

Integrated Thallassaemia Decision Support System

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Abstract: - Thalassaemia is a genetic blood disorder where the blood cells are unable to carry sufficient oxygen supply for the organs. The Thalassaemia has a distribution concomitant with areas where P. Falciparum malaria is common. The alpha Thalassaemia is concentrated in Southeast Asia, Malaysia, and southern China. The beta Thalassaemia is seen primarily in the areas surrounding Mediterranean Sea, Africa and Southeast Asia. Due to global migration patterns, there has been an increase in the incidence of Thalassaemia in North America in the last ten years, primarily due to immigration from Southeast Asia (The Reader's Digest, 1989). The increment of the cases forces the government hospital to have an alternative method in diagnosing Thalassaemia than only depend on the Hematologist. Case-Based Reasoning is a subset of an Artificial Intelligence technique utilizes the specific knowledge of previous experiences to solve new problems by remembering previous similar cases. It is highly suitable for medical domain. Hence, this work provides model that demonstrates how Thalassaemia can be diagnosed via Integrated Thalassaemia Decision Support System (ITDSS).

Key-Words: - DSS, CBR, ITDSS, Thallassaemia , Medical Application, Diagnose Disease, AI.

1 Introduction

Thalassaemia was defined as a clinical entity in 1925 by Dr. Thomas B. Cooley and his associate Pearl Lee. Thalassaemia disorders user characterized by defective production of hemoglobin. This leads to low production, and excessive destruction, of red blood cells, it happened by Symptoms and the person seems fatigue is a feeling of weariness, tiredness, or lack of energy, Figure 1 shows the inheritance recessive diseases man married woman carries of Thallassemia then passed to the children one with Thallassemia major, two with Thallassemia minor and one normal.

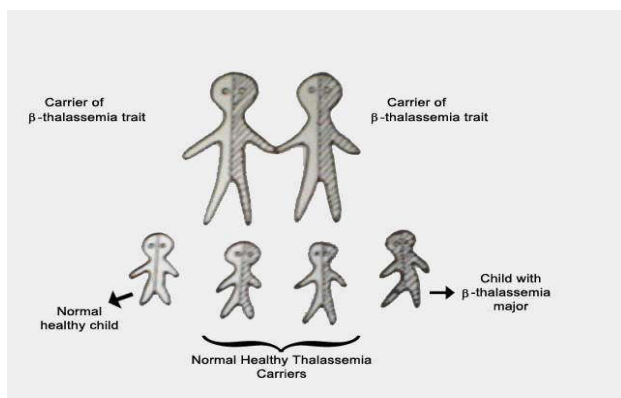


Fig-1 Thalassemia Passed on From Parents to Their Children

This paper discusses the design and development of ITDSS. Decision support system can be defined as an interactive data processing and display system which is used to assist in the concurrent decision-making process [1]. ITDSS was developed using Visual Basic.Net; MS Access and Case Based Reasoning is a hybrid approach [2]. Which memorizes and retrieves the experience in solving similar previous problems this capability allows CBR express previous experience knowledge and thus to use it to enhance the decision in new like situations. The basis of CBR is that by computing distances between new cases and previously stored. Indexed cases, and retrieving those cases that are similar.

1.1 Problem Statement

Thalassaemia is a genetic blood disorder where the blood cells are unable to carry sufficient oxygen supply to the body's organs. The Thalassaemia Association of Malaysia's (TAM) President, Datuk Abd. Ghani Che Man estimated more than 2000 Malaysians were suffering from this disease, while another one million or so were carrier of Thalassaemia, and this number is increasing. Realized that the Thalassaemia Diagnosis on Web using Case-Based Reasoning Technique [3] Mobile Thalassemia Diagnosis System using Case-Based Reasoning Technique. Available do not cater enough to cope with the

healthcare services, demand enhancing on the existing systems are necessary. In addition the problems of latency in Mobile Device that might not support Web-Based system and there is another factor contribute to the lack of diagnosing by experts or specialists. By this researcher is a new diagnosing system namely Integrated Thalassaemia Decision Support System (ITDSS) which allows the cooperation of different existing decision models encapsulated in Task Specialized diagnosis Thalassaemia disease using Case Based Reasoning a subset of Artificial Intelligence to suggest solution for the new case attempt and learns through addition of the new cases to case-base.

The role of AI technologies; namely, expert systems and data mining, in environmental KMS. AI technologies can be useful to solve problems in environmental application areas and sectors. It offers promising opportunities for developing intelligent Environmental Decision Support Systems. The selection of the appropriate Knowledge representation techniques offer potentially powerful tools for the development of Environmental Knowledge-Based Systems. The variety of such techniques enabling the design of a robust Intelligent Environmental Decision Support Systems [10].

ITDSS incorporates a prototype development environment in providing an effective and intelligent system that can be accessed globally using minimal hardware and software requirements.

1.2 Research Objectives

The general objective of this work is to propose an integrated Thalassaemia Decision Support System. Specifically this objective can be viewed in to three parts

- To identify the requirement of ITDSS.
- To design the prototype base on objective.
- To develop the proposed prototype

1.3 Scope

This proposed work cover Thalassaemia cases obtained from Pathology Department of Alor Setar General Hospital. It focuses to the design and implementation of Case Base Reasoning (2006), the technique to diagnose the new cases. This work also covers the reports requested by user.

1.4 Significant Study

This work will provide an alternative method to support physician in diagnosing Thalassaemia disease. It aims to provide decision, and to provide better case management for future usage.

2 Literature Review

This section having several related works which are disused in this paper.

2.1 Thalassaemia Disease

Thalassaemia is an inherited blood disorder which is caused by an abnormal gene. A person with Thalassaemia is unable to produce normal, functioning haemoglobin in the blood. Haemoglobin carries oxygen from the lungs to all parts of the body. When the body is not able to produce normal, functioning haemoglobin, the affected person suffers from anemia. Thalassaemia is passed on from parent to child and can affect both males and females. A person who has inherited one Thalassaemia gene is said to have Thalassaemia minor (Thalassaemia trait). Thalassaemia major is a severe form of anaemia.

According to [4] presented Knowledge Extraction using Visualization of Hemoglobin Parameters to Identify Thalassaemia, The analysis of large amounts of data is better performed by humans when represented in a graphical format. Therefore, a new research area called the Visual Data Mining is being developed endeavoring to use the number crunching power of computers to prepare data for visualization, allied to the ability of humans to interpret data presented graphically. This work presented how the Fast Map DB visual data mining tool was employed along with the laboratorial dataset used to analyze blood samples from individuals with Thalassaemia disorders, evaluating and comparing the data with those obtained from normal.

The Thalassaemia has a distribution concomitant with areas where *P. Falciparum* malaria is common. The alpha Thalassaemia is concentrated in Southeast Asia, Malaysia, and southern China. The beta Thalassaemia is seen primarily in the areas surrounding Mediterranean Sea, Africa and Southeast Asia. Due to global migration patterns, there has been an increase in the incidence of Thalassaemia in North America in the last ten years, primarily due to immigration from Southeast Asia[9].

As the consequences of blood transfusion, patient are body will suffer ferrum overload. This endangered the patients if left unattended. Thus,

patients have to undergo treatment to get rid of this excess ferrum. As for the treatment, according to Prof. Dr. Chan Lee Lee of University Malaya, the patients have to go through subcutaneous infusion for eight hours to twelve hours every day for the period of five to seven days a week. They are injected to dispose off excess ferrum through urine. Moreover, patients need chelating agent to dispose of this excess ferrum, failing which may cause damage to liver.

2.2 Medical Support System

Augmenting Knowledge-Based Medical Systems with Tacit Healthcare Expertise towards an Intelligent Tacit Knowledge Acquisition Info-Structure, the healthcare scenarios and Tacit Knowledge Acquisition Info-Structure provide an effective framework for effective and efficient healthcare knowledge management especially in augmenting knowledge-based medical systems with tacit healthcare expertise. They believe that have presented a demonstrator application and methodology for the acquisition and subsequent operation of tacit healthcare knowledge. Nevertheless, there exist the potential to enhance the said work to further acquire, represents. Refine and disseminate tacit healthcare knowledge. Due to the complex nature of the problem at hand, i.e. tacit healthcare knowledge acquisition, they believe that a synergy of knowledge management efforts world-wide might eventually lead to the development of a standardized set of healthcare knowledge-based tools and methodologies as proposed by Yu [7].

2.3 Case Based Reasoning

Case-based reasoning (CBR) is an approach to building software systems that enable their users to reuse the experiences from similar situations that occurred in the past and have been documented in the form of cases. A case can be seen as a complex object that contains at least a problem description and a solution. The reasoning step in CBR systems is based on the hypothesis that similar problems have similar solutions or i.e. that the solution of a similar problem is a good starting point for the selection construction of a solution for the problem at hand.

Case-Based Reasoning allows the incremental case-base for new case will be retained if suitable and accurate. Maintenance of the case library is relatively easy and can be carried out by domain

experts. In medical field, CBR is used widely since in medical field, pass experience is regarded as precedent for medical practitioner to prescribe drugs or certain treatment, Jurisica and Glasgow, in their study apply CBR to automate image analysis to evaluate morphology and development features of embryos in the field of in-vitro fertilization.

According to Abidi, a Case Base Reasoning Framework to Author Personalized Health Maintenance Information, in this work has presented a new approach to compositional adaptation that is applied to the healthcare domain. It concludes that the application of CBR techniques for information personalization in case healthcare information personalization is an interesting alternative to existing personalization techniques. The work presented here is a successful 'proof of concept' is currently deployed for use by a small set of users, with an anticipated increment to the healthcare information content.

Integrated Case-Based Reasoning was applied by [5], this paper firstly discusses about the mixed Case-Based Reasoning technique, then research in detail on the model which combine CBR and RBR. They propose a concrete framework of CBR. Next they have researched an integrated CBR plan with genetic and decision tree. The integrated method has great ability of anti-noise and tackle with the boundary problem well. The final experiment result suggests that the algorithm is rather accurate.

An intelligent contract analysis and processing method. the CBR-based contract processing system ties sales, product design and manufacturing departments together by contracts. It can greatly improve the enterprise information standard and make quick action to the market[11].

2.4 CBR for Medical Application

An application is a style allow users to deal with the system attractively and easy to use also responsive, so nowadays the hospitals uses case base reasoning for medical application of solved problems and a mechanism for retrieving and adapting these cases. Many implemented CBR systems involve little or no adaptation and the reasoning mechanism is simply a retrieval system with solutions being used intact or with adaptation performed by the user.

Applying the Augmenting Medical Case Base Reasoning Systems with Clinical Knowledge Derived from Heterogeneous Electronic Patient

Records, A resource-intensive knowledge engineering exercise tends to undermine the incorporation of CBR systems to medical diagnostic-support tasks. The work presented here suggests an alternative to the practice of sourcing experiential information directly from expert medical practitioners [2].

They investigated the state-of-the art of case based reasoning (CBR), a recent AI method in the medical domain. A case study in the stress medicine domain is presented here. Today stress has become a major concern in our society. The demand of the decision support system (DSS) in stress domain is increasing rapidly. Case-based reasoning has been demonstrated a powerful methodology widely applied in medical scenarios for decision support. This paper makes an in-depth study of the issues and challenges of applied CBR researches in medical domains. We outlined the recent CBR systems in terms of not only their functionality but also the various key techniques that support such systems. In particular we point out that a current hot trend in CBR applications is to build multi-modal and multi-purpose CBR systems to tackle the high complexity in medical domains [12].

2.5 Medical Diagnosis System

The medical diagnosis system dynamically integrates problem-solving agents to solve large problem. The deep-knowledge was deemed appropriate when an interaction process seemed worth investigating, that is, when some interaction seemed to be present among hypotheses in the current diagnosis. In the medical diagnosis the interaction system ran. Diagnosis System in Medicine with Reusable Knowledge Components, According to [1], they show how to develop a diagnosis-aid system by reusing and adapting generic knowledge components for diagnosing eye emergencies. And they Construction knowledge systems are viewed as modeling activity for developing structured knowledge and reasoning models. To ensure well-formed models, the use of some knowledge engineering methodology is crucial. Additionally, reusing models can significantly reduce the time and costs of building a new application.

According [3], Presented Thalassaemia on Web using Case-Based Reasoning Technique, it provides empirical evidence that demonstrates how Thalassaemia can be diagnosed. The performance achieves 94 percentage accuracy. Previous work develop [8], They applied

Computer Diagnostics System of Children's Health Condition in Early Age, In this connection it is actual that the solution of tasks connected with the development of mathematical methods and algorithms, permitting to receive the diagnostic solutions for detection and prevention of functional deviations of children of early age. Thalassaemia on Web using Case-Based Reasoning Technique, it provides empirical evidence that demonstrates how Thalassaemia can be diagnosed. The performance achieves 94 percentage accuracy[3].

3 Research Methodology

In this paper the general method design research in its multiplicity of as-practiced variants is described, followed by the method as used in a published. According to [6], the astute reader recognized Figure 1, the general methodology for all design research, as a variant, reasoning in the design cycle. This is a logical and inevitable result of the fact that in design research knowing (Figure 2) is making. To better focus on the process as a research method, a column labeled Outputs has been substituted for the Logical Formalism column.

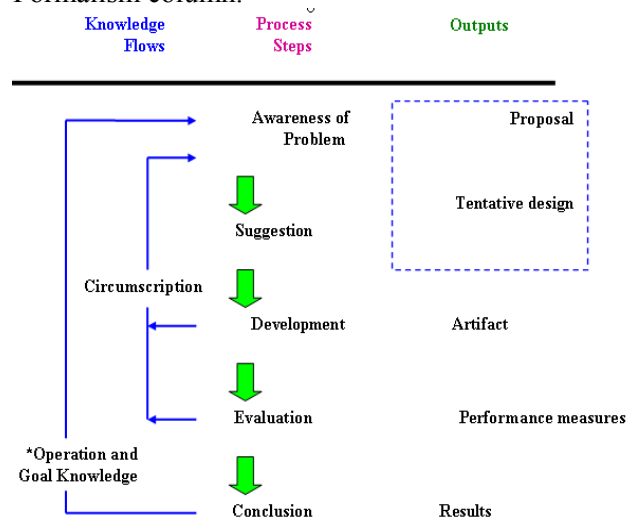


Fig. 2 General Methodology of Design Research

Typical design research effort precedes as follows.

3.1 Awareness of Problem

An interesting problem comes from multiple sources: new developments in industry or in a reference discipline. Reading in an allied discipline also provides the opportunity for application of new findings to the researcher's

field. The output of this phase is a Proposal, formal or informal, for a new research effort to define problem statement, scope, objectives and significant, etc.

3.2 Suggestion

The Suggestion phase follows immediately behind the proposal and is intimately connected with it Proposal and Tentative Design (the output of the Suggestion phase) indicates. Indeed, in the formal proposal for design research, a Tentative Design and likely the performance of a prototype based on the designed by model diagrams Unified Modeling Language (UML) and the tools Rational Rose 2003 that drawn diagrams also the requirement at depend of the attributes.

- Activity Diagram.
- Use Case Diagram.
- Class Diagram.
- Sequence Diagram.
- Collaboration Diagram.

Activity Diagram (ITDSS)

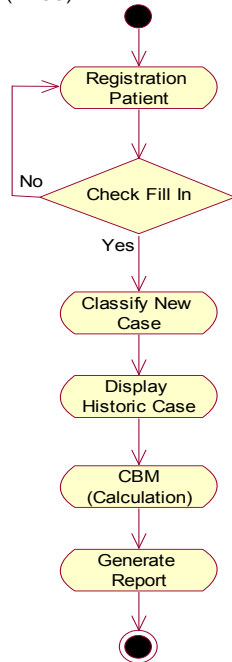


Fig – 3 Activity Diagram

The design follows the proposal include UML diagrams, and formulation of suitable algorithm to achieve the desired result. The UML diagram is uses use case diagram, activity diagram, class diagram, sequency diagram and collaboration diagram. Also design database (conceptual diagram, logical diagram and physical diagram).

The following activity diagram shows the activities for the system of (ITDSS)

The Figure 3 shows the activities steps, it begins by filling the patient information, then the system check if the physician has enter all the required information, in case there is incomplete information the system ask the physician to enter the information again, else the system display another screen, for filling the value of attributes, after that the system retrieve and display the previous cases and make calculation for the new case based on the previous cases, at the end the system generate the report.

Figure 4 shows the sequence of actions the physician follow to add the value of case for new patient.

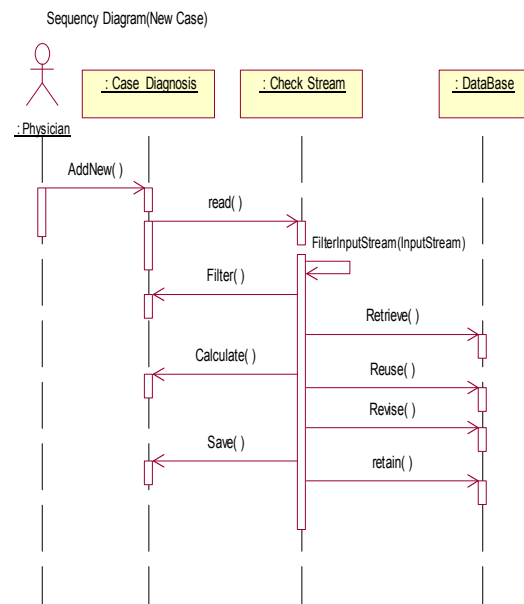


Fig- 4 Sequency Diagram New Case

Figure 5 shows the sequence of actions of how the data manipulated by database.

The formula used is as following equations:

$$\text{Local similarity (a, b)} = \min(1, x/y)$$

where $x = \text{new} - \text{case}$;

$$y = \text{range} \quad \text{--- (1)}$$

$$\text{Local similarity (a, b)} = 1,$$

$$\text{New} \neq \text{Case} \quad (\text{String}) \quad 0,$$

$$\text{New} = \text{Case} \quad \text{--- (2)}$$

Equation number one makes calculation of local similarity by subtraction the value of new case from previous cases divided by maximum case substation by the minimum case value for each attribute, if the attribute is non numeric then it will make comparison between the new case and

previous cases, if there is similarity the result will be 0 else the result will be 1.

$$\text{Global similarity} = \{1 - [\text{casedistance} / \sqrt{\sum \text{weight}}]\} * 100 \quad \text{--- (3)}$$

$$\text{Case distance} = \sqrt{\sum (\text{weight} \times \text{disr}^2)}$$

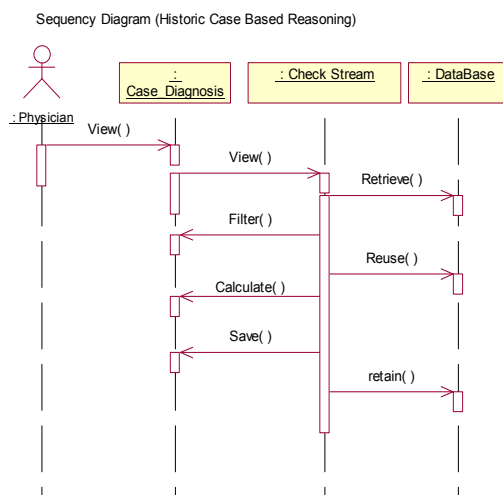


Fig – 5 Sequence Diagram Historic CBR

Equation number two represents global similarity that make calculations by 1 subtraction of case distance divided by the sum of the new cases multiply it 100, that means the case distance root of the new cases multiply by distance square.

4. Development

The tentative design is implemented in this phase. The techniques for implementation of course vary depending on the artifact to be constructed.

- An algorithm is case based reasoning.
- Graphic User Interface and code implementation is Visual Basic.NET 2003.
- Storing the knowledge base in MsAccess 2003.

Crystal Report 10 for outcome the results.

Input of the system content of personal information of patient with his parent, the value of attributes of the case Thalassaemia These are numeric type (HB, TRBC, MCV, MCH, MCHC, ALDEHBF, HBA2S, SEFE), another non-numeric type (HBEL, HINC), also the name and password of the physician who will use the system.

Reports of the system optional requests by (numbers of patients, result diagnoses, gender, states of Malaysia and cities, date of diagnosis, by birth of date, blood group)

4.1 System Architecture

The architecture of Integrated Thalassaemia Decision Support System is embody from Physician, who interacts with the system, the interface (GUI) prepared by VB.NET 2003 as prototype is a basis of application, crystal report for printing the reports, Database Access 2003 which has tables to stores the data for patients information and physician how will use the system also another table contain of historic data, the AI technique adopted for this application namely CBR management, the performance for CBR management to calculation the cases to get out the result of diagnosis as shown in Figure 3.1.

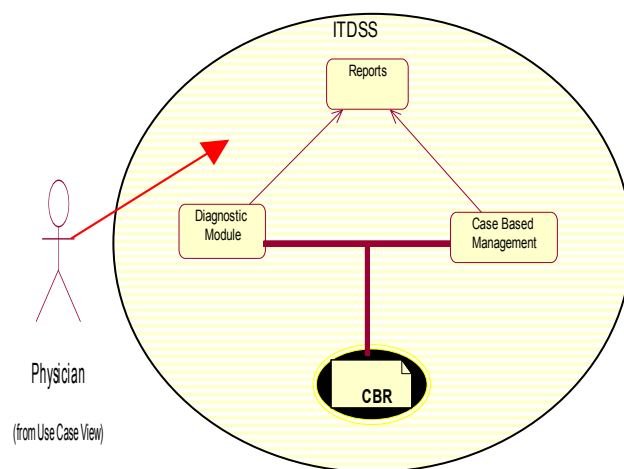


Fig – 6 System Architecture

4.2 CBR Cycle

CBR life cycle has four phases, the first phase is retrieve where the system will retrieve similar cases that have similarity with the new case, it starts with a problem description and ends when a best matching previous case has been found. The second phase reuse, it's the information and knowledge in that case to solve the problem the solution of retrieved case as a suggestion or solution to the new problem, if the solution needs to be changed, adaption will be performed to the solution, before suggesting to the physician. The third phase revision when a case solution generated by the reuse phase is not correct, an opportunity for learning from failure arises, it consist of of two tasks (1) evaluate the case solution generated by reuse, if successful, learning from the succes case retainment, (2) otherwise repair the case solution using domain-specific knowledge. The last phase case retainment this is the process of incorporation

what is useful to retain from the new problem solving episode into the existing knowledge. The learning from success or failure of the proposed solution is triggered by the outcome of the evaluation and possible and possible repair. It involves selecting which information from the case retain, in what form to retain it, how to index the case for later retrieval from similar problem, and how to integrate the new case in the memory structure as shown in the Figure 7.

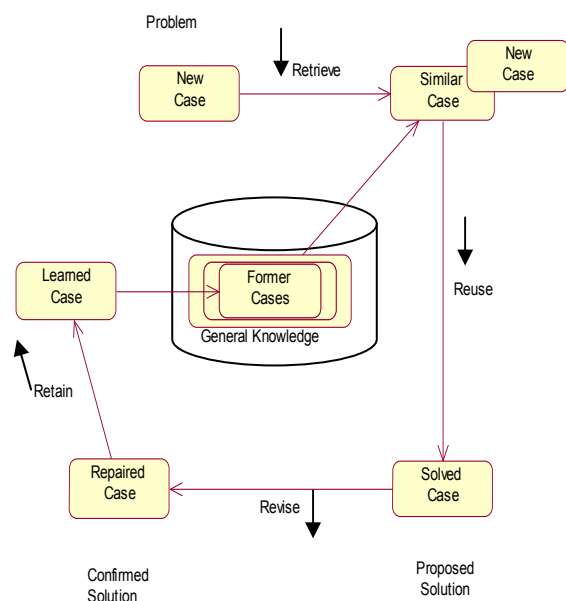


Fig - 7 Case Based Reasoning Cycle

The Integrated Thalassaemia Decision Support System is regard as the retrieve process starts when physician enter the ten values (Haemoglobin , Total Red Blood Cells, Mean Corpuscular Volume of Red Cells, Mean Corpuscular Haemoglobin Concentration, Alkaline Denaturation for Haemoglobin Feotus Haemoglobin Electrophoresis, Haemoglobin A2 Estimation, Haemoglobin Inclusion, Serum Ferritin) of related attributes needed for diagnosis. Then clicking the calculate diagnosis button, the system immediately calculates the percentage of similarity between the new case and the cases in the case-based database using the nearest technique. The highest percentage of similarity is then displayed through a message box; the diagnosis retrieved case with the highest similarity percentage is then being reuse to propose diagnosis to the new case. The physician revises the suggested diagnosis and decides as to

accept or reject the proposed diagnosis. If it is accepted, then the diagnosis is retained in case based database learned case and will be basis of comparison with new case in the future.

4.3 Development Steps

This step is focusing on build the system of (ITDSS), it has four component, started the prototype with graphic user interface (GUI) by using VB.NET 2003 as programming language runs under Windows XP, the second component base knowledge as database access 2003 where the data allocated, the third case based management which calculated the new case base on the retrieve the data which allocated in the database and finally with this prototype achievement crystal report version 10 to get outcome from database access which is under controlling the system by using many option of menu as to generated the reports.

4.3.1 Calculation the Diagnosis

The calculation of the new case as it shown in the Figure 8, its steps of flowchart as many of activities including conditions this activities and conditions appears clearly in this diagram.

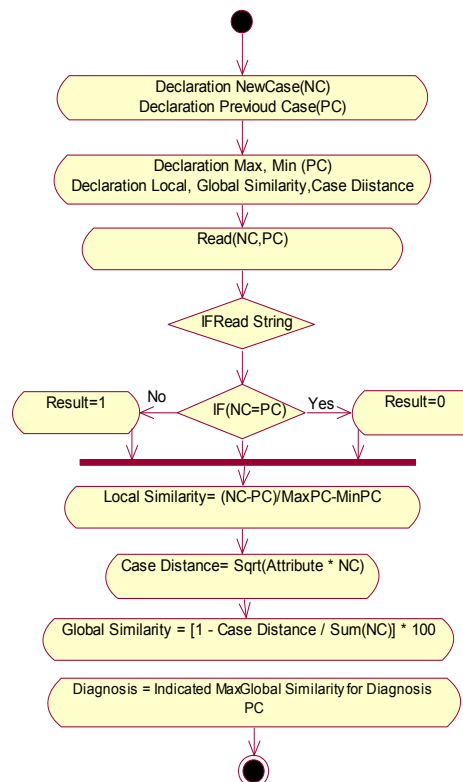


Fig - 8 Calculation New Case

4.3.2 Screenshot

In this step screenshot as it shown in the figure 6, that's appear divided 6 section, at the top and left of the section id of patient who has the case and id of physician who is allowance to diagnose the new case also at the top and right the result of diagnosis that's come after calculation by enter of the button of Diagnosis, another two section at left each section has four attributes as numeric values, the two section at right one of at the top has two attributes as non-numeric, the last section has two button one of diagnosis the new case after click it appears the result, the last button for back to the main menu.

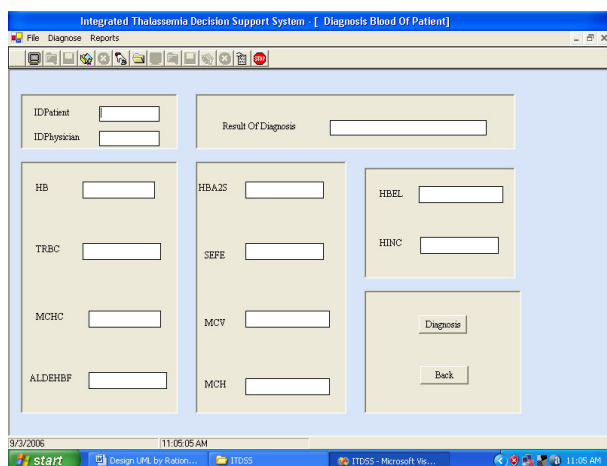


Fig – 9 Screenshot For Diagnose New Case

4.3.3 Set Dataset

In this step, the dataset in the database as knowledge base by sets 8 cases allocated until retrieving if in use for calculation the new case is coming, this sets is increase after new case calculated, the attributes as it is shown in the table 1 contain eight attributes numeric, two attributes non numeric and diagnosis result. The sample dataset shown in the table 2 , it contain eight attributes numeric also two attributes non-numeric including the result of

Table 1Attributes Case Thalassaemia

No	Attributes	Description	Type
1.	HB	Hemoglobin	Double
2.	TRBC	Total Red Blood Cells	Double
3.	MCV	Mean Corpuscular Volume of Red Cells	Double
4.	MCH	Mean Corpuscular	Double

		Hemoglobin	
5.	MCHC	Mean Corpuscular Hemoglobin Concentration	Double
6.	ALDEHBF	Alkaline Denaturation for Hemoglobin Feotus	Double
7.	HBEL	Hemoglobin E Lectrophoresis	String
8.	HBA2S	Hemoglobin A2 Estimation	Double
9.	HINC	Hemoglobin Inclusion	String
10	SEFE	Serum Feritin	Double
11	Diagnosis	Result of Diagnose Comes After Calculation	String

diagnosis, that's different type of Thalassaemia make it for retrieving when the new case coming.

Table 2 Attributes Values for Testing

	Diagnosis	SEFE	HINC	HBA2S	HBEL	ALDEHBF	MCHC	MCH	MCV	TRBC	HB
	Beta Thalassaemia	0	NIL	2	A2 + F + A	158	34.5	20.1	58.1	5.23	10.5
	Beta Thalassaemia trait	30.9	NIL	4.5	A2 + A	49	31.8	22.7	71.5	3.65	8.3
	Consist alpha thalassaemia trait	55.4	NIL	2.8	A2 + A	14	33.4	21.7	64.8	5.4	11.7
	E/Beta thalassaemia	0	NIL	40.5	E + F	32	31.6	19.6	62	3.42	6.7
	Hemoglobin E trait	0	NIL	20.7	E + A	0.8	35.2	20.7	68.7	4.2	8.7
	Hemoglobin H disease	207.9	Many	4.5	A2 + A + H	94	23.3	16.7	71.7	3.11	5.2
	Hemoglobin H with constant spring	212	Numerous	4.8	A2 + A	158	32.2	20.1	62.2	3.79	7.6
	Hemoglobin H with constant spring	212	Numerous	4.8	A2 + A	158	32.2	20.1	62.2	3.79	7.6
	Normal	17.9	NIL	2.4	A2 + A	2	30	19	63	4.6	8.5

5 Evaluation

Once constructed, the artifact is evaluated according to criteria that are always implicit and frequently made explicit in the Paper (Awareness of Problem phase). Deviations from expectations, both quantitative and qualitative are carefully noted and must be tentatively explained. That is, the evaluation phase contains an analytic sub-phase in which hypotheses are made about the behavior of the artifact.

This part discusses findings and testing results. The research process in this study consists of performance and accuracy also covers the development the prototype including dataset in database and test set the data.

5.1 Test Dataset

The system tested by 20 different new cases, case by case, it is computation the subtraction for the new case and all the previous cases, the range get it between maximums value of each attributes and minimums, also divided the value of subtraction by the range, then the result multiply for new case, after that calculation for Math Squirt, then the values if greater than one it equals one then summations all case distances, the global case to get it happen by one subtraction of divided summations of case distance by 10 multiplied one hundred that compared with the previous results and finally add case to case base. The table 3 contain of four columns, the first column percentage of similarity between suggested diagnosis and actual diagnosis including the result of accurate diagnosis, it shown below all the accurate is similarity.

Table 3 Test DataSet

PERCENTAGE OF SIMILARITY	SUGGESTED DIAGNOSIS	ACTUAL DIAGNOSIS	ACCURATE DIAGNOSIS
100	Beta Thalassaemia Trait	Beta Thalassaemia Trait	Yes
100	Consistent with alpha Thalassaemia Trait	Consistent with alpha Thalassaemia Trait	Yes
100	E/Beta Thalassaemia	E/Beta Thalassaemia	Yes
100	Hemoglobin E trait	Hemoglobin E trait	Yes
100	Hemoglobin H disease	Hemoglobin H disease	Yes
100	Normal	Normal	Yes

5.2 Result Testing

The result of testing it shown in table 4, it's a sample of report diagnosis Thalasaemia disease,

that's appear performed and accuracy, also the reports has many optional for displaying.

Table – 4 Result of Testing

Report Thalassaemia Diagnosis											
ID Patient	HB	TRBC	MCV	MCH	MCHC	ALDEHBE	HBEL	HBA2S	HINC	SEFE	Diagnosis
81	8.30	3.65	1.50	22.70	31.80	4.90	A2 + A	4.50	NIL	30.90	Beta Thalassaemia trait
82	10.50	4.68	8.90	22.40	38.00	4.20	A2 + A	6.10	NIL	56.90	Beta Thalassaemia trait
83	9.40	5.00	1.00	19.00	31.00	2.00	A2 + A	4.30	NIL	0.00	Beta Thalassaemia trait
84	8.00	3.53	5.00	22.70	30.40	0.90	A2 + A	4.40	NIL	68.00	Beta Thalassaemia trait
85	10.50	5.23	8.10	20.10	34.50	15.80	A2 + F + A	2.00	NIL	0.00	Beta Thalassaemia
86	12.80	5.09	7.20	25.10	32.60	2.00	A2 + A	3.10	Occasio	0.00	Consistent alpha thalassaemia trait
87	12.20	5.08	4.80	24.00	37.10	0.20	A2 + A	3.00	NIL	0.00	Consistent alpha thalassaemia trait
88	6.70	3.42	2.00	19.60	31.60	32.00	E + F	40.50	NIL	0.00	E/Beta thalassaemia
89	3.10	1.45	5.30	21.40	28.40	47.30	E + F	36.60	NIL	1.266	E/Beta thalassaemia
90	8.80	4.07	6.30	21.60	38.40	3.30	E + A	49.20	NIL	6.90	Hemoglobin E trait
91	11.80	5.77	6.90	20.40	30.40	2.30	E + A	21.90	NIL	0.00	Hemoglobin E trait
92	10.20	4.87	9.50	20.90	35.20	2.90	E + A	18.90	NIL	0.00	Hemoglobin E trait
93	7.41	3.46	2.90	21.40	29.30	1.60	E + A	25.30	NIL	188.3	Hemoglobin E trait
94	5.20	3.11	1.70	16.70	23.30	9.40	A2 + A + H	4.50	Many	207.9	Hemoglobin H disease
95	8.10	4.31	8.00	18.90	27.80	1.60	A2 + A + H	1.20	Numero	226.8	Hemoglobin H disease
96	8.50	5.28	0.00	16.10	32.20	12.00	A2 + F + A	1.60	Many	0.00	Hemoglobin H disease
97	8.50	4.60	3.00	19.00	30.00	2.00	A2 + A	2.40	NIL	17.90	Normal

5.3 Distributions

The sample distribution of the types of Thalassaemia as shown in the figure 10 by dividing from all the cases in the database.

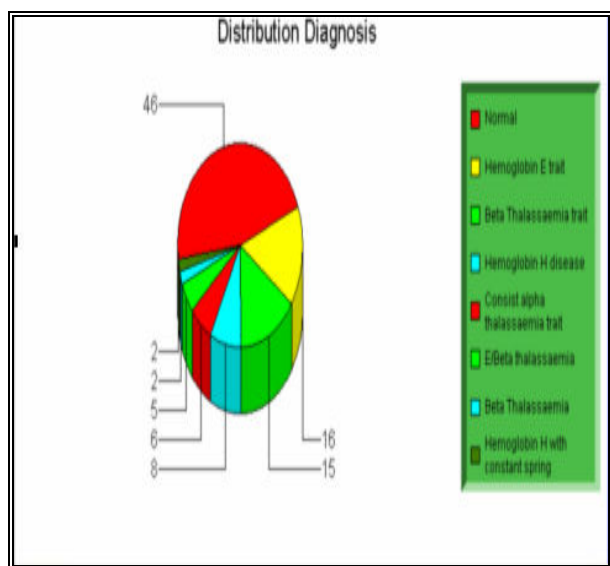


Fig - 10 Distribution of Diagnosis Thalassaemia

6 Conclusion

This phase is the finale of a specific research effort. Typically, it is the result of satisfying, that is, though there are still deviations in the behavior of the artifact from the (multiply) revised hypothetical predictions, the results are adjudged "good enough." Not only are the results of the effort consolidated and "written up" at this phase, but the knowledge gained in the effort is frequently categorized as either "firm" facts that have been learned and can be repeat ably applied or behavior that can be repeat ably invoked - or as "loose ends" anomalous behavior that defies explanation and may well serve as the subject of further research.

The implementation is performance of accuracy of diagnosis the cases which more viable. The main objective of using (CBR) algorithm in comparative distribution of diagnoses the Thalassaemia disease successfully. The accuracy of diagnosis the new case based on the previous cases. These previous cases were checked and confirmed from the experienced pathologist, this system will diagnose more accurately whenever the database of the system having more Thalassaemia cases record. This Thalassaemia Decision Support System decides the case on value of different attributes which are analyzed by the pathologist. After that our system forecast

the Thalassaemia disease by comparing different dataset of previous cases disease. From that he/she will be confidence of our system and increase the accuracy based on the large database.

Limitation

This paper limited only for diagnose Thalassaemia disease by entering the values of the attributes using keyboard of the PC, Thalassaemia calculates by Case Based Reasoning technique.

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