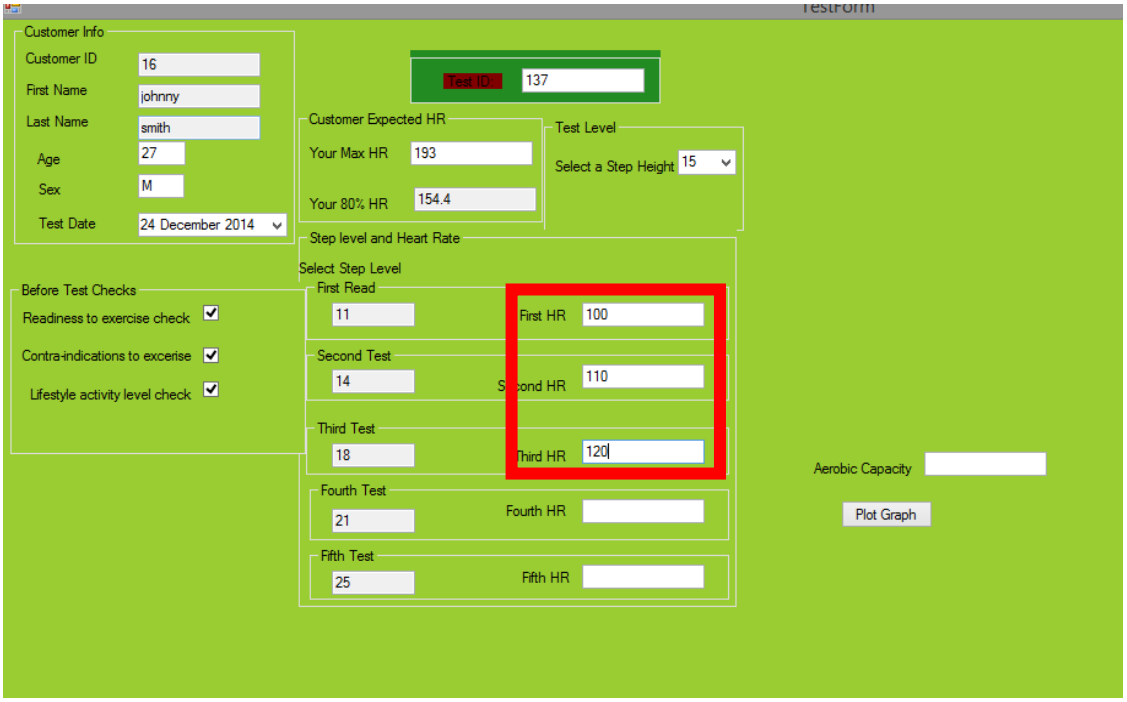
Step 3: Check all boxes to make sure the customer is ready for test.

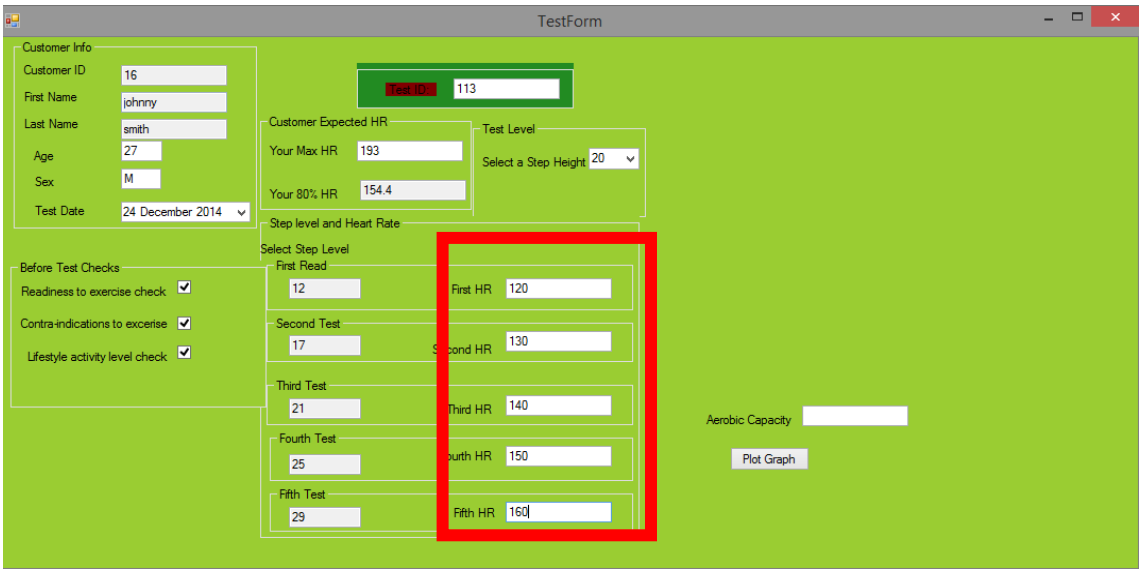


Select 4: Select the step height



Step 5: Enter at least three or five hearts rate in numbers only in all five boxes.

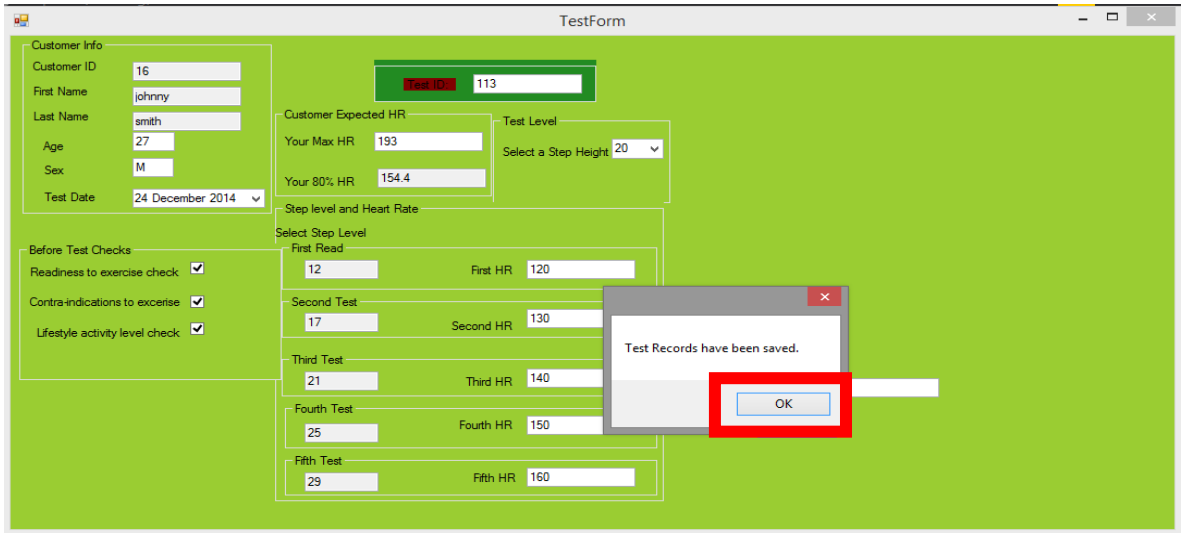




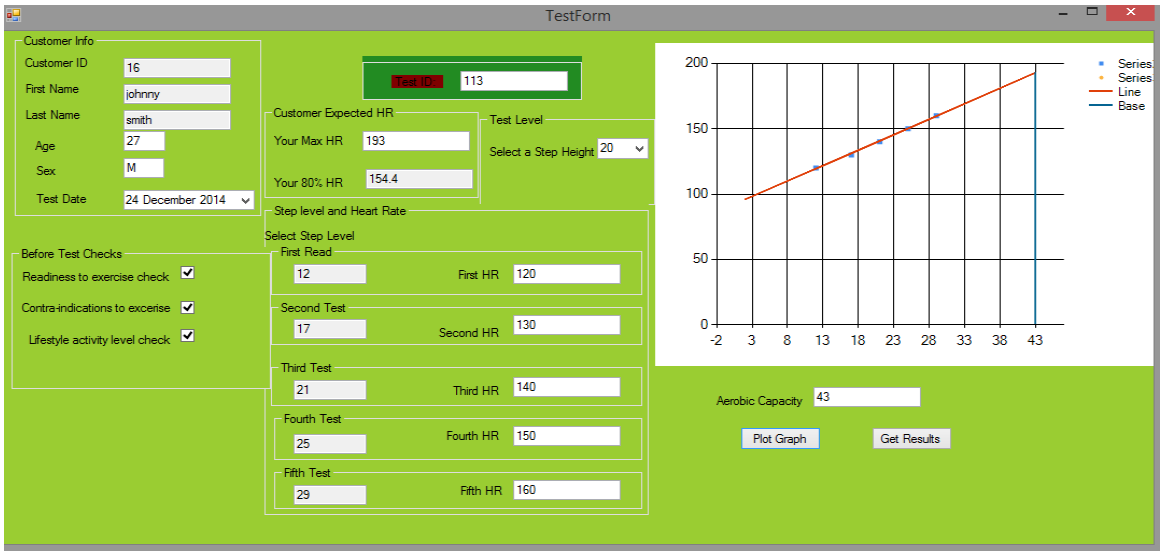
Step 6: Click “Plot Graph” Button. Note Get Results comes up as soon as you click the “Plot Graph” button.

Data saved to database successful message pops up.

Step7: Click ok



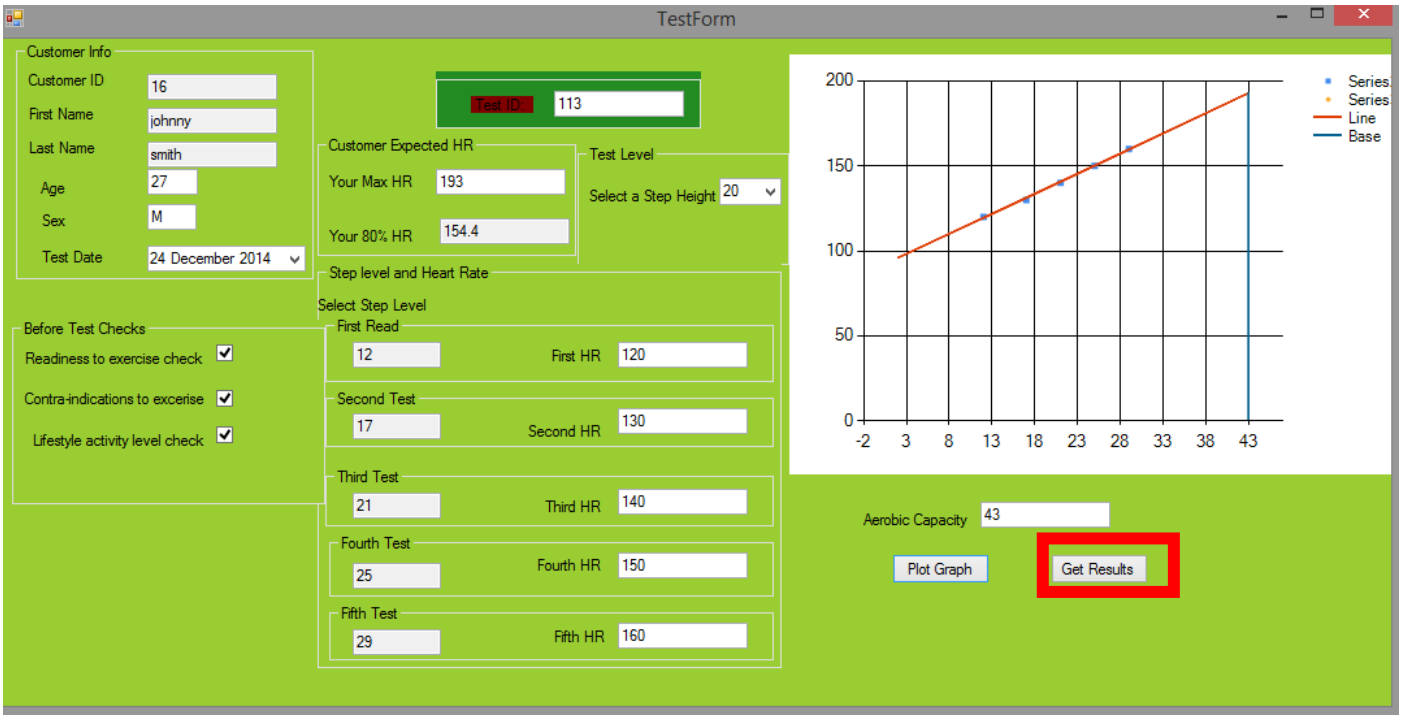
Graph gets Plotted.



Displaying the Final Result to customer

Step 1: please follow all the steps at **Performing Test / Plotting the Graph**

Step 2: Click Get Results



New window will pop up with the Test Results.