A Small Scale Exploratory Study on Diabetes Management by Integration of Personalized Healthcare Pathways in an ICT Platform

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ABSTRACT: Now- a- days the demand for surpassed treatment quality, efficiency and reduced prices have become utmost business disputes and challenges for the contemporary care systems. This provides a customized care Pathway (PHP) that targets to satisfy predominant characteristics, within the type of associate ICT system for polygenic disorder disease management developed within it. So in order to fulfil the patient's requirements, we continuously monitor the general status of the patient. The personalized system for the individual patients is in accordance with the METABO platform, have been deployed in four hospitals in order to analyse the potential. It consists of the patient's personal health data. So PHP has been integrated into an information and communication technology(ICT) system to eradicate an organized centred care and accomplishes a shift from organized centred care to patient-centred care. So a study has been conducted in order to check the platform and perform the study accordingly.

KEYWORDS: Customized care pathway, ICT system, METABO platform, patient-centred, disease management

I. INTRODUCTION

The health care sector is being anticipated by the integrated exponential growth of the health care costs, together with frequently proliferating demand. The combined demand for the higher treatment and an efficient quality and reduced costs is one of the main research and business challenges for the modern healthcare system. Based on the concept of personalized health care systems, vivid research projects have been carried out in the recent years. A solution may be represented especially for the chronic diseases through the utilization of standard clinical protocols, by personalized patient - centred healthcare services, with increased individualized and a unique treatment. The continuous progression and improvement of telemedicine platforms and decision support systems (DSS) for diagnosis, treatment, and management of different illnesses could be made possible with the advancement in information and communication technology (ICT). It presents a personalized healthcare pathway(PHP) concept that aims to satisfy the fore mentioned characteristics, in the form of an ICT system for diabetes disease management developed in the "METABO" research framework. The project was started with aim of providing physical and virtual spaces to address the needs of health practitioners to implement more effective care provision, and empower patients to become the co-producers of their own health[2].

The foundation for the deployment of efficient and innovative health care means can be provided by the e-health solutions and clear identification of procedures in which health is viewed as a continuous process where the patient's role, as well as corresponding expected actions, must be done. The current research and development work in the area aspires to devise techniques based on the guidelines and decision support services that enhance and optimize patient care and the quality of medical care by incorporating recommendations for specific conditions in the design of applications and platforms. Personalized alerts based on the patient's individual characteristics in accordance with the health is being provided. For this, a continuous monitoring of the patient's general health status is being considered. Treatment personalization requires that general healthcare practices, disease management guidelines, therapy schemes and follow-ups must all be adapted to the chronic patient's particular conditions and clinical status. Current research and development work in the area aims to devise techniques based on guidelines and decision support services that enhance and optimize patient care and quality of medical care by incorporating recommendations for specific conditions in the design of applications and platforms.

Diabetes management is a special and representative case of chronic disease, because of the pandemic dimension that is reaching, the complication associated to the disease, patients are not timely diagnosed are not fully aware of the daily actions they need to perform, especially in the first stage, when they do not "perceive" the disease[1].

II. RELATED WORK

In [3] rethinking health: ICT-enabled services to empower people to manage their health,lifestyle is a key determinant in the prevention and management of chronic diseases. If we would exercise regularly, eat healthy, control our weight, sleep enough, manage stress, not smoke and use alcohol only moderately, 90% of type II diabetes, 80% of coronary heart disease, and 70% of stroke could be prevented. Health statistics show that lifestyle related diseases are increasing at an alarming rate. Public health promotion campaigns and healthcare together are not effective enough to stop this "tsunami". The solution that is offered is to empower people to manage their health with the assistance of ICT-enabled services. A lot of R&D and engineering effort is being invested in Personal Health Systems. Although some progress has been made, the market for such systems has not yet emerged. The aim of this critical review is to identify the barriers which are holding back the growth of the market. It looks into the theoretical foundations of behaviour change support, the maturity of the technologies for behaviour change support, and the business context in which behaviour change support systems are used. In [4] a holistic environment for the design and execution of self-adaptive clinical pathways, one of the main challenges to be confronted by modern health care, so as to increase treatment quality, is the personalization of treatment. The treatment personalization requires the continuous reconfiguration and adaptation of the selected treatment schemes according to the "current" clinical status of each patient and "current" circumstances inside a health care organization that change rapidly, as well as the updated medical knowledge. In this paper, we present an innovative software environment that provides an integrated solution concerning the adaptation of health care processes (clinical pathways) during execution time. The software comprises a health care process execution engine assisted by a semantic infrastructure for reconfiguring the clinical pathways. During the execution of clinical pathways, the system reasons over the rules and reconfigures the next steps of the treatment. In [5]my heart project: A framework for personal health care applications, my heart is a so-called Integrated Project of the European Union aimed at developing intelligent systems for the prevention and monitoring of cardiovascular status. A healthy and preventive lifestyle as well as early diagnosis of heart disease could save millions of life years annually, simultaneously reducing the morbidity and improving patient quality of life. The approach of my heart project is to monitor Vital Body Signs (VBS) with wearable technology, to process the measured data and to give the user (therapy) recommendations from the system. Using its broad base of technical and business expertise, four concepts addressing cardiac health have been developed and tested on a technical, business, reliability and usability level.In [6] a fuzzy expert system for diabetes decision support application,an increasing number of decision support systems based on domain knowledge are adopted to diagnose medical conditions such as diabetes and heart disease. It is widely pointed that the classical ontologies cannot sufficiently handle imprecise and vague knowledge for some real world applications, but fuzzy ontology can effectively resolve data and knowledge problems with uncertainty. This paper presents a novel fuzzy expert system for diabetes decision support application. A five-layer fuzzy ontology, including a fuzzy knowledge layer, fuzzy group relation layer, fuzzy group domain layer, fuzzy personal relation layer, and fuzzy personal domain layer, is developed in the fuzzy expert system to describe knowledge with uncertainty. By applying the novel fuzzy ontology to the diabetes domain, the structure of the fuzzy diabetes ontology (FDO) is defined to model the diabetes

knowledge. Additionally, a semantic decision support agent (SDSA), including a knowledge construction mechanism, fuzzy ontology generating mechanism, and semantic fuzzy decision making mechanism, is also developed. The knowledge construction mechanism constructs the fuzzy concepts and relations based on the structure of the FDO.

In [7] an ontology-based personalization of health-care knowledge to support clinical decisions for chronically ill patients, chronically ill patients are complex health care cases that require the coordinated interaction of multiple professionals. A correct intervention of these sort of patients entails the accurate analysis of the conditions of each concrete patient and the adaptation of evidence-based standard intervention plans to these conditions. There are some other clinical circumstances such as wrong diagnoses, unobserved comorbidities, missing information, unobserved related diseases or prevention, whose detection depends on the capacities of deduction of the professionals involved. In this paper, we introduce an ontology for the care of chronically ill patients and implement two personalization processes and a decision support tool. The first personalization process adapts the contents of the ontology to the particularities observed in the health-care record of a given concrete patient, automatically providing a personalized ontology containing only the clinical information that is relevant for health-care professionals to manage that patient. The second personalization process uses the personalized ontology of a patient to automatically transform intervention plans describing health-care general treatments into individual intervention plans.

III. PROPOSED SYSTEM

This project is having the following four modules:
1) Loading the Dataset
2) Calculating BMI value
3) Algo for calculating Fat Test
4) Calculating value of HBA1C

A. *Loading the Dataset:*

This is the first module in our project after running the main.java. In our project, we are supposed to load the DATASET on which we are going to do our Exploratory Study. For this requirement, we had taken 500 patients details of a well known hospital and prepare those details as a dataset so that we can load that dataset in our protocol.
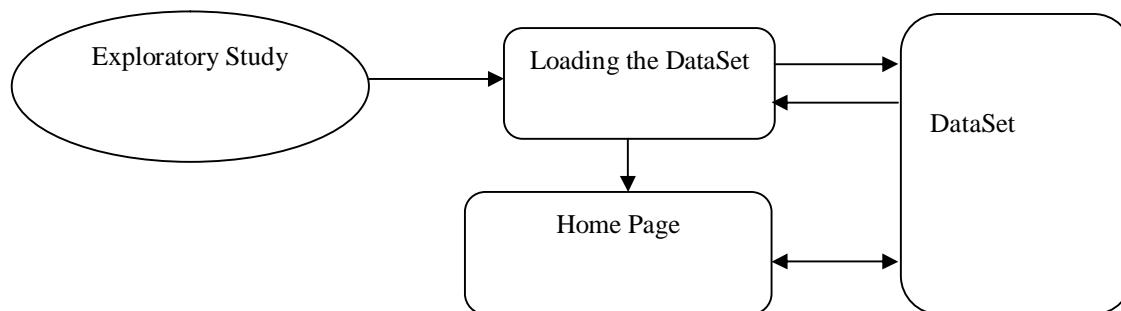

Fig. 1. Loading the dataset

B. *Calculating BMI value:*

Lifetime diabetes risk at 18 years of age increased from 7.6 to 70.3% between underweight and very obese men and from 12.2 to 74.4% for women. The lifetime risk difference was lower at older ages. At 65 years of age, compared with normal-weight male subjects, lifetime risk differences (percent) increased from 3.7 to 23.9 percentage points between overweight and very obese men and from 8.7 to 26.7 percentage points for women. The impact of BMI on diabetes duration also decreased with age. So in this module we are calculating the BMI value for both men and women basing on the available data, results are shown with the help of graphical representation.
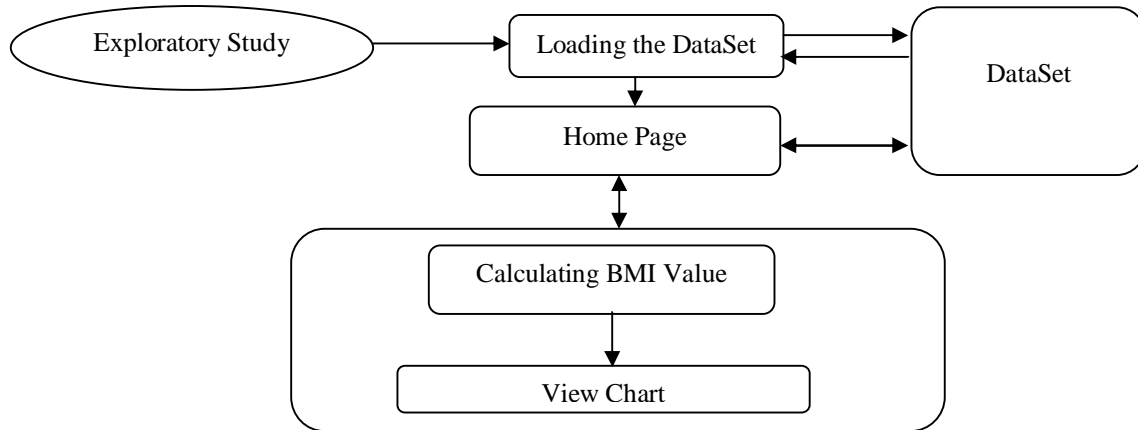
Fig.2. Calculating the BMI value

C.   *Algo for calculating Fat Test:*

People who are obese are at much greater risk than others for type 2 diabetes. Recently, however, research has demonstrated that it's not weight alone that increases health risk it's where that weight is located. So we are using a heuristic algo to calculate the fat test and determine the results.
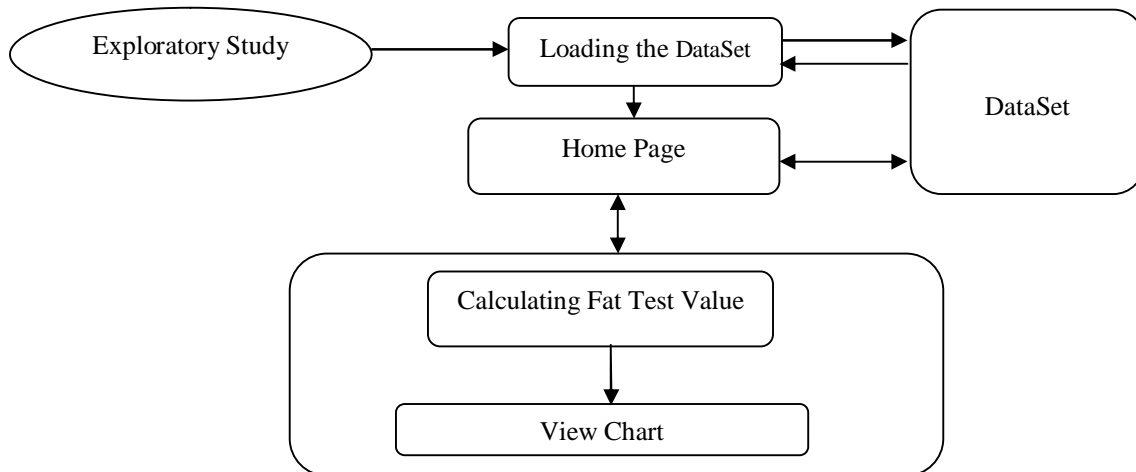

Fig.3. Algo for calculating Fat Test

D.   *Calculating Value of HBA1C:*

The term HbA1c refers to glycated hemoglobin. It develops when hemoglobin, by measuring glycated hemoglobin (HbA1c), clinicians are able to get an overall picture of what our average blood sugar levels have been over a period of weeks/months. For people with diabetes this is important as the higher the HbA1c, the greater the risk of developing diabetes-related complications. HbA1c is also referred to as hemoglobin A1c *or* simply A1c. This will be calculated by our project and results are displayed in the form of graphical representation.
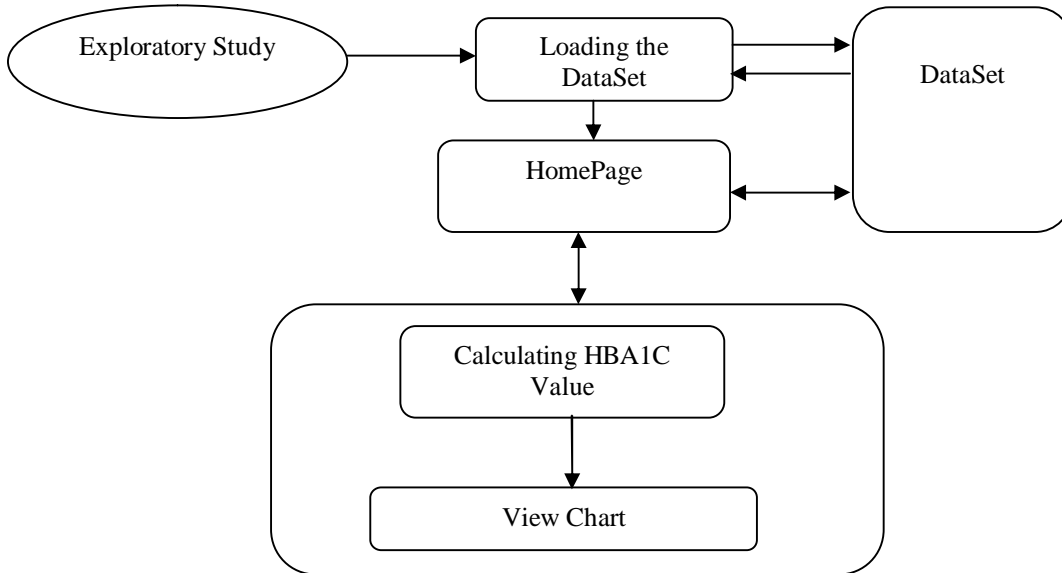
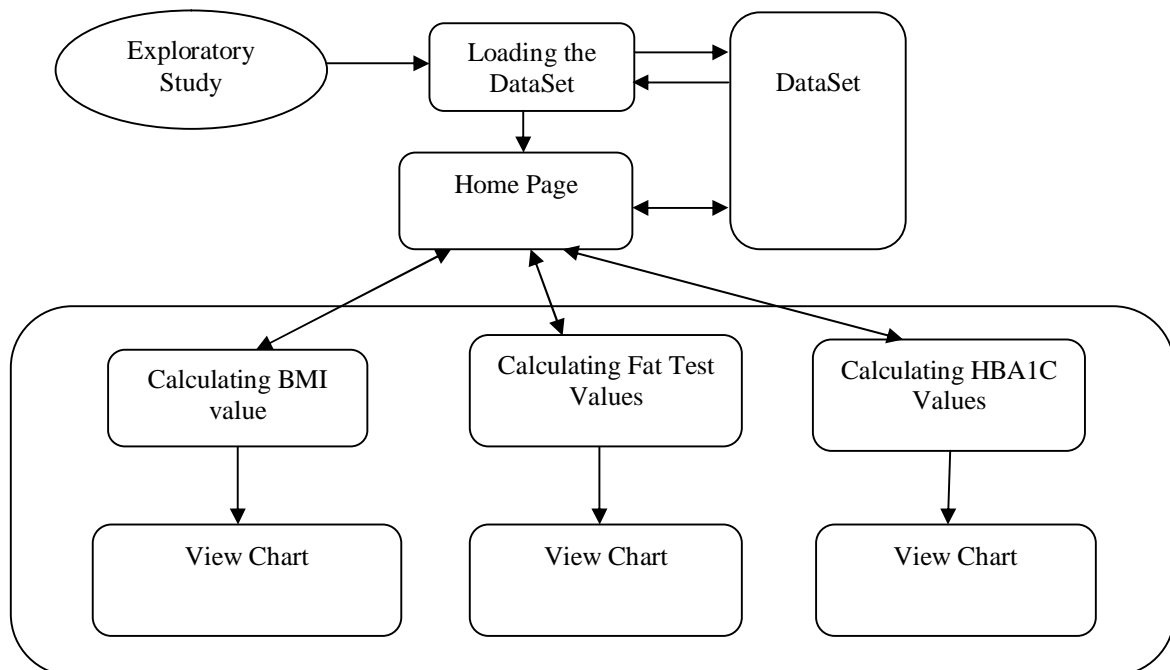Fig.4. Calculating Value of HBA1C

IV. **SYSTEM MODEL**

Fig.5. System Model

Here a small scale exploratory study is being conducted. First we load the dataset from the database. Then a dataset is being evolved which comprises of a homepage. Then there are three tests specifically: Calculating BMI(Body Mass Index), value which calculates the weight of the specified patient, next is Calculating Fat Test values of the patient after the BMI is calculated and finally Calculation of HBA1C values (glycated haemoglobin) is done. Then an individual graph for each of them is analysed which helps the in the identification of diabetes disease.

V. SIMULATION RESULTS

This project is implements like web application using corejava and the Server process is maintained using the socket & serversocket and the design part is played by Cascading Style Sheet. It includes the various results of the different tests along with the patient's test details and the complete graph for each test too that indicates the differentiations and the variations for the overall individual test that completes a small scale exploratory study of the patients for the diabetes disease.

Fig. 6. Homepage of the exploratory study of diabetes management
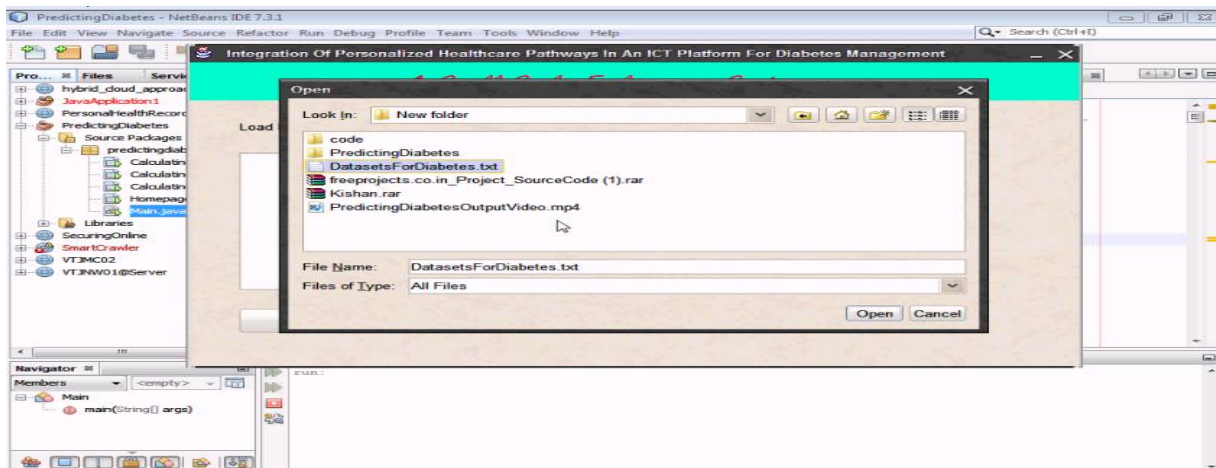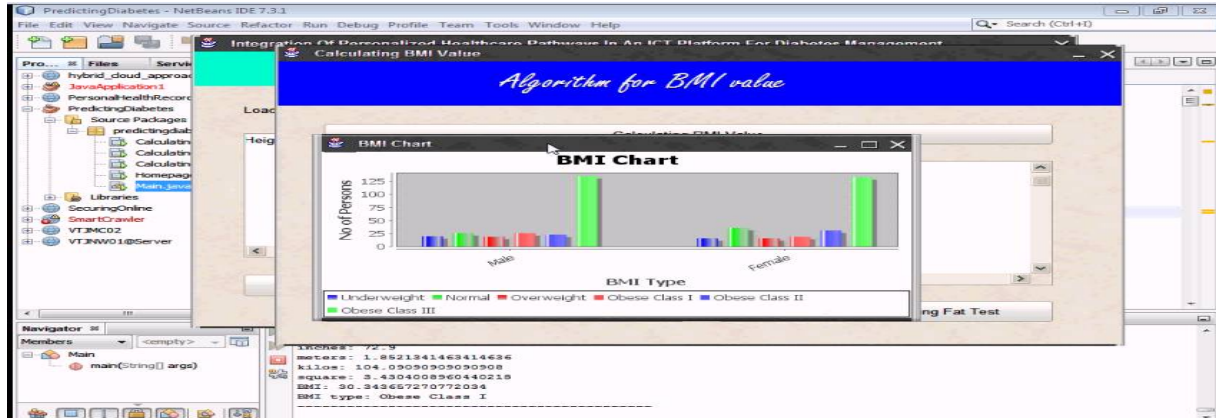

Fig. 7. Loading of the datasets of the patients

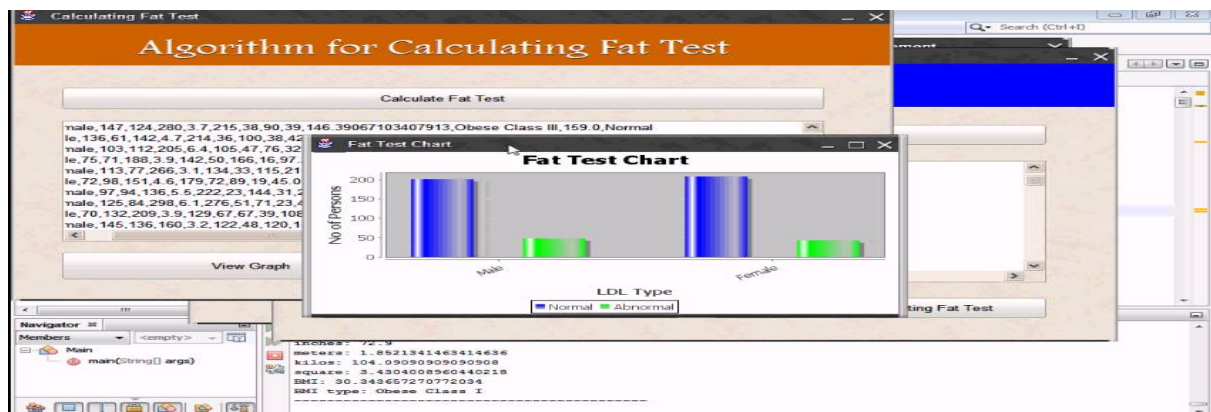Fig. 8. Algorithm and a graph for calculating BMI value

Fig. 9. Algorithm and a graph for calculating Fat test that indicates normal and abnormal patients.
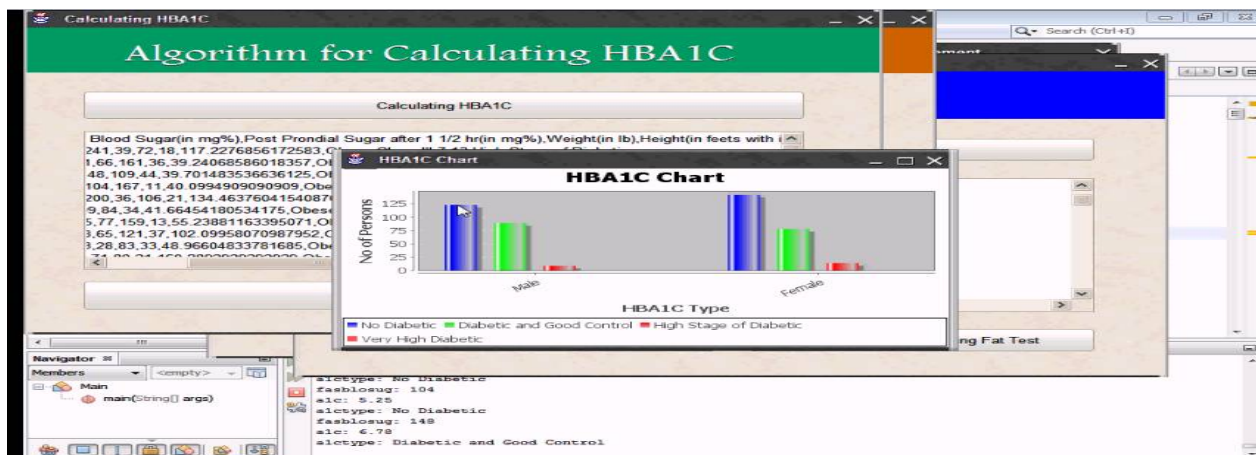

Fig. 10. Algorithm and a graph for calculating HBA1C test that indicates patients having high stage or normal diabetes .

VI. CONCLUSION AND FUTURE WORK

Here a personalized ICT -based health management of diabetic patients is being enhanced and being supported. These results of the study indicate the expediency, workability, compliance and a good enhancement of the platform. The given platform is more likely to be used and is a competent one that could be useful by the patients or the users that gives vivid clarifications from the previous ones and a perfect representation of the patient's health status. Different tests conducted i.e., the BMI test, Fat test and HBA1C test for the identification of diabetes conclude that these tests are being carried out with diabetic patients in a detailed way which helped to fulfil the advantageous aspects expected with them. It provides a real time data set of the patients in the hospitals. We could increase the efficiency performance and further research needs to be carried out about the information, correlating usability results, and the clinical outcomes.

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