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Knowledge & Multimedia Based Web Systems (i'mPARENT)

Bitirme Ödevi

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Contents

I.ÖZGÜNLÜK BİLDİRİSİ

Özgünlük Bildirisi

1. Bu çalışmada, başka kaynaklardan yapılan tüm alıntıların, ilgili kaynaklar referans gösterilerek açıkça belirtildiğini,
2. Alıntılar dışındaki bölümlerin, özellikle projenin ana konusunu oluşturan teorik çalışmaların ve yazılım/donanımın benim tarafımdan yapıldığını

bildiririm.

İstanbul, 20.05.2008   İstanbul, 20.05.2008

Murat Bilici   Can Kayacan

II
Knowledge and Multimedia Based Web Systems
(Summary)

In the world, each person encounters problems about the issue of lack of experience and information, communication and sharing. New technologies and techniques aims to create effective solutions for that global problems.

Nowadays, technology is an increasingly influential factor. Computers and mobile devices are being widely used with internet. Human has a lifelong learning process and technology offers powerful learning tools that demand new skills and understandings.

In this project, solutions are created for more specific target; parents and infants. Although infants and parental problems are critical for the world, software solution has not been created yet. **i'mParent** has innovative approaches for these problems in a new way with technology.

Firstly, **i'mParent** presents social network for parents with features like news, friends, blog, group, event that all supported by rich media and tools. It is aimed to create world biggest community by considering parents' needs. Solution was integrated with Map features that enables parents could gather and share their experiences about the best places and activities for their babies and family adventures.

Secondly, there are big amount of information and information sources about baby care and parent like web sites, magazines, books etc. However, without filtering and indexing, these information is not utilizable. In Artificial Parent part of **i'mParent**, dynamic, interactive and intelligent information based system which based on artificial intelligence, created for parents. They can easily get information that they need immediately under experts supervision.

Finally, baby voices are turned into comprehensible language to make communication between parents and infants more strong. Moreover, RSS feed presented for their babies status. By this way, parents can access their babies status even they are not with their babies.

i'mParent aims to solve global problems and offers an innovative tool to communicate, create, disseminate, access, store and manage information.

III
Bilgi ve Çokluortam Tabanlı Web Sistemleri
(Özet)

Proje'nin Amacı:

Dünyada her insan, ebeveyn olduktan sonra deneyim, bilgi, iletişim ve paylaşım eksikliği nedeniyle sorunlar yaşamaktadır. Proje içerisinde, ebeveynler için dinamik ve etkileşimli bilgi dönüşüm platformu bulunmaktadır. Bu platform ebeveynleri bilinçlendirmek, eğitmek ve onları yönlendirmek amacıyla oluşturulmuştur. Ayrıca, araştırmalar bebeklerin konuşmaya başlayana kadar ortak bir dil kullandıklarını göstermektedir ve projede bu anlamlı seslerin etkili kullanımı teknoloji aracılığıyla sağlanmaktadır. Sistem bebeğin ses analizini yaparak bebeğin ihtiyaçlarını ve ne anlatmak istediğini ebeveyne iletir. Bu proje sayesinde, bebekler ve ebeveyn arasındaki iletişim problemine bir çözüm bulunmuştur.
 Bu yeni yaklaşım, iletişim kurmak ve hayat boyu değişmeyen, aynı zamanda tüm dünyada ortak olan eğitim değerleri aracılığıyla, bilgiye ulaşmak, saklamak ve yaymak için yepyeni bir araç sunmaktadır.

Proje Hakkında:

Ebeveynlerin bebeklerini büyütürken ve yetiştirirken karşılaştıkları ciddi sorunları vardır. Özellikle yeni ebeveynlerin bu konudaki bilgi ve tecrübe eksiklikleri, bebeklerinin problemlerini çözmelerinde, onları anlayabilmelerinde, doğru davranışta bulunmalarında sıkıntılar yaratmaktadır. Sistem son teknolojileri en etkin biçimde kullanarak ebevenylerin bu sorunlarını çözmeyi amaçlamaktadır.

 i'mParent uzmanlar tarafından da onaylanmış mevcut problemlere, yenilikçi çözümler getirmekte ve eğitimin ana değerlerinden yola çıkılarak üretilen küresel çözümler, tüm insanlığı kapsamaktadır. Mevcut ve Gelecek teknolojiler gözönünde bulundurularak geliştirilen i'mParent, kullanıcıların ihtiyacı doğrultusunda; insanlara dinamik, akıllı, çoklu dil desteğine sahip, interaktif bir platform sağlamaktadır. Ebeveynlerin karşılaştıkları en büyük sorunlardan biri de bebeklerin neden ağladığı, probleminin ne olduğu sorunudur. Yapılan son araştırmalar dünya üzerindeki bebeklerin ortak sorunları için ortak davranışlarda bulunduklarını ve ortak sesler çıkardığını göstermektedir. Sistem de bu araştırmaların sonuçlarını kullanarak, bebeklerin seslerini algılamakta ve aileye bebeğin ağlamasının olası nedenlerini sunmaktadır. Bu şekilde aile daha da bilinçlenmektedir. Ayrıca sesler sabit olmayıp, sürekli değişebilmekte aileler de bu sürece katılabilmektedirler. Kendi keşfettikleri sesleri sisteme yükleyebilmekte ve bu sesler daha sonraki analizlerde kullanılabilmektedir.

Bu yöntemler kullanılarak ebeveynler bilinçlendirilmekte ve eğitilmektedirler. Üstelik, i'mParent sayesinde mevcut araştırmalar gerçek verilerle desteklenirken, insanlığın kaderini değiştirecek yeni araştırmalar için bir başlangıç noktası oluşturmaktadır.

Projenin Kapsamı :

i'mParent uygulaması genel olarak üç ana uygulamadan oluşmaktadır. Bunlar;

1. Parents'Network
2. ArtificialParent
3. BabyNotCry

olmak üzere isimlendirilmişlerdir.
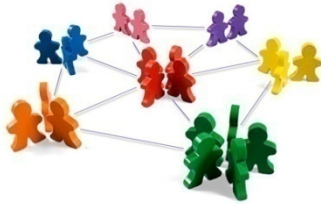
İlk uygulama, Parents'Network bir web uygulaması olup, günümüzde sosyal ağ servis hizmeti veren uygulamalarla benzer özelliklere sahiptir. Bu kısımda amaç, ebeveynlerin kendi aralarında ve uzmanlar ile sosyalleşmeleri, bilgi paylaşımında bulunmalarıdır. Haber, arkadaş, blog, grrup, aktivite gibi modüller zengin ortam ve araçlarla desteklenerek kullanıcıların hizmetine sunulmuştur. Ayrıca gerçek zamanlı mesajlaşma, e-posta, mesaj gibi özellikler uygulama içerisinde iletişimi kuvvetlendirmektedir. Uygulamaya entegre edilen harita modülü sayesinde ebeveynler yer ve mekan deneyimlerini diğer kullanıcılar ile paylaşabilmektedir. Uygulama içerisinde bulunan modüller etiketleme, yorum ekleme gibi ek özelliklerle desteklenmiş, böylece kullanıcıya her türlü şekilde bilgi ve fikir paylaşabilme olanakları sunulmuştur. Kullanıcılar için çeşitli roller belirlenmiş, böylece uygulama içerisinde bazı yetkilendirmeler yapılarak kullanıcıların uygulamayı farklı özelliklerle kullanması sağlanmıştır.

ArtificialParent uygulaması, ebeveynlerin anlık problemlerine çözüm üretebilmek ve ihtiyaç duydukları bilgiyi karşılayabilmek amacıyla oluşturulmuştur. Günüzmüde, Ebeveyn eğitimi ve bebek bakımı ile ilgili büyük miktarda bilgi ve bilgi kaynağı bulunmakta. Örnek olarak web siteleri, e-kitaplar, dergiler, gazeteler, tv-radyo programları, kitaplar, makaleler vb. gösterilebilir. Fakat bilgilerin indekslenip ve filtrelenip kullanılabilir hale getirilmeden yararlı olması mümkün değildir. Nitekim teknoloji çağında karşılaştığımız ve karşılacağımız en büyük problemlerden biri de kullanılabilir bilginin edinilebilmesidir. **i'mParent**, teknoloji sayesinde bu problemlere yeni ve akılcı yollarla yaklaşmıştır. Üstelik, sistem geri bildirim toplayarak dinamik hizmet vermekte, kullanıcının girmiş olduğu verileri ileride kullanmak üzere veritabanında saklamaktadır.

Son olarak, BabyNotCry uygulaması ebeveyn ve bebeği arasında ki iletişimi kuvvetlendirmek için geliştirilmiştir. Sistem akıllı istemci uygulama şeklinde geliştirilmiş böylece programın yerelde kullanılabilmesi sağlanmıştır. Uygulamayı kullanan ebeveynler

bebeklerinin seslerini yorumlayabilmek tedirler. Dünyada geliştirilen ilk yazılım çözümü olmasıyla bir ilki temsil etmektedir. Örnek seslere yapılan denemelerde uygulamanın yüksek doğruluk oranında çalıştığı gözlemlenmiştir. Dahası uygulamaya kayıt olan kullanıcılar, şifre ve kullanıcı adlarıyla oturum açtıklarında, istemci uygulama web servisi üzerinden sunucu tarafında bulunan uygulama ile etkileşim kurmakta, böylece aile bebeğinin durumunu nerede olursa olsun görebilmektedir. Sunucu uygulama bebeğin durumu hakkındaki bilgileri RSS beslemesi olarak sunmakta böylece, XML formatına geçirilen bilgiler, diğer uygulamalar tarafındanda erişilebilir hale gelmektedir.

Projenin Sonuçları :

i'mParent basit bir web sisteminden öte, dünyadaki ebeveyn problemleri için son derece gelişmiş ve akılcı çözümlerin üretilmiş olduğu bir projedir. Mevcut ve Gelecek teknolojilerin akılcı bir mühendislikle projeye dahil edilmesi, **i'mParent**'ı sadece iyi bir web projesi olmaktan çıkarıp; dünyanın, insanların ve teknolojinin geleceğini ilgilendiren bir kimliğe kavuşmasına neden olmuştur.

Sistem içinde sunulan sosyal ağ servisi ailelerin ihtiyaçları doğrultusunda düzenlenmiş, zengin araç ve ortamlarla dedsteknlenmiştir. Akıllı sistem, web üzerinden çalışan bilgi tabanlı bir sistem üzerine oturmakta ve gelecek teknolojiler göz önüne alınarak tasarımı yapılmaktadır. Ses çözümü dünyada ilk ve tek yazılım çözümü olması nedeniyle büyük önem taşımakta, ailelerin yıllar boyunca karşılaştıkları sorunlardan birine çözüm üretilmiştir.

Bir diğer önemli nokta, sistemde toplanacak olan verinin gelecek araştırmalar için büyük önem taşımasıdır. Yapılacak analizlerle pek çok önemli bilgi yorumlanabilecek, mevcut sorunlara daha akılcı çözümler üretilebilecektir.

1 Introduction

1.1. Problem Description

In the world, each person encounters problems about the issue of lack of experience and information, communication and sharing. New technologies and techniques aims to create effective solutions for that global problems.

Nowadays, technology is an increasingly influential factor. Computers and mobile devices are being widely used with internet. Human has a lifelong learning process and technology offers powerful learning tools that demand new skills and understandings.

In this project, solutions are created for more specific target; parents and infants. Although infants and parental problems are critical for the world, software solution has not been created yet.

Firstly, parents need a place to share their experience and communicate each other. This problem based on, there is no social network service for parents with rich media and tool support. Moreover, they can not communicate with experts over internet.

Secondly, there are big amount of information and information sources about baby care and parent like web sites, magazines, books etc. However, without filtering and indexing, these information is not utilizable. Parents need a information system that they can get information easily. Intelligent system is required to provide convenient solution and understand their real problems.

Finally, baby voices are not comprehensible and parents can not understand their baby's needs. One of the problems is, parent cannot access their baby's status over internet.

In this project, these problems are aimed to be solved.

1.2. Previous Researches

BabyNotCry part of project based on research, Dunstan Baby Language[1]

These research executed on hundred of babies from over 30 countries and results produced. Parents that used this researches, have positive feedbacks.

Another research about baby voice is WhyCry product which was developed to interpret baby voices [2]

Other technical researches referenced in analysis of project part.

1.3. Researches in Project Development Cycle

During project cycle, technical and non-technical researches have been executed. Technical researches based on knowledge based system and voice recognation analysis, design and implementation. These reseaches covers artificial intelligence, data mining, machine learning, pattern recognation and voice processing. Non-technical researches

consist of, medical problem-solution informations, medical ontologies, baby language and social network services.

1.4. Report

In this report,firstly project plan is described. After that, information is given about general concepts and patterns related with sytstem . In Analysis and Modelling part, system designed wity software engineering methods. Finally part of the report covers test and comments about system.

2 PROJECT PLAN

2.1 Main Functions of Project

A functional decomposition of the software
- ✓ Creating social network among parents and experts with rich media support
- ✓ Matching problems with feasible solutions
- ✓ Providing smart flows to solve problems
- ✓ Acquiring data with feedbacks for dynamism
- ✓ Supervision over solutions
- ✓ Analysing baby's voice
- ✓ Adaptation of system with machine learning
- ✓ Accesible baby status

2.2 Performance Criterias

- ✓ Although parents education problems are critical for parent education in the world, software solution has not been created yet with AI techniques. There are big amount of information and information sources about baby care and parent education like web sites, magazines, books etc. However, without filtering and indexing, these information is not utilizable. Moreover, parents can not share their experiences which turns tacit knowledge into explicit, in dynamic and multilanguage platform.
- ✓ Low cost software solution for end-user.
- ✓ Researches about baby voices show that baby voices are meaningful. Only "WhyCry" has been created to try to understand baby voice until now. However it is an hardware, offline, high priced and is not up-to-date. ImParent eliminates these disadvantages.
- ✓ It collects feedback and it dissolves the boundaries between parents. It is a new invention about baby voice analyzing in researches.

2.3. Project Scope

In the project, problems are idendified under two main titles, Knowledge Based System and Multimedia System.

To verify systems, technical researches executed about;
- ✓ Knowledge Based Systems
- ✓ Expert Systems
- ✓ Artificial Intelligence Methods
- ✓ Case Base Reasoning
- ✓ Ontologies & Object Oriented Structure
- ✓ Machine Learning
- ✓ Clustering & Classification
- ✓ Data & Web Mining
- ✓ Pattern Recognation
- ✓ Web Technologies
- ✓ Web Services

- ✓ Voice Analysis & Recognation
- ✓ Data Access
- ✓ Software Patterns
- ✓ Social Network
- ✓ Single Sign On
- ✓ RSS Feeds
- ✓ XSS

Non-Technical researches executed about;

- ✓ Parents' & Infants problems
- ✓ Diagnosis Methods
- ✓ Recent Solutions
- ✓ Experts & Doctors Ideas

2.4. Estimations about Project

This section provides cost, effort and time estimates for the projects

2.4.1. Historical data used for estimation

Previous version of project PARE.NeT completed in 5 months

2.4.2. Estimation techniques applied and results (COCOMO)

Programming Language C# and J#, 3000 line, 3 KLOC. Proje semi-detached project

Factor:	
1. Reliability	1.35
2. Database	0.95
3. Complexity	0.86
4. Running Time Constraints	1.01
5. Storage Constraints	1.17
6. Virtual Machine Variables	0.84
7. Computer Process Time	0.90
8. Analyser Capacity	1.30
9. Programmer Capacity	0.71
10. Experience	0.85
11. Virtual Machine Experience	0.90
12. Programming Language Experience	1.1
13. Modern Programming Techniques	1.00
14. Software Tools	1.00
15. Developing Time	1.1

Tablo 2.1: **EAF Calculation**

Total EAF = 0.84

* PM (Person-Month) : $PM = 3.0 \times (KLOC)^{1.12} \times EAF$
$$= 8,6 \text{ person-month}$$
* Project Time = $2.5 \times (PM)^{0.35} = 5,3$ month

2.5. Risk Management

This section discusses project risks and the approach to managing them.

Risks:	Solutions:
New technologies and techniques	Researches and consulting researchers
Real world solution	Consulting medical experts
Communication problem between project members	Scheduled Meetings and Project management tools
Short time period and relation between project modules	Decomposition of modules and effective sharing of work

Tablo 2.2: Risk Management Table

2.6. Schedule

2.6.1 Project Modules

A functional decomposition of project used for scheduling is presented here.

   a. Research about technology (2 weeks)
   b. Research about parent education and collecting data (7 weeks)
   c. Defining details of ImParent, Modules (2 weeks)
   d. Creating Database, Information Module (1week)
   e. Creating Algorithms, Information Module (2 weeks)
   f. Object Oriented design (2 weeks)
   g. Creating Web Services, Information Module (1 week)

   h. Creating Voice Analyzing Module (5 weeks)
   i. Testing Voice Module with sample voices (3 weeks)
   j. Registering data and voice samples into database (1 week)
   k. Creating User Interface (2 weeks)
   l. Test and Error Correction (1 week)
   m. Documantation (14 weeks)
   n. Presentation (14 weeks)
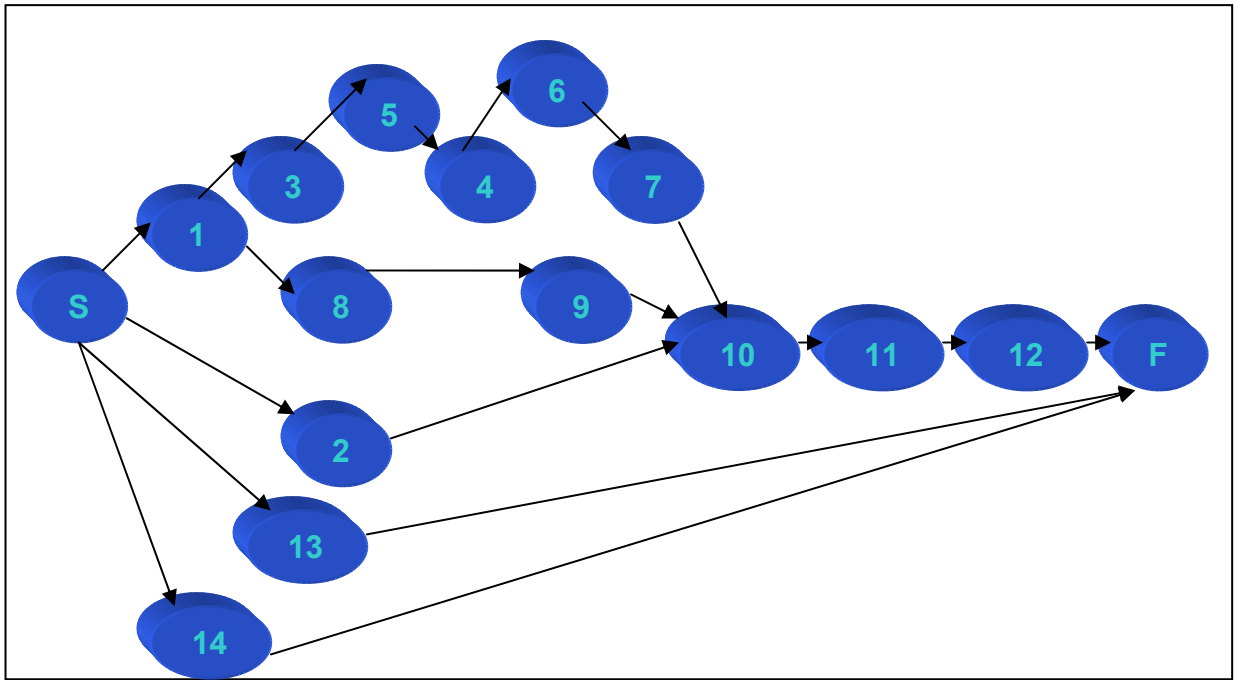
Figure 2.1: Modules Workflow
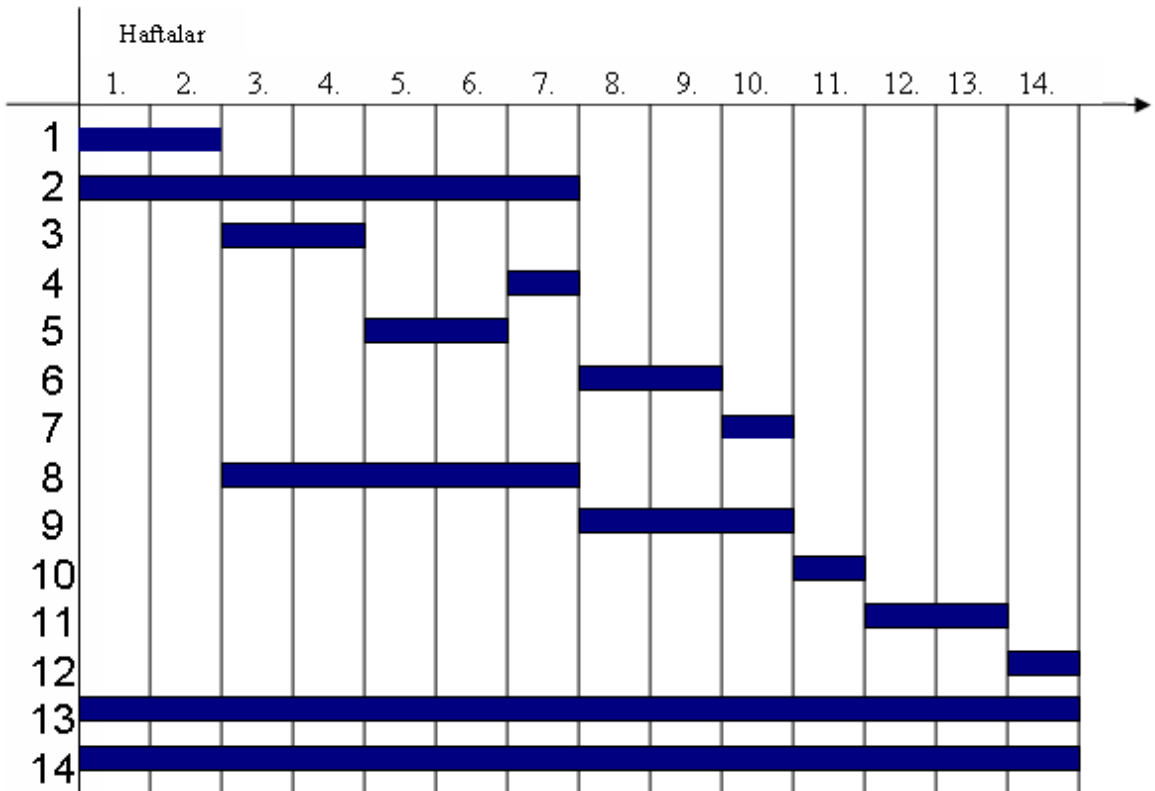
2.6.2 Gannt Chart

Figure 2.2: Gannt Chart

2.7. Project Resources

- Server
- Software Tools
  1. Programming Languages : C#, J#
  2. .NET Framework 3.5
  3. Microsoft Visual Studio 2008
  4. Microsoft SQL Server 2005 Management Studio
  5. Microsoft SQL Server 2005 Business Intelligence & Analysis Services
  6. Silverlight
  7. ASP.NET
  8. ASP.NET XML Web Service
  9. AJAX
  10. ASP.NET AJAX Toolkit
  11. RSS Toolkit
  12. Anti XSS
  13. SSO (OpenID, LiveID)
  14. Live Library
  15. DataSet Designer
- Technical Resource about technologies
- Non-Technical Resource about parents&infants problems

2.8. Project Team

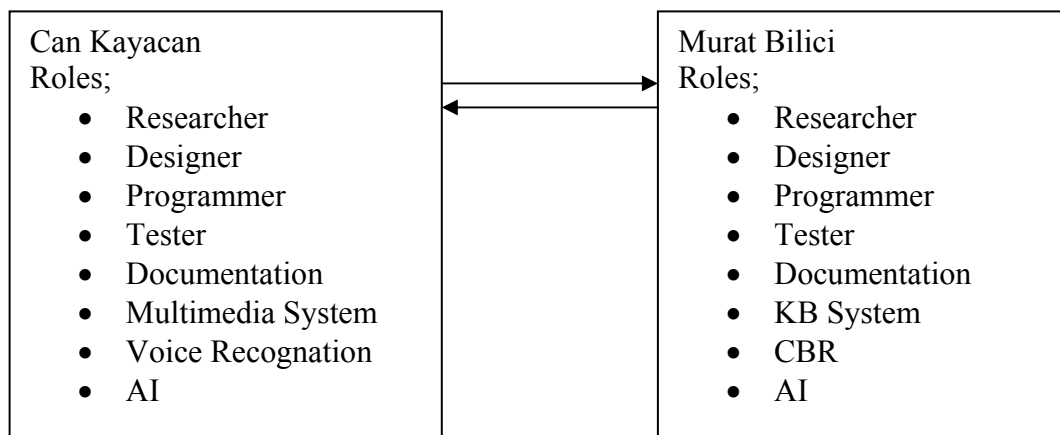| Can Kayacan Roles; • Researcher • Designer • Programmer • Tester • Documentation • Multimedia System • Voice Recognation • AI	Murat Bilici Roles; • Researcher • Designer • Programmer • Tester • Documentation • KB System • CBR • AI

Figure 2.3: Project Team

3 CONCEPTS

3.1. Knowledge Based Systems

A *knowledge-based system* is a program for extending and/or querying a knowledge base [3].

A *knowledge-based system* as a computer system that is programmed to imitate human problem-solving by means of artificial intelligence and reference to a database of knowledge on a particular subject [4].

Knowledge-based systems are systems based on the methods and techniques of Artificial Intelligence. Their core components are the knowledge base and the inference mechanisms.

Expert systems, case-based reasoning systems and neural networks are all particular types of knowledge-based systems, there are others who consider that expert systems and neural networks are different, and exclude neural networks from this category.

KBS is a frequently used abbreviation for *knowledge-based system*.

3.2. Ontologies & Object Oriented Structure

A body of formally represented knowledge is based on a *conceptualization*: the objects, concepts, and other entities that are presumed to exist in some area of interest and the relationships that hold them [5].

An *ontology* is an explicit specification of a conceptualization. The term is borrowed from philosophy, where an ontology is a systematic account of Existence. For knowledge-based systems, what "exists" is exactly that which can be represented [6].

Ontology can be described of a program by defining a set of representational terms. In such an ontology, definitions associate the names of entities in the universe of discourse (e.g., classes, relations, functions, or other objects) [6].

3.3. Expert Systems

Expert knowledge is a combination of a theoretical understanding of the problem and a collection of heuristic problem-solving rules that experience has shown to be effective in the domain.

Expert systems are constructed by obtaining this knowledge from a human expert and coding it into a form that a computer may apply to similar problems [7].

3.4. Artificial Intelligence

It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable [8].

3.5. Case Base Reasoning

Case-based reasoning (CBR), broadly construed, is the process of solving new problems based on the solutions of spesific similar past problems that previously experienced, concrete problem situations (cases) [9].

3.6. Machine Learning

Machine Learning is the study of computer algorithms that improve automatically through experience. Applications range from datamining programs that discover general rules in large data sets, to information filtering systems that automatically learn users' interests [10].

3.7. Clustering & Classification

Clustering is the unsupervised classification of patterns (observations, data items, or feature vectors) into groups (clusters). The clustering problem has been addressed in many contexts and by researchers in many disciplines; this reflects its broad appeal and usefulness as one of the steps in exploratory data analysis[11]. *Clustering* is a division of data into groups of similar objects. Representing the data by fewer clusters necessarily loses certain fine details, but achieves simplification [12].

3.8. Data & Web Mining

Data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both [13].

3.9. Social Network Service

A *social network service* uses software to build online social networks for communities of people who share interests and activities or who are interested in exploring the interests and activities of others.

3.10. Patterns

3.10.1. Multitier Architecture

Multi-tier architecture is a client-server architecture in which an application is executed by more than one distinct software agent. For example, an application that uses middleware to service data requests between a user and a database employs multi-tier architecture. The most widespread use of "multi-tier architecture" refers to *three-tier architecture*.
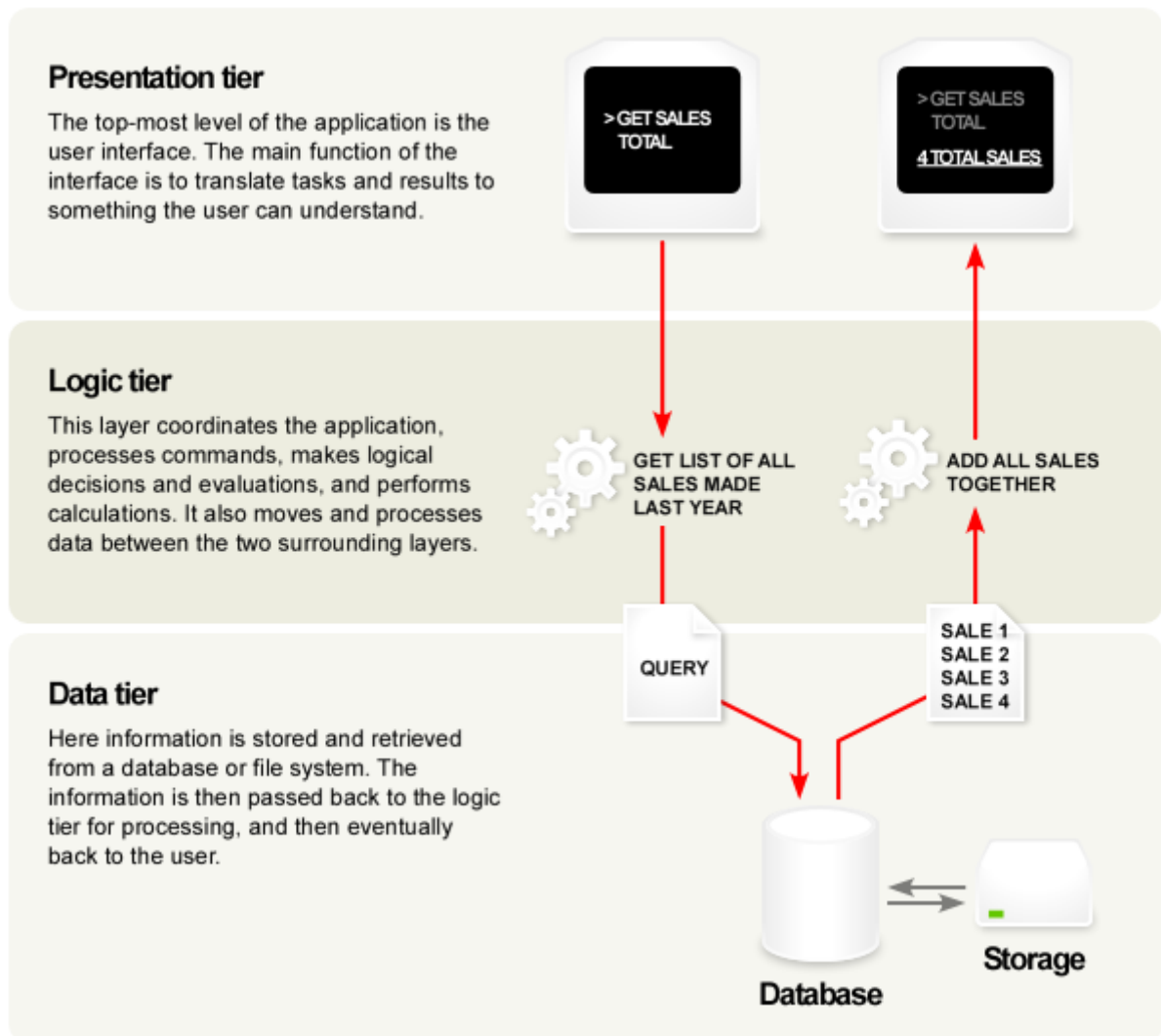
3.10.1.1. Three-tier architecture

Figure 3.1: Three Tier Architecture

Three-tier' is a client-server architecture in which the user interface, functional process logic ("business rules"), computer data storage and data access are developed and maintained as independent modules, most often on separate platforms [14].

The three-tier model is considered to be a software architecture and a software design pattern.
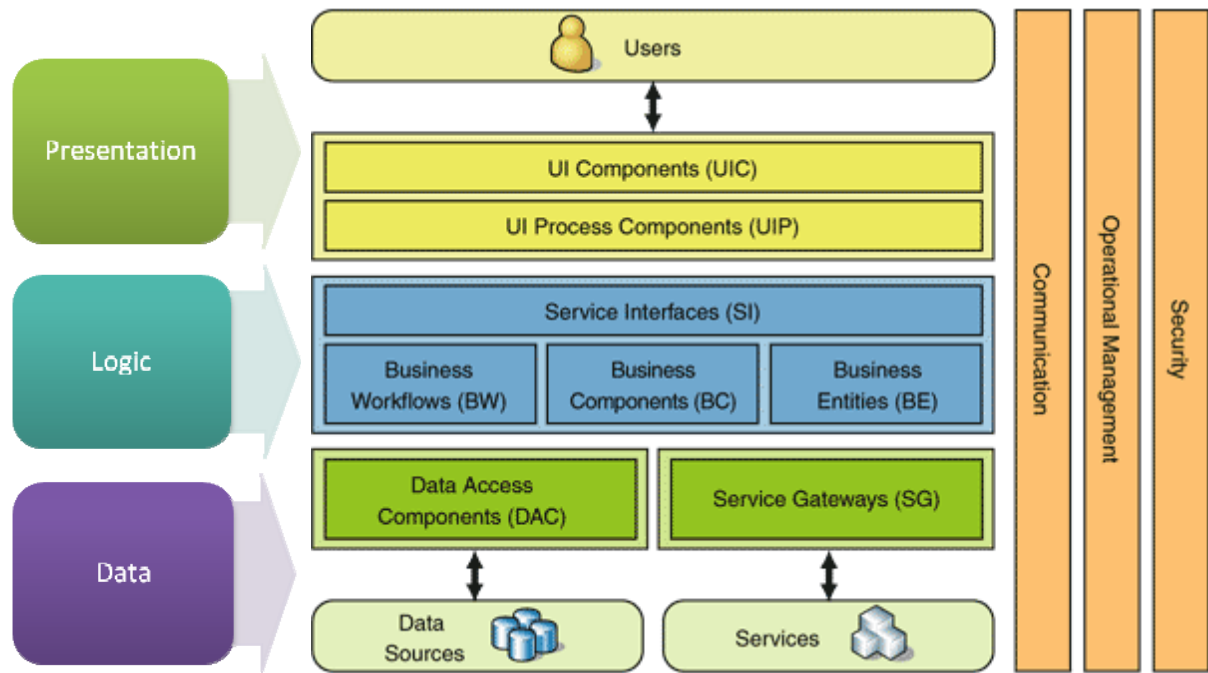
Figure 3.2: Detailed Three Tier Architecture

The 3-Tier architecture has the following three tiers:

Presentation Tier

> This is the top most level of the application. The application consists of a series of forms (pages) with which the user interacts. Each form contains a number of fields that display output from lower layers and collect user input. It communicates with other tiers by outputting results to the browser/client tier and all other tiers in the network.

Application Tier (Business Logic/Logic Tier)

> The logic tier is pulled out from the presentation tier and, as its own layer, it controls an application's functionality by performing detailed processing.

Data Tier

> This tier consists of Database Servers. Here information is stored and retrieved. This tier keeps data neutral and independent from application servers or business logic. Giving data its own tier also improves scalability and performance.

3.10.2. Model-View-Controller

The *Model-View-Controller (MVC)* design pattern provides solutions by decoupling data access, business logic, and data presentation and user interaction [15] :
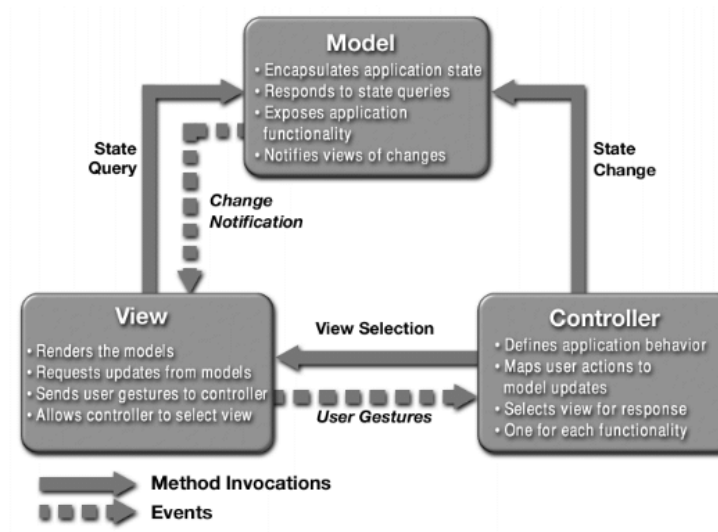

Figure 3.2: Model-View-Controller

Model

   The model manages the behavior and data of the application domain, responds to requests for information about its state (usually from the view), and responds to instructions to change state (usually from the controller).

View

   The view manages the display of information.

Controller

   The controller interprets the mouse and keyboard inputs from the user, informing the model and/or the view to change as appropriate.

3.11. Voice Recognition

The steps and each of its significances and an overview of these is presented in the figure below.
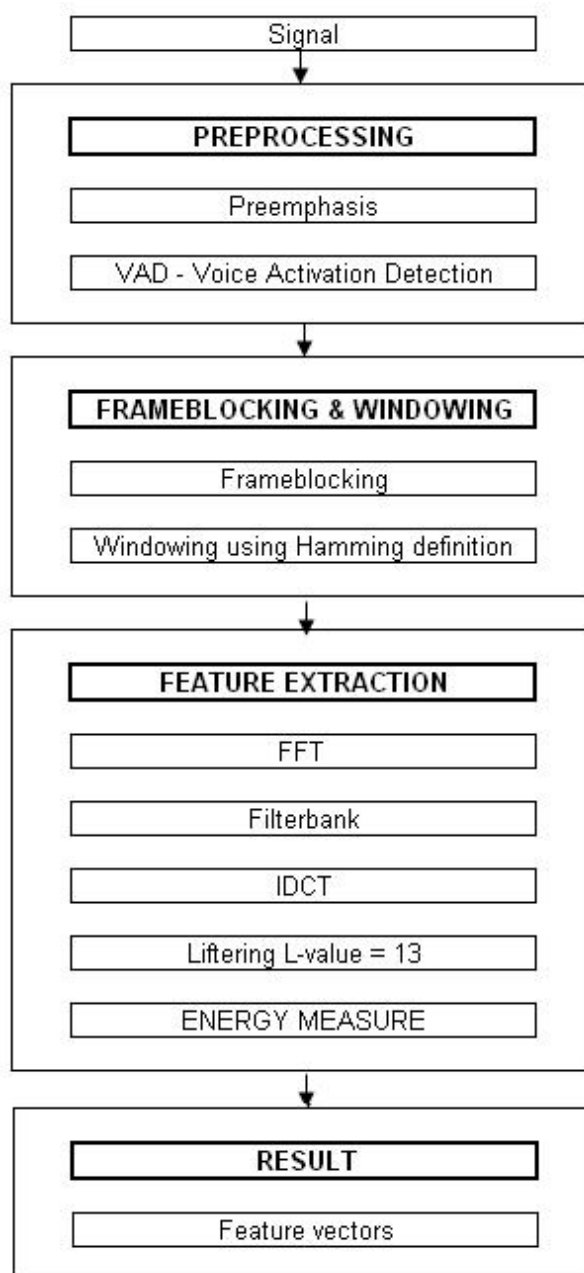

Figure 3.3: Voice Recognation Flow

3.11.1. Speech Signal

The original analogue signal which to be used by the system in both training and testing is converted from analogue to discrete
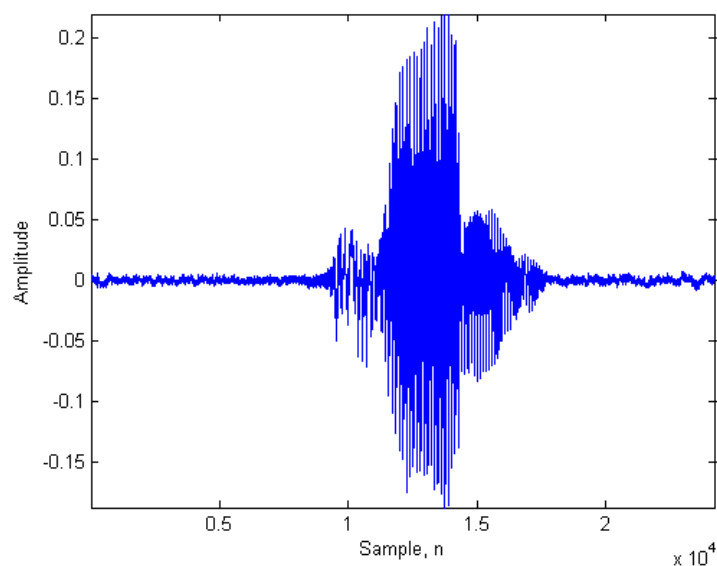An example of a signal in waveform sampled is given in figure.

Figure 3.4: Speech Signal

3.11.2. Preemphasis

The preemphasizer is used to equalize amplitude of high and low frequency.

This preemphasis is easily implemented in the time domain by taking difference.

Ã(n) = A(n) -a* A(n-1)

a= scaling factor = 0.95
A(n)= Digitized Speech Sample
A(n-1) = Previous digitized Speech Sample
Ã(n) = Pre emphasised Speech Sample.
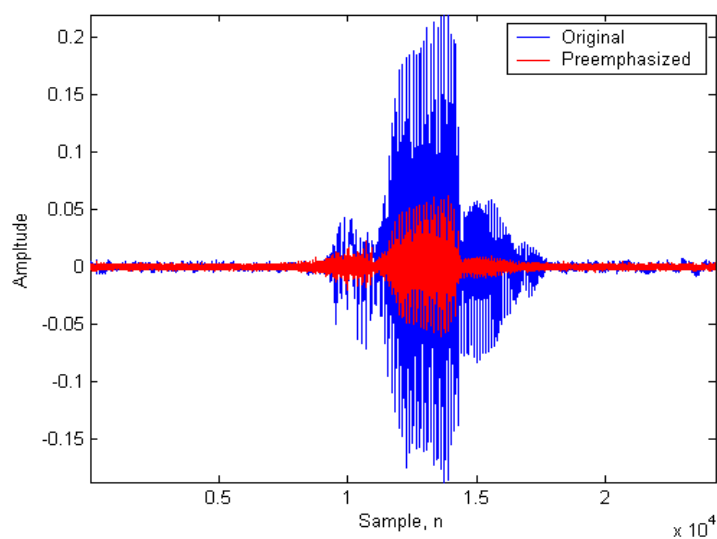n = No. of Samples in the whole frame.

Figure 3.5: Preemphasis

3.11.3. VAD (Voice Activity Detection)

When you have got access to a sampled discrete signal it is significant to reduce the data to contain only the samples which is represented with signal values, not noise. Therefore the need of a good Voice Activation Detection function is needed.
Methods that can be used for detecting word boundary.
- Energy or Average magnitude.
- Average Zero Crossing rate.
- Average Zero Crossing rate with threshold.[16]

Average Zero Crossing with threshold rate method used in ImParent application. For low frequency average zero crossing rate gives poor result. Because background noise has comparable frequency. This can be solved by registering zero crossing only for those input signal which has energy greater than some threshold.
Energy of segment is given by

$$E = \sum_{k=0}^{n-1} x(N+k)^2$$

Energy magnitude of each segment is compared with threshold. Threshold dynamically determined.
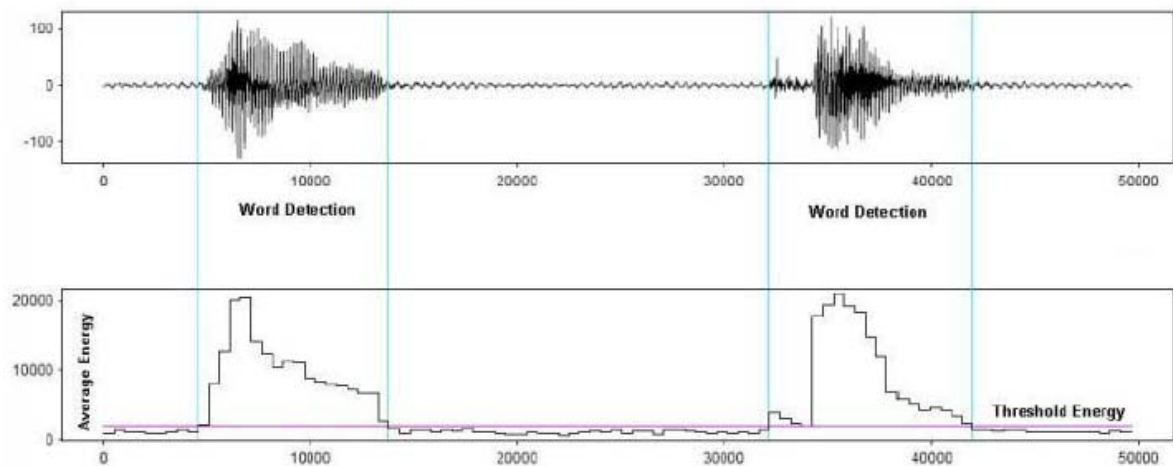

Figure 3.6: Voice Activity Detection

3.11.4.Framing

Here a continuous speech signal is divided into frames of N samples. Adjacent frames are being separated by M(M<N). The values used in our project are M = 512, and N = 256.[17]
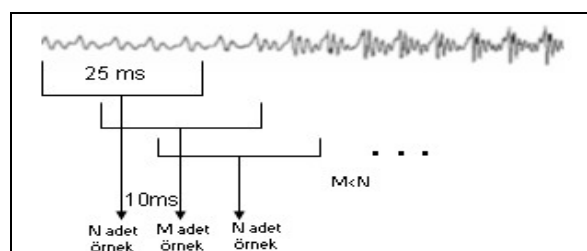
Figure 3.7: Framing

3.11.5. Windowing

The Hamming window is used to decrease the signal to zero at the beginning and end of each frame. [17]

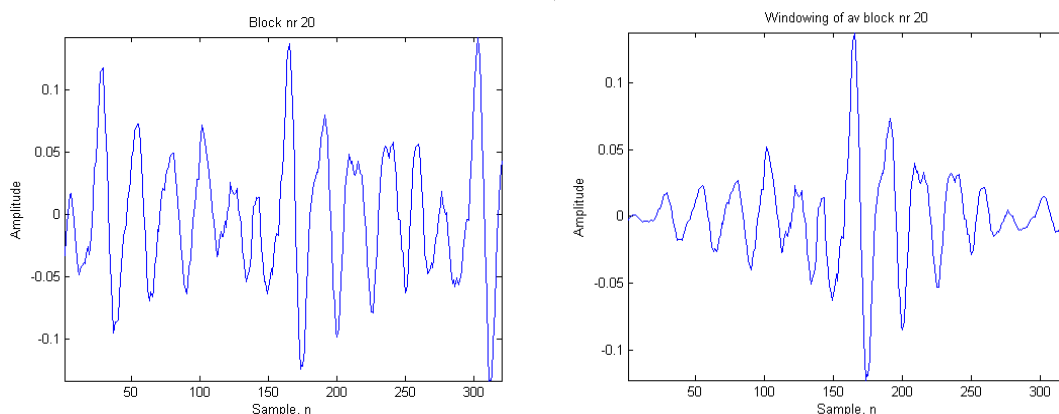*h(n) = 0.54 – 0.46 cos(2πn / N -1), 0≤ n ≤N -1*

Figure 3.8: Windowing

3.11.6. FFT on each block

This algorithm extracts frequency amplitudes for discrete frequency intervals from given segment.
For N sample points as input to FFT routine N/2 complex values are computed corresponding to each of the N/2 points in FFT.
There are only N/2 points in FFT as highest frequency that can exist is half the sampling rate.

$$X_n = \sum_{k=0}^{N-1} x_k e^{-2\pi jkn/N}, \quad n = 0,1,2,\ldots,N-1$$

Example: Consider the following array of data, obtained by sampling a function f(t) with period 2π at 16 equally spaced points in the interval $[0,2\pi]$:

1.0000	0.3333	0.5355	1.9569	4.0000	5.4342	5.1213
2.7282						
-1.0000	-4.5759	-6.5355	-6.1995	-4.0000	-1.1915	0.8787
1.5145						

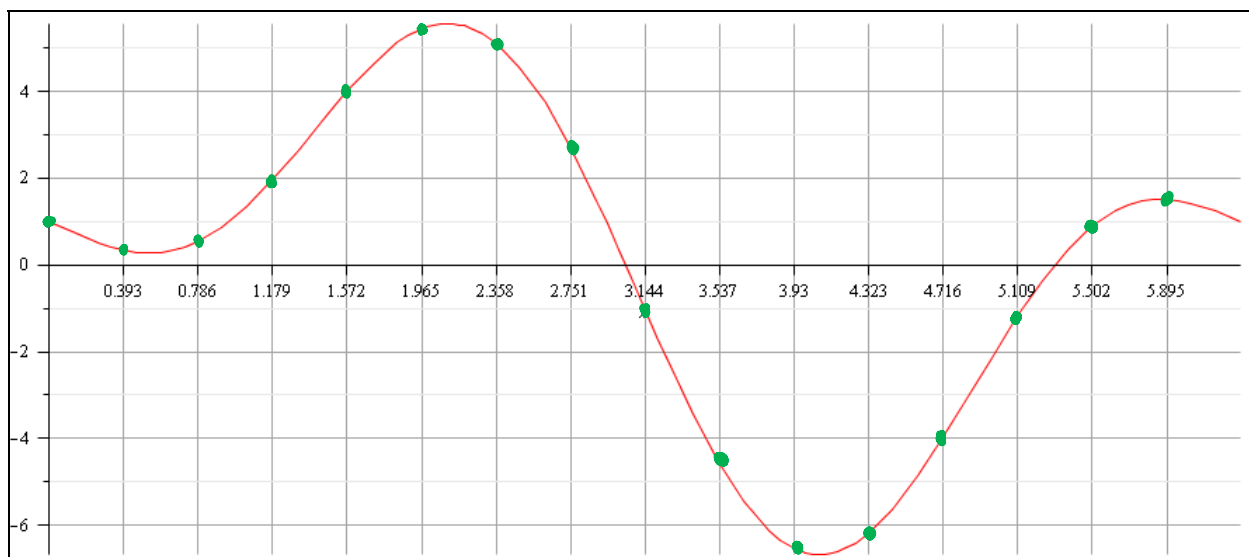**Figure 3.9**: FFT

We setup two arrays a (reflecting the data) and b (containing zeros) as follows:
double a[] = { 1.0000, 0.3333, 0.5355, 1.9569, 4.0000, 5.4342, 5.1213, 2.7282,
-1.0000, -4.5759, -6.5355, -6.1995, -4.0000, -1.1915, 0.8787, 1.5145 };
double b[] = {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0};
Then we use these arrays as input to the computeFFT method as follows:
computeFFT(1, 16, a, b);
When that method finishes, it recomputed a and b. When we print out the new values of a
and b, we find:
a[0]= 0.0000   b[0]= 0.0000
a[1]= 1.0000   b[1]= 4.0000
a[2]= 0.0000   b[2]=-3.0000
a[3]= 0.0000   b[3]= 0.0000
            ...
Thus, we can conclude that the original (unknown) function with given period 2π was:
$$f(t) = \cos(t) + 4\sin(t) - 3\sin(2t)$$
To complete the assignment, you will need to decompose a function represented by an
array of length N and period P.

3.11.7. Mel spectrum coefficients with filterbank

The fact that the human perception of the frequency content in a speech signal is not
linear there is a need for a mapping scale. There are different scales for this purpose.
The scale used in this thesis is the Mel scale. This scale is warping a measured
frequency of a pitch to a corresponding pitch measured on the Mel scale. The
definition of the warping from frequency in Hz to frequency in Mel scale is described
in *Eq.4.4* and vice versa in *Eq.4.5*. [18]

$$F_{mel} = 2595 \cdot \log_{10}(1 + \frac{F_{Hz}}{700})$$

The practical warping is done by using a triangular Mel scale filterbank as shown in
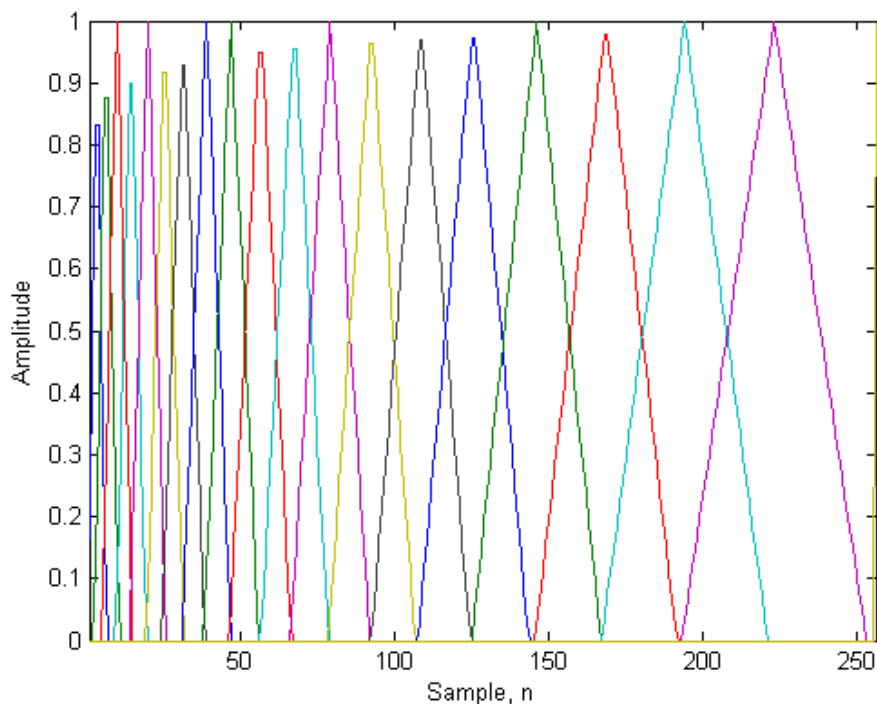following figure:

Figure 3.10: Mel Scale FilterBank

3.11.8. Cepstrum

(Mel-Cepstrum coefficients, DCT – Discrete Cosine Transform)
In this final step we use the Discrete Cosine Transform (DCT) to convert the log mel-scale spectrum back to time domain. The result of the conversion is MFCC.

$$\tilde{c}_n = \sum_{k=1}^{K} (\log \tilde{S}_k) \cos\left[n\left(k - \frac{1}{2} \right) \frac{\pi}{K} \right], \quad n = 1, 2, \ldots, K$$

From the spectrum values, the coefficients (MFCC) are obtained by the above formula.[19]

3.12. Web Service

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.
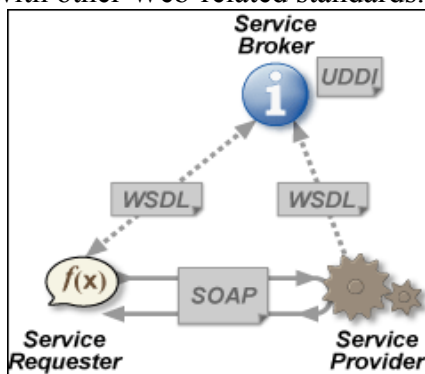

Figure 3.11: Web Service

3.13. DataProvider and DataSet (ADO.NET)

3.13.1. Data provider

These classes provide access to a data source, such as a Microsoft SQL Server or Oracle database and OLEDB data provider. Each data source has its own set of provider objects, but they each have a common set of utility classes:

Connection: Provides a connection used to communicate with the data source. Also acts as an abstract factory for command objects.

Command: Used to perform some action on the data source, such as reading, updating, or deleting relational data.

Parameter: Describes a single parameter to a command. A common example is a parameter to a stored procedure.

Data Adapter: A bridge used to transfer data between a data source and a DataSet object (see below).

Data Reader: Used to efficiently process a large list of results one record at a time. It allows records to be accessed in a read-only, forward-only mode, i.e., records have to be accessed in sequential order; they can neither be randomly accessed nor can a record which has been processed previously be accessed again.

3.13.2. DataSets

DataSets objects, a group of classes describing a simple in-memory relational database, were the star of the show in the initial release (1.0) of the Microsoft .NET Framework. The classes form a containment hierarchy:

A *DataSet* object represents a schema (either an entire database or a subset of one). It can contain tables and relationships between those tables.

A *DataTable* object represents a single table in the database. It has a name, rows, and columns.

A *DataView* object "sits over" a DataTable and sorts the data (much like a SQL "order by" clause) and filters the records (much like a SQL "where" clause) if a filter is set. An in-memory index is used to facilitate these operations. All DataTables have a default filter, while any number of additional DataViews can be defined, reducing interaction with the underlying database and thus improving performance.

A *DataColumn* represents a column of the table, including its name and type.

A *DataRow* object represents a single row in the table, and allows reading and updating of the values in that row, as well as retrieving any rows that are related to it through a primary-key foreign-key relationship.

A *DataRowView* represents a single row of a DataView. The distinction between a DataRow and DataRowView is important when iterating over a result set.

A *DataRelation* is a relationship between tables, such as a primary-key foreign-key relationship. This is useful for enabling DataRow's functionality of retrieving related rows.

A *Constraint* describes an enforced property of the database, such as the uniqueness of the values in a primary key column. As data is modified any violations that arise will cause exceptions.

A *DataSet* is populated from a database by a DataAdapter whose Connection and Command properties have been set. However, a DataSet can save its contents to XML (optionally with an XSD schema), or populate itself from XML, making it exceptionally useful for web services, distributed computing, and occasionally-connected applications.

4 ANALYSIS AND MODELING

Analysis of problem details and modelling of solutions through concepts and patterns are discussed in this part. Solution created over Object Oriented Structure by referencing real world and abstract objects. Modelling of solutions are visualized by UML diagrams. Moreover, architecturel model via patterns and relation between project and concepts are discussed.

4.1. Project Overview

The aim of the project is; providing complete solutions to solve infants' and parental problem. These problems are based on basic concepts and detailed through specifications. After long term analysis of problems with experts ideas, general solution topics are created. These solution topics correspond directly users' needs and these are;

   a. Parents need a social network service solution to share their experience and socialize with rich media support
   b. Parents need a technological solution to understand their baby's needs and access their baby's status from everwhere
   c. Parents need a pre-professional help which directs them when they have a problem

These users' needs requires a huge, dynamic and online knowledge & multimedia based system. Moreover, not only user needs but also information which is going to used in researchs was taken into considerition.

Each solution based on different problem concepts.

4.1.1.Social Network Service Concepts

Authentication Standarts : Web based solution needs a authentication system to provide accessibility for user by their roles. Nowadays, technolgy becomes a solution, shared identity service, which allows Internet users to log on to many different web sites using a single digital identity, eliminating the need for a different user name and password for each site. New SSO(Single Sign On) systems are launched by different providers. Some of them are OpenID, LiveID, GoogleID etc. User want to login with thier existing IDs.

Friend : One of the main feature of social network system is connecting with people, creating relationship with them. User want to create a friendship with existing user, send message or they want to invite other friends.

News : Users want to be informed by news in web site and they want to add a various news abput them or something else.

Blogs : Million of internet user blogging and user want to have their own blog in social network services.

Groups : Users want to create and join group, related with them. They want extra features as a admin and user of a group.

Events : Users want to create and join event, related with them. They want extra features as a admin and user of a event.

Media : Rich media support is really important for social network site user.

Map : People start using web based maps through their needs.

Recent Items : Social network service user want to informed about recent items in social network web site.

Communication : Parents want to communicate with experts and other parents. These are provided by Instant messaging system, messagin system in web site and e-mail.

All these items need several extra features like tagging, commenting, managing etc.

4.1.2. Baby Language and Accessible Status Concepts

Baby Language : Researches show that babies have meaningful voices and they use these voices until they begin speaking. However many parent are unconcious about these voices and they cannot understand their babies.

Status : Parents want to access their baby's status when they are not with them and some parents use various technological equipment for that.

Voice Recognation : Many language have speech recognation system except baby language. Babies have smilar voices for their basic needs.

4.1.3. Problem Solution Concepts

User-Created Data : Parents gain experience while bringing up their babies. However these experience is tacit and they can not share and store their experience easily.

Expert-Created Data : Parents need confident information when they have a problem. Without supervision of experts user created data is not trustable enough.

Problem : Problems are consist of requirements that parents need when they don't know what to do or they just want to inform about.

Solution : Solution contains answers for problems that mentioned above.

Problem-Solution Relations : One of the most important consept among all. Problem solution relations based on two difference. First one user created problem and solution assocation which needs expert authentication and the second one expert created problem and solution assocation which is authenticated directly.
Both relation needs dynamic and refreshable features like;
- One problem can have more than one solution
- Onu solution can answer more than one problem

- Solution of problem can be changed. New solution will be added, old solution will be removed
- Every solution have different importance for problems
- Problems are associated with symptoms and metawords
- Problems and symptoms have importance for history

Analysis : Analysis of problem by looking symptoms, similarities in histories, baby spesific features etc. İs among user needs to solve their problems.

History : Users and babies problem & symptom histories added to system with dates to make them usable in feature matching algorithms. Moreover, parents can watch their past actions and their babies status.

4.1.4. Data Initialization Concept

Project based on huge knowledge & information set. At first step, data initialized from web, books, magazines and other sources. Sample voices tested in baby language analysis. But, information in system is going to increase day by day. User created data added into system and in problem-solution part, these datas need supervision of experts.

4.2. Technical Analysis of Project

After analysis of project overview and general concepts, technical analysis of project is mentioned in this part. Firstly, actors of the system are defined and roles of them are determined. Secondly, objects of the system are created with relations among them.

4.2.1. Actors

There are four different user type in the system;

a. Guest
b. Parent (Logged in)
c. Expert (Logged in)
d. Admin (Logged in)

Each of them has different roles and authorization

a) **Guest**

These user type don't need to login system. It is authorized to use only basic features of system. It has read-only rights, it can not create data.

b) Parent

These user type need to login system. It has rights;

- ✓ Can add Baby, Message, New, Friend, Blog, Group, Event, Media, Map, Voice Templates, Comment, Tag
- ✓ Can manage and associate these items
- ✓ Can use communication, search, view, read, rate and analysis features
- ✓ Can add Problem, Solution
- ✓ Can associate problem and solution but need expert authorization
- ✓ Can add, delete, manage history

c) Expert

These user type need to login system. It has parents rights and extra rights;

- ✓ Can authorize problem solution association
- ✓ Can add, delete, manage problem solution items
- ✓ Can see analysis

d) Admin

These user type need to login system. It has experts rights and extra rights;

- ✓ Can add, delete, manage all items
- ✓ Can manage analysis
- ✓ Can add, remove, manage user items

4.2.2. Object Oriented Structure (Analysis & Modelling)

Each application same actors above. In this part analysis of object oriented struture is given for each application. Modelling of objects as classes in UML notation are illustrated.

4.2.1.1. Parents' Network

a. BaseItem
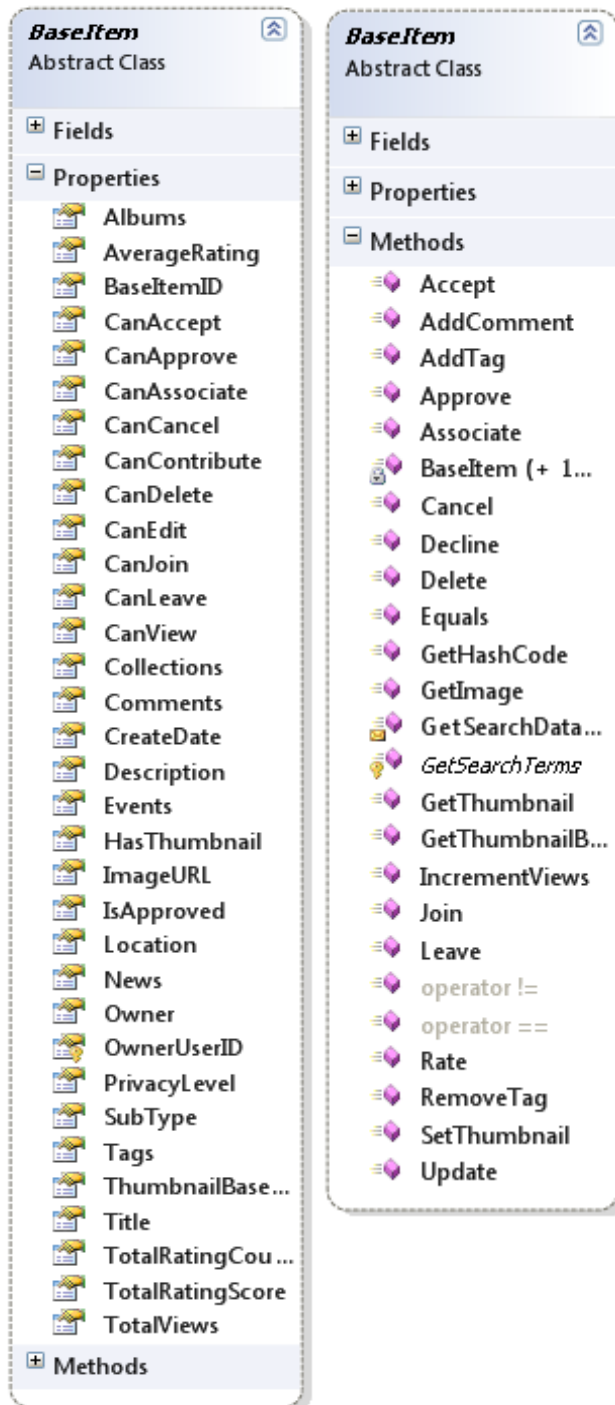
This is the abstract class and base for social network service items. It has several common properties and methods which are going to use in social network service. Some of mehods are overrided by inherited classes.

BaseItem
Abstract Class

⊞ Fields
⊟ Properties
- Albums
- AverageRating
- BaseItemID
- CanAccept
- CanApprove
- CanAssociate
- CanCancel
- CanContribute
- CanDelete
- CanEdit
- CanJoin
- CanLeave
- CanView
- Collections
- Comments
- CreateDate
- Description
- Events
- HasThumbnail
- ImageURL
- IsApproved
- Location
- News
- Owner
- OwnerUserID
- PrivacyLevel
- SubType
- Tags
- ThumbnailBase...
- Title
- TotalRatingCou...
- TotalRatingScore
- TotalViews

⊞ Methods

BaseItem
Abstract Class

⊞ Fields
⊞ Properties
⊟ Methods
- Accept
- AddComment
- AddTag
- Approve
- Associate
- BaseItem (+ 1...
- Cancel
- Decline
- Delete
- Equals
- GetHashCode
- GetImage
- GetSearchData...
- *GetSearchTerms*
- GetThumbnail
- GetThumbnailB...
- IncrementViews
- Join
- Leave
- operator !=
- operator ==
- Rate
- RemoveTag
- SetThumbnail
- Update

Figure 4.1: BaseItem Class

Class Inheritance Hieararchy from BaseItem

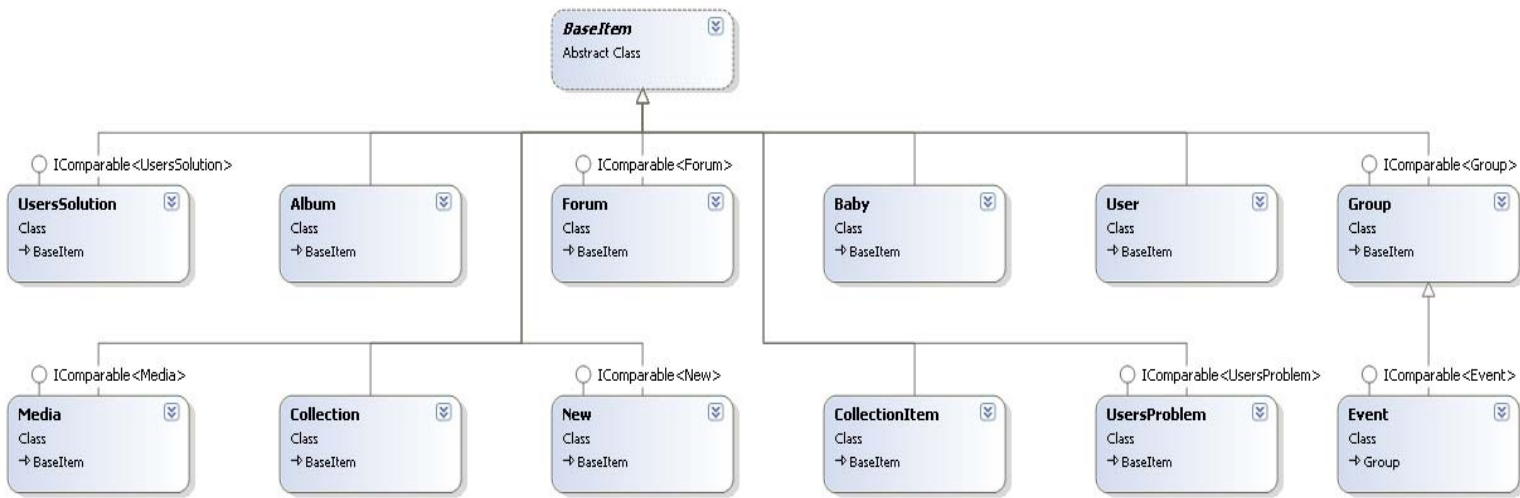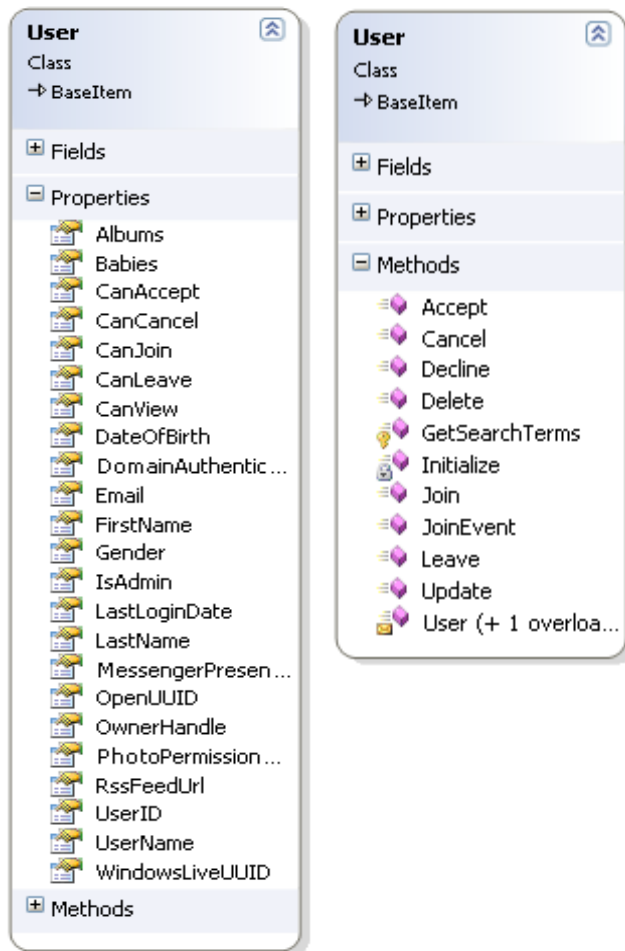**Figure 4.2:** Class Inheritance Hieararchy from BaseItem

b.   User : BaseItem

This class is contains some attributes of user profile. It inherited from baseitem and overrides some of methods.

Authentication works are done by ASP.Net membersihp provider. Other attributes of user like password, id, role are handled by ASP.Net membership provider classes.
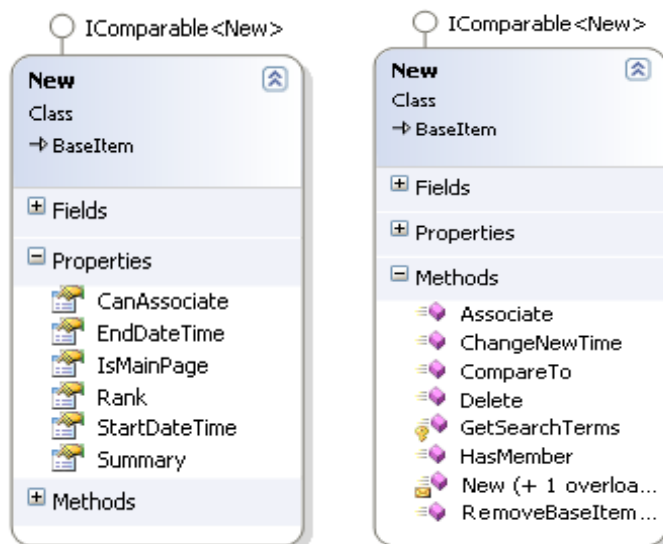
Classes like Album, Baby are properties of User class.

Figure 4.3: User Class

c. **Baby :** BaseItem

Figure 4.4: Baby Class
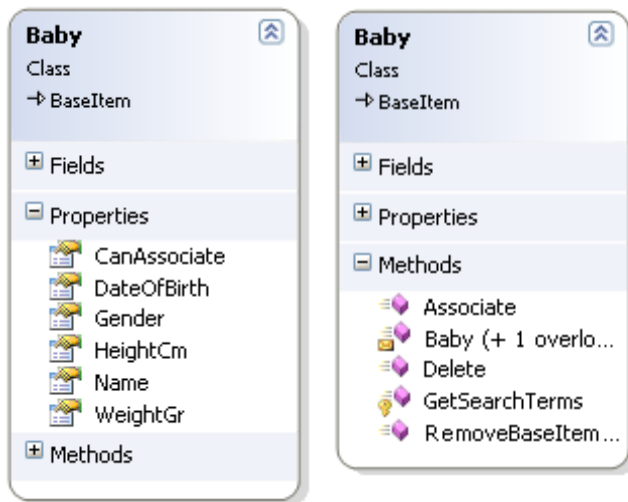
This is the Baby class used in system which owned by user, inherited from BaseItem.

d. **New :** BaseItem

Figure 4.5: New Class

This is the New class used in system, inherited from BaseItem.

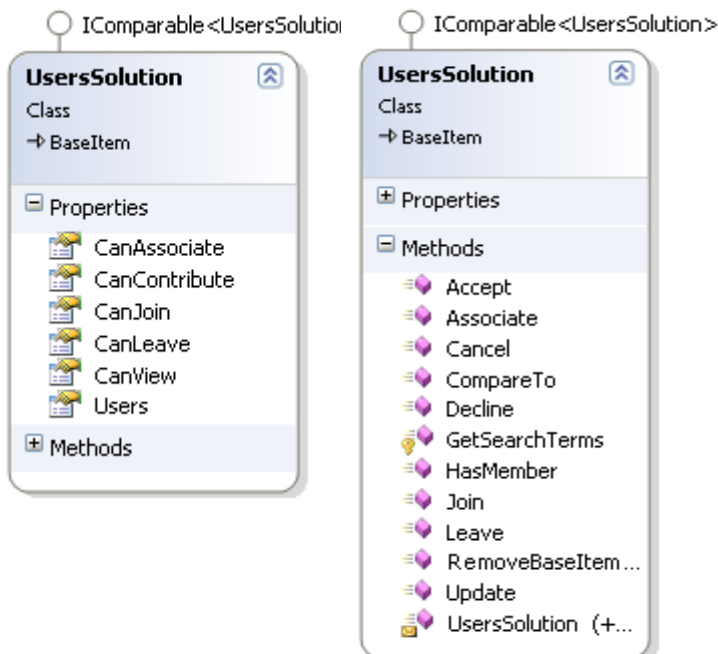e. **UsersProblem :** BaseItem

Figure 4.6: UsersProblem Class
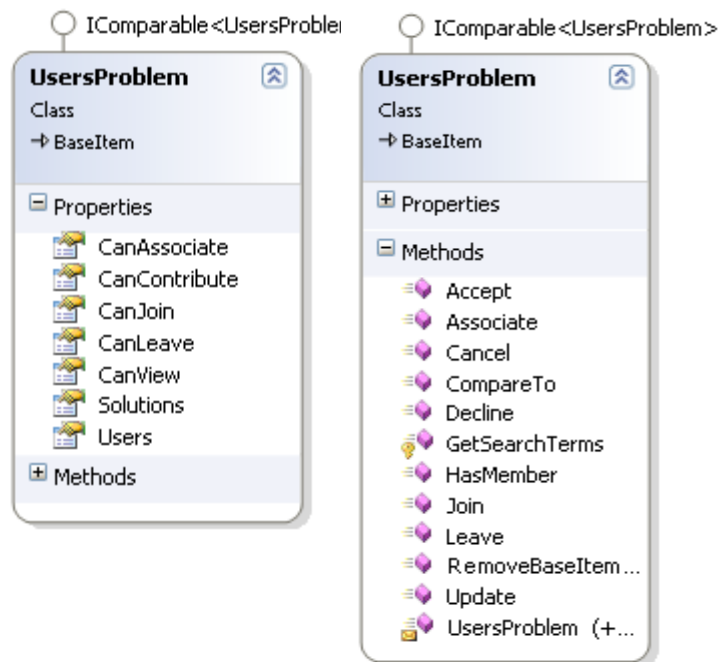
This is the UsersProblem class used in system, inherited from BaseItem.

Solutions property of UsersProblem class is list of solution object.

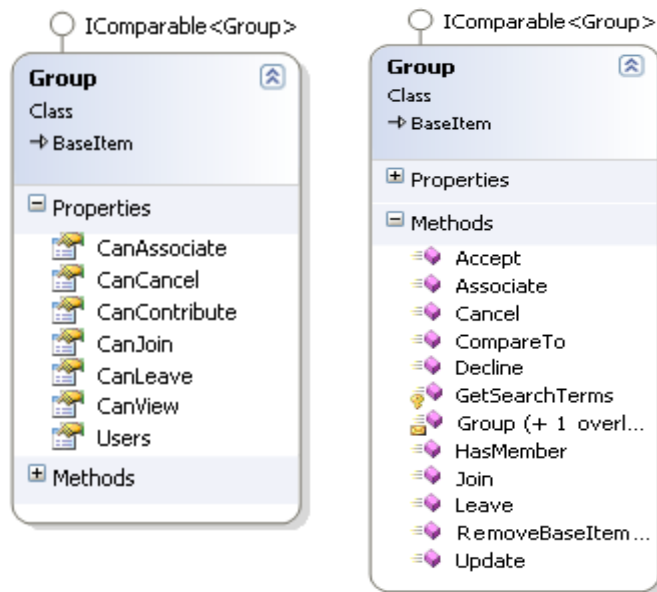Users property of UsersProblem class is a list of user object.

f. **UsersSolution :** BaseItem

Figure 4.7: UsersSolution Class

This is the Solution class used in system, inherited from BaseItem.
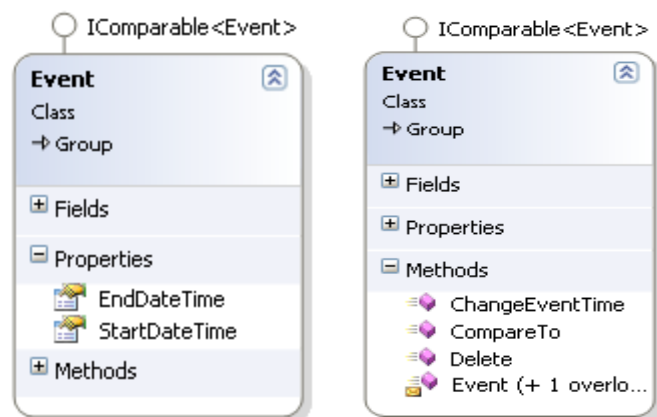
g. **Group:** BaseItem

This is the Group class used in system, inherited from BaseItem.

Users property of Group class is a list of User objects.
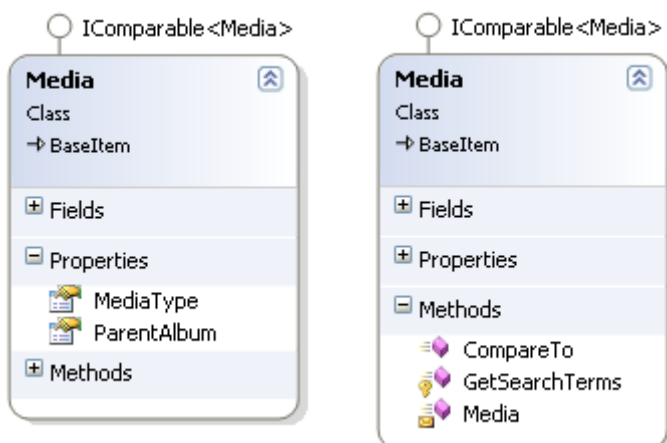
Figure 4.8: Group Class

h. **Event :** Group

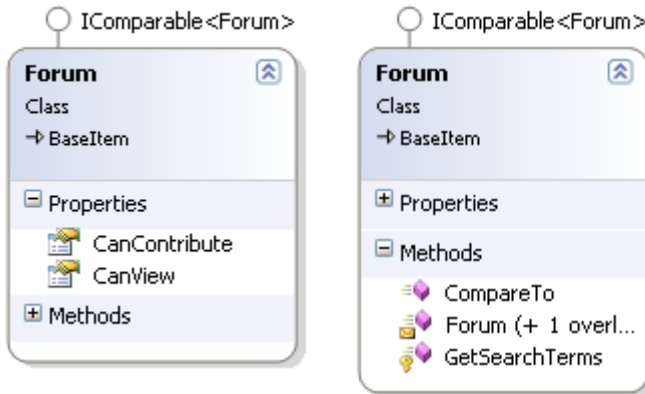This is the Event class used in system, inherited from Group.

Figure 4.9: Event Class

i. **Media :** BaseItem

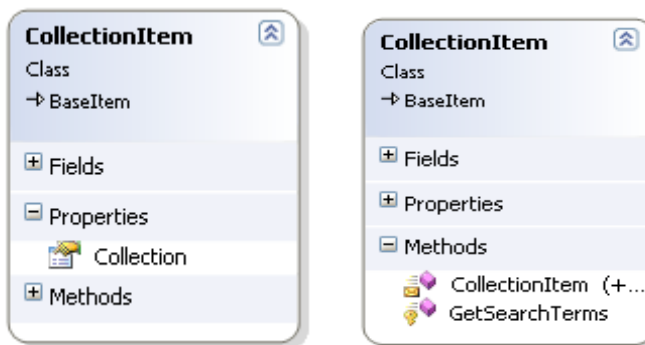This is the Media class used in system, inherited from BaseItem.

j. Forum : BaseItem

This is the Forum class used in system, inherited from BaseItem.

Figure 4.11: Forum Class

k. CollectionItem : BaseItem
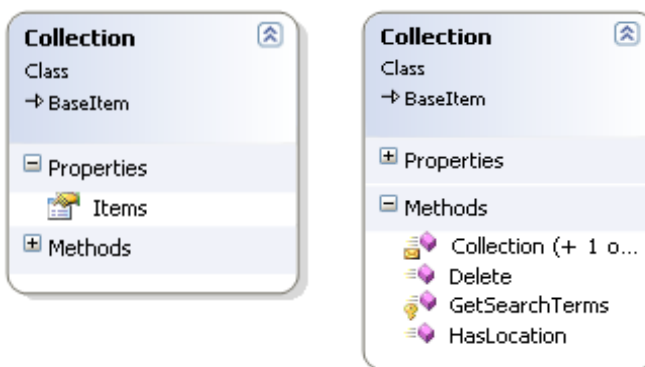

This is the CollectionItem class used in system, inherited from BaseItem.

Collection property of CollectionItem class is a Collection object.

Figure 4.12: CollectionItem Class
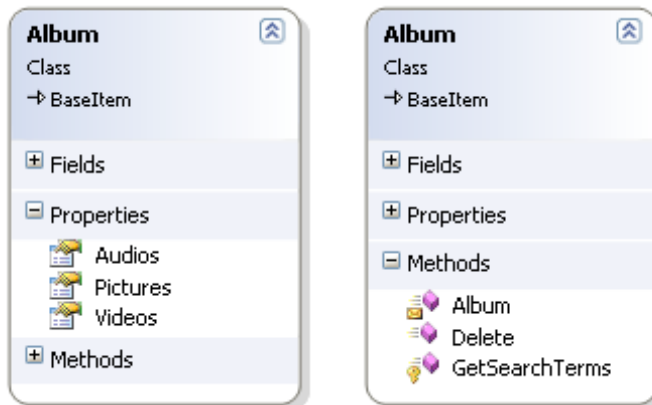
l. Collection : BaseItem

This is the New class used in system, inherited from BaseItem.

Items property of Collection class is a list of CollectionItems objects.

Figure 4.13: Collection Class

m. Album : BaseItem

This is the Album class used in system, inherited from BaseItem

Auidos, Pictures, Videos property of Album class is a list of Media objects.

Figure 4.14: Album Class

4.2.2.2. ArtificialParent

a. ExpertsProblem
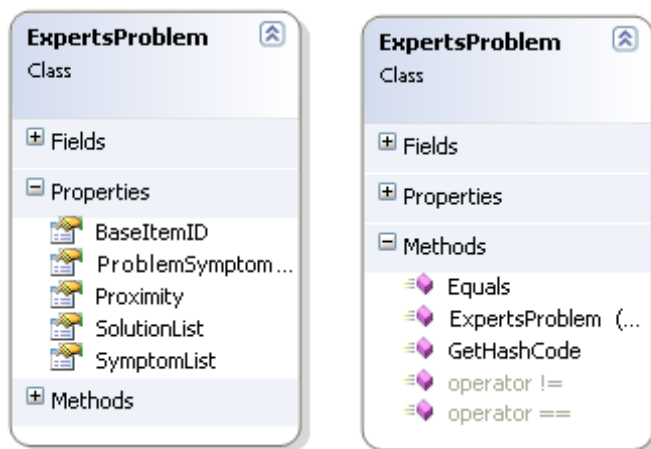
This is the ExpertsProblem class used in system, inherited from BaseItem.

SolutionList property of ExpertsProblem class is a list of Solution objects.

SymptomList property of ExpertsProblem class is a list of Symptom objects.

Figure 4.15: ExpertsProblem Class

b. ExpertsSolution
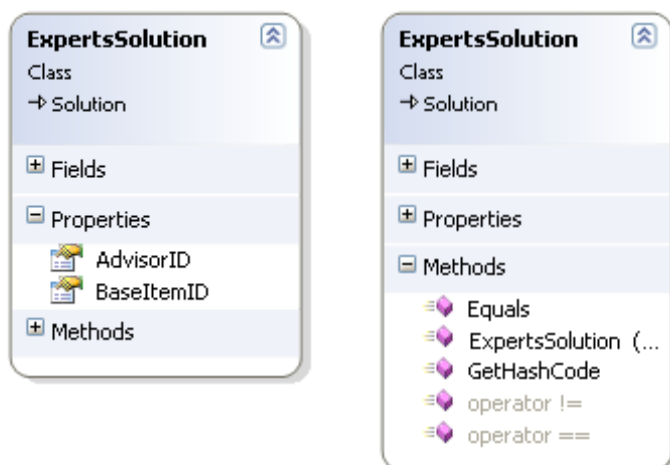
This is the ExpertsSolution class used in system, inherited from BaseItem.

c. History
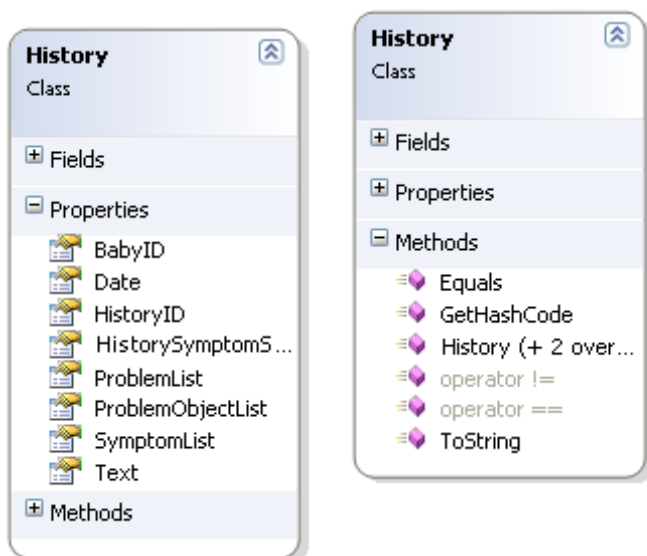
This is the History class used in system.

ProblemList property of Hİstory class is a list of Problem objects.

SymptomList property of History class is a list of Symptom objects.

Figure 4.17: History Class

d. MetaWord
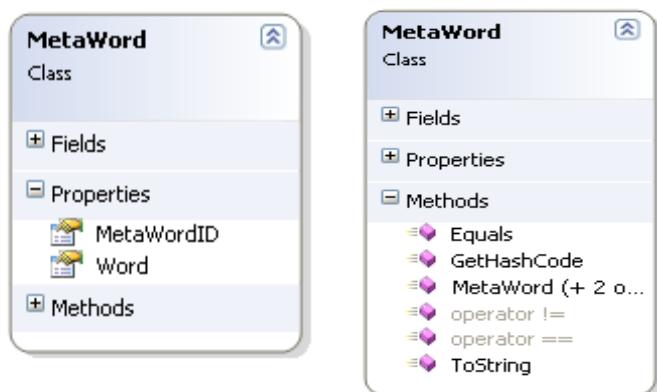
This is the MetaWord class used in system.

Figure 4.18: MetaWord Class

e. Symptom
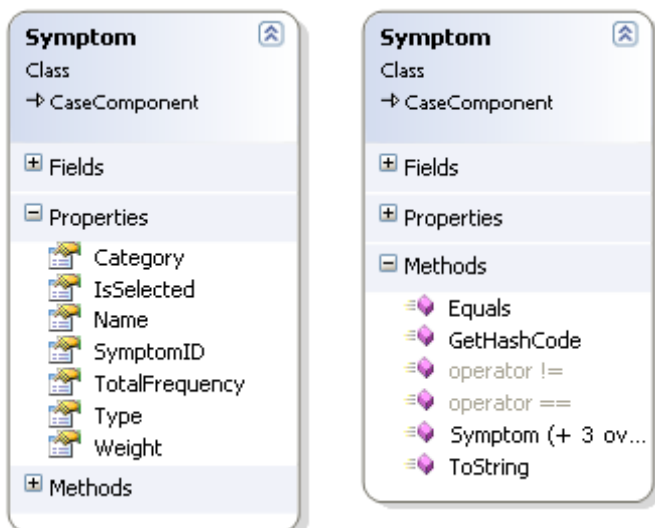
This is the Symptom class used in system.

f. SymptomCategory
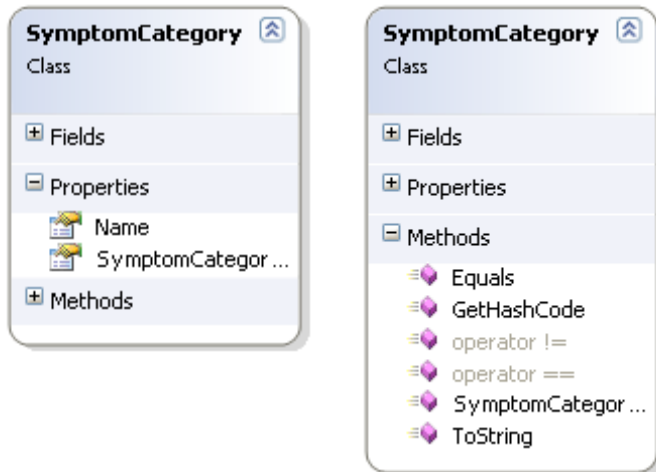
This is the SymptomCategory class used in system.

Figure 4.19: Symptom Class

g. ProblemSymptomAssociation
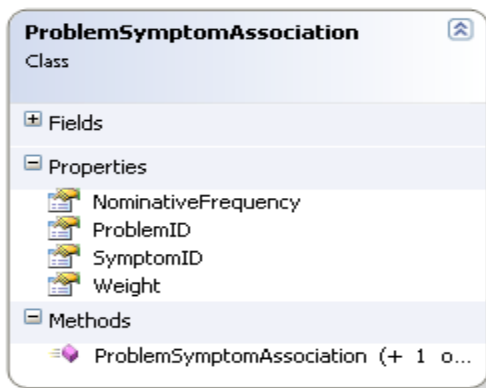
This is the ProblemSymptomAssociation class used in system.

Figure 4.20: ProblemSymptomAssociation Class

h. ProblemMetaWordAssociation
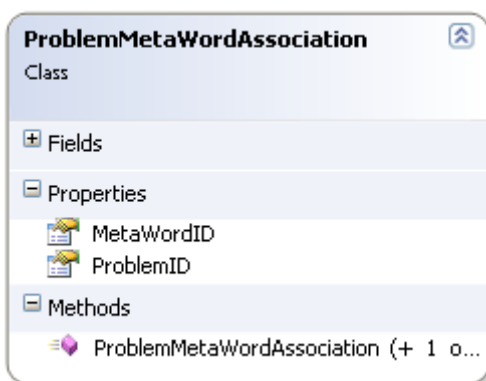
This is the ProblemMetaWordAssociation class used in system.

Figure 4.20: ProblemMetaWordAssociation Class

i. ProblemSolutionAssociation
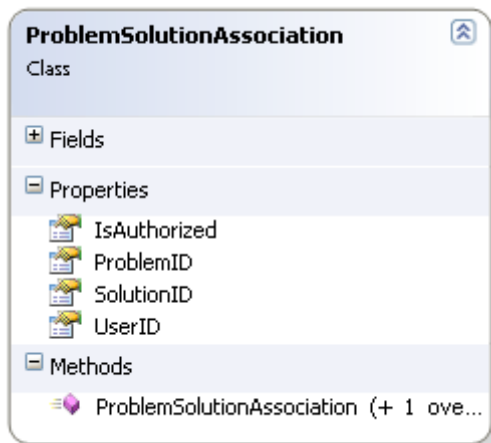
This is the ProblemSolutionAssociation class used in system.

Figure 4.20: ProblemSolutionAssociation Class

j. HistoryProblemAssociation
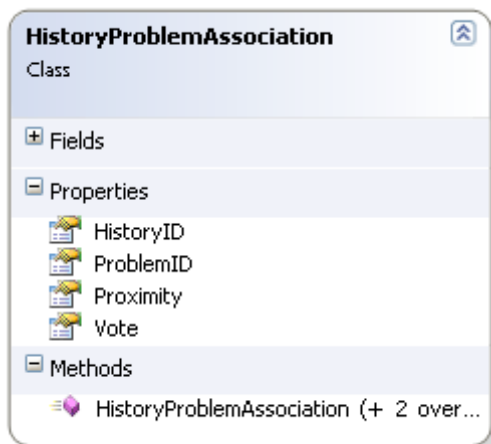
This is the HistoryProblemAssociation class used in system.

Figure 4.20: HistoryProblemAssociation Class

k. HistorySymptomAssociation
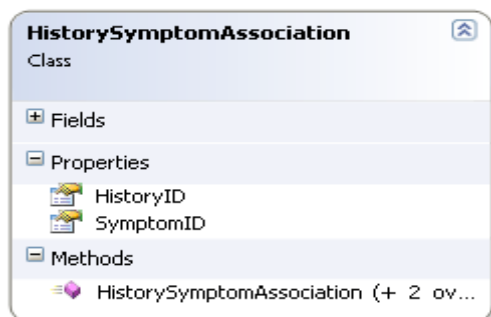
This is the HistorySymptomAssociation class used in system.

Figure 4.20: HistorySymptomAssociation Class

4.2.2.3. BabyNotCry

a. **MicInput:**
MicInput class is used for continuous record voice from microphone, with at least 400ms pause in between words or discrete recording with at least 100ms in the front and end being silent

b. **ObjFrame:**
ObjFrame class stores 100ms of samples (1600 samples), and calculate the averge square mean.

c. **ObjSound:**
This class is used to combine several 100ms frames that comes from the ObjFrame objects.

d. **EndPt:**
This is the detection of the noise and search for the spot where the acutal word is being sounded, and remove the noise from the sample.

e. **Point:**
This class represents a class which stores coordinates in k-dimensional space.

f. **Centroid:**
This class represents a centroid of a codebook. It includes:
   - the distortion measure which is sum of all points' distances from the centroid
   - the points that belong to this centroid or cell
   - total number of points that belong to this centroid or cell

g. **FFT**
FFT class for real signals. Upon entry, N contains the numbers of points in the DFT, real[] and imaginary[]. It contains the real and imaginary parts of the input. Upon return, real[] and imaginary[] contain the DFT output.

h. **Codebook:**
This class represents a codebook for Vector Quantization component. It includes the centroids for the words trained and the points to be compared.

i. **FeatureExtraction:**
Feature extraction class used to extract mel-frequency cepstral coefficients(MFCC) from input signal.

j. **Engine:**
This class represents a speech recognition engine that utilizes the other classes.
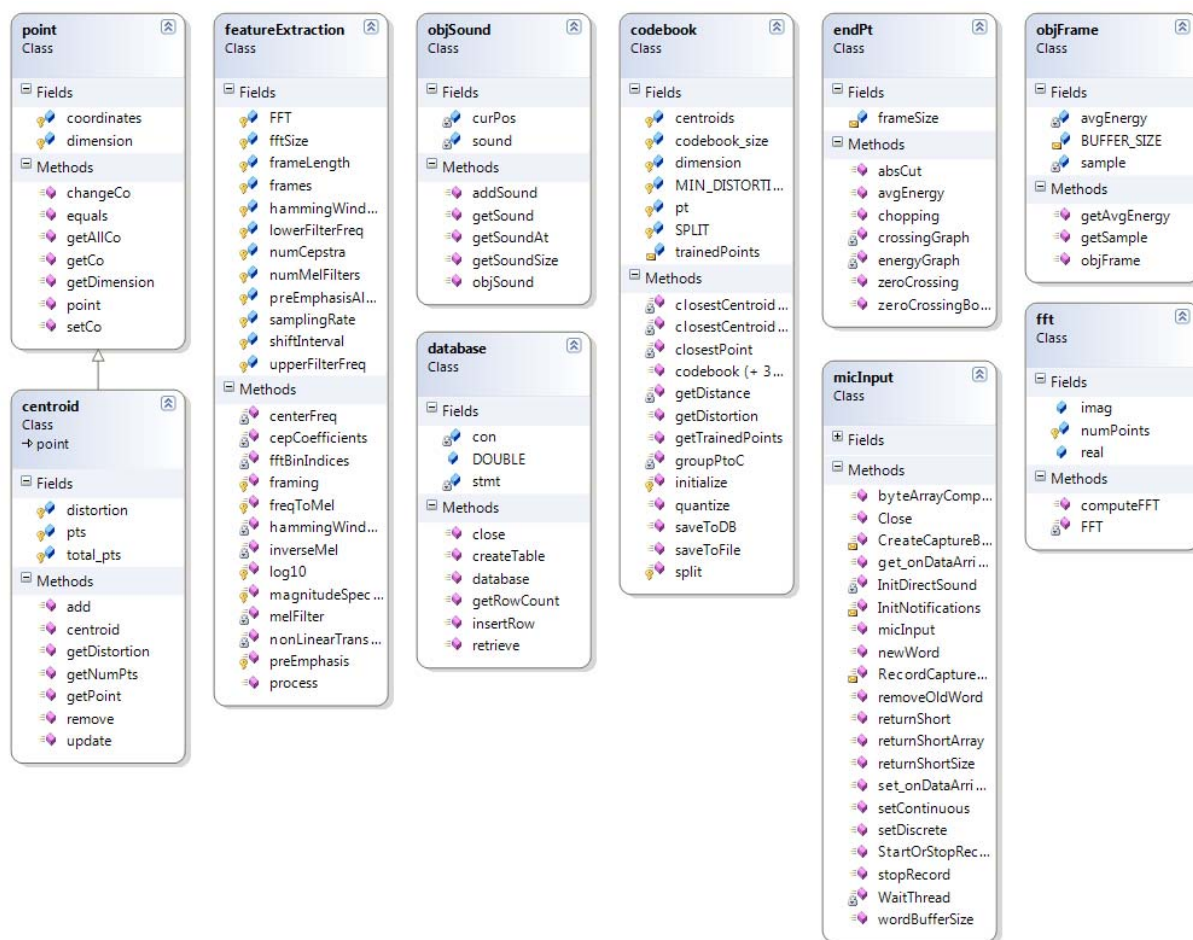
Figure 4.21: BabyNotCry Classes

4.2.3. Algorithms

In previous part, objects technical analysis described. In this part, algoritms and object relations in this algoritm are defined.

4.2.3.1. Intelligent Search Algorithm

Parents want feasible solutions for their problems that searched in system. System returns solution set with approximations. Steps of algorithms;

1) Parent enters problem text.
2) Text decomposed into words.
3) Metawords selected among words.
4) These metawords search in system.
5) System returns symptom set to verify problem.
6) Each step symptom set is refreshed dynamicaly.
7) The most convenient solution returns to parent.
8) Symptoms and problems added into history.

4.3. **Modelling** Through Concepts & Patterns

In this part, system is designed through concepts, patterns, object oriented analysis&modelling previous parts.

General system is designed on three-tier pattern which is widely used in SOAP and MVC pattern is used in presentation layer.

Also, database diagram which contains tables and relations is given in this part.

4.3.1. **Architecture** via Patterns

Presentation
- This is the top most level of the application. The application consists of web forms (pages) with which the user interacts. Each form contains a number of fields that display output from lower layers and collect user input.

Model
- The model of this application is business tier of general architecture which manages the behavior and data of the application domain, responds to requests for information about its state (usually from the view), and responds to instructions to change state (usually from the controller).

View
- Views consistf of web pages which display information.

Controller
- The controller interprets the mouse and keyboard inputs from the user, informing the model and/or the view to change as appropriate.

Business
- The logic tier is pulled out from the presentation tier and, as its own layer, it controls an application's functionality by performing detailed processing.

Data
- This tier consists of Database Servers. Here information is stored and retrieved. This tier keeps data neutral and independent from application servers or business logic. Giving data its own tier also improves scalability and performance.

4.3.1.1. Analysis of Business Tier

4.3.1.2. Visualization of Data Tier
a. Parents' Network (Blog Tables)

Figure 4.22: Parents' Network Blog

DB Diagram

b. Parents' Network

Figure 4.23: Parents' Network DB Diagram

c. ArtificialParent

Figure 4.24: ArtificialParent DB Diagram

d. ASP.NET Membership

Figure 4.25: ASP.NET Membership DB Diagram

4.3.2. **Modelling** via Concepts

i'mParent is not a simple application, it consist of several solutions. It based on concepts which are described in concepts part. Firstly, within i'mParent, a dynamic and interactive information platform which is powered by artificial intelligence techniques is provided for the parents with contribution of experts. By parents' network in i'mParent, parents have social platform to share and communicate. These show that, i'mParent Knowledge Based System and ArtificialParent part has similar features with expert system. With object oriented structure, medical and social ontologies is planning to implement in i'mParent. CBR technique is researched and some features implemented on ArtificialParent part.
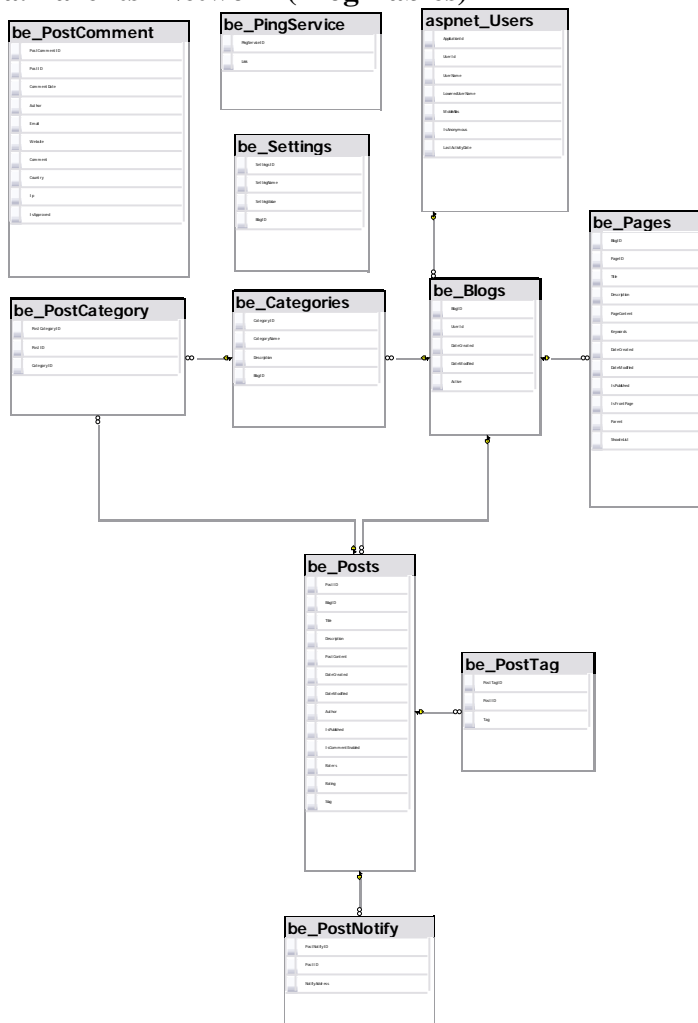
Data&Web Mining techniques are researched to transfer existing literature into Knowledge Based System.

Machine Learning algorithms implemented through pattern recognation.

5 DESIGN, IMPLEMENTION AND TEST

This part covers design, implemention and test of system. Firstly, technologies that used in project is listed. Than some modules that used in system is described. Finaly, test part is explained.

5.1.Technologies

a. Programming Languages : C#, J#
b. .NET Framework 3.5
c. Microsoft Visual Studio 2008
d. Microsoft SQL Server 2005 Management Studio
e. Microsoft SQL Server 2005 Business Intelligence & Analysis Services
f. Silverlight
g. ASP.NET
h. ASP.NET XML Web Service
i. AJAX
j. ASP.NET AJAX Toolkit
k. RSS Toolkit
l. Anti XSS
m. SSO (OpenID, LiveID)

Modellemesi yapılan sistem, .NET teknolojileri kullanılarak hayata geçirilmiştir.

5.2.Project Modules:

5.2.1 Feature Extraction

The methods explained before used in this method. Takes a speech signal and returns the Mel-Frequency Cepstral Coefficient (MFCC).

```
public static double[][] process(short inputSignal[]){
    double MFCC[][];

    // Pre-Emphasis
    double outputSignal[] = preEmphasis(inputSignal);

    // Frame Blocking
    framing(outputSignal);

    // Initializes the MFCC array
    MFCC = new double[frames.length][numCepstra];

    // apply Hamming Window to ALL frames
    hammingWindow();

    //
    for (int k = 0; k < frames.length; k++){
        FFT = new fft();
```

```
// Magnitude Spectrum
double bin[] = magnitudeSpectrum(frames[k]);

// Mel Filtering
int cbin[] = fftBinIndices();
// get Mel Filterbank
double fbank[] = melFilter(bin, cbin);

// Non-linear transformation
double f[] = nonLinearTransformation(fbank);

// Cepstral coefficients
double cepc[] = cepCoefficients(f);

// Add resulting MFCC to array
for (int i = 0; i < numCepstra; i++){
   MFCC[k][i] = cepc[i];
}
}

return MFCC;
}
```

5.2.2 Recognizing Sounds: Vector Quantization Method

Vector Quantization (VQ) is a quantization technique used to compress the information and manipulate the data such in a way to maintain the most prominent characteristics.
VQ in its application in speaker recognition technology assists by creating a classification system. Given the extracted feature vectors, each codeword is used to construct a codebook. Although numerous VQ algorithms exist, we have chosen to use Linde-Buzo-Gray or LBG VQ Algorithm for our IMParent application as illustrated in the following flow diagram.
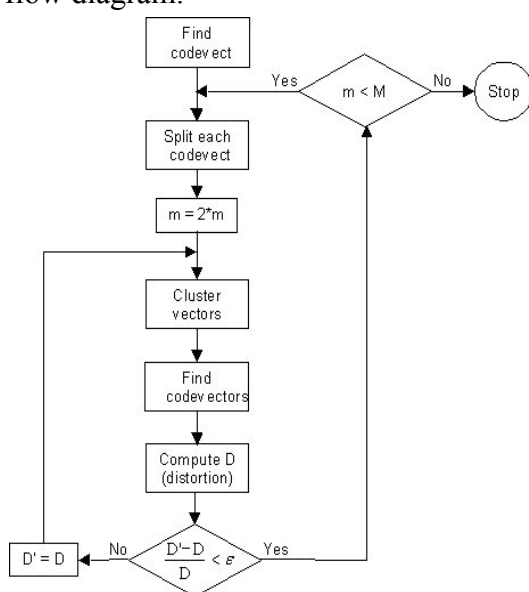

Figure 5.1: LBG VQ Algorithm Method

The LBG can be classified as an iterative procedure. The LBG algorithm is operated on a given codeboo<k. LBG splits the codebook into segments and performs an exhaustive analysis on each segment. The analysis compresses the training vector information creating a new codebook which is then used to compute the next segment. Based on Fuzzy Clustering. This code book is obtained using a splitting method. In this method an initial codevector is set as the average, and then split in two vectors. Then the iterative algorithm is run with those two vectors. Resulting two vectors are then split again into 2 vectors each. This give us now four vectors, and the process is then repeated until the desired number of codevectors is obtained. The process continues until all segments have been processed and the new codebook is created. The aim of this algorithm is to minimise any distortions in the data creating a codebook which is computationally optimised, while providing a sub-optimal solution. [20]

The implementation of this method in ImParent application is as follows:

```java
protected void initialize(){
    double distortion_before_update = 0; // distortion measure before        double
distortion_after_update = 0; // distortion measure after

    // design a 1-vector codebook
    centroids = new centroid[1];

    // initialize it with (0, 0) coordinates
    double origin[] = new double[dimension];
    centroids[0] = new centroid(origin);

    // initially, all training points will belong to 1 single cell
    for(int i = 0; i < pt.length; i++){
        centroids[0].add(pt[i], 0);
    }

    centroids[0].update();

    // Iteration 1: repeat splitting step and K-means until required number of codewords is
reached
    while( centroids.length < codebook_size ){
        // split codevectors by a binary splitting method
        split();

        // group training points to centroids closest to them
        groupPtoC();

        // Iteration 2: perform K-means algorithm
        do{
            for (int i = 0; i < centroids.length; i++){
                distortion_before_update += centroids[i].getDistortion();
                centroids[i].update();
            }
```

```
// regroup
groupPtoC();

for (int i = 0; i < centroids.length; i++){
    distortion_after_update += centroids[i].getDistortion();
}

}while( Math.abs(distortion_after_update - distortion_before_update) <
MIN_DISTORTION );
    }
}
```
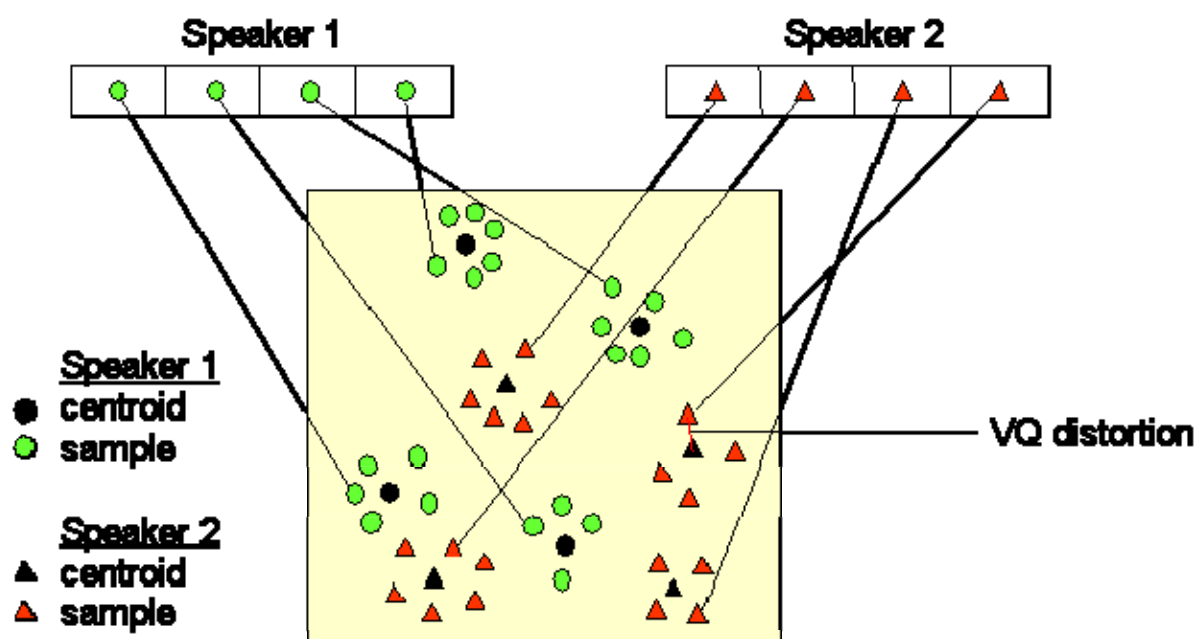

Figure 5.1: Method Result

5.2.3. Sentence Decomposition Engine

These engine provides extracting meaningful words from entered text. It is responsible for;

1) Decomposin sentence into words.
2) Selecting MetaWords

It improves search performance by decreasing search words from sentences.
Spaces and punctuation is taken into consideration during decomposition.
Some words like `"i","you","he","she","it","we",`
`"they","my","your","his","her","its","our","their","me","him","us","them"`
`,"am","is","are","the","a","an","now","to","be","was","were","up","on",`
`"with","of","off","at","in","this","that","there","these","those"` is not
taken into consideration by selecting MetaWords.

5.3.Test Plan

System was tested during its development process. This test process covers debugging and fixing. Final test covers stability, flexibility and reliability of system. Also, fixing bugs one of the other part of this process.
Audio part needs extra test which consist of real cases and samples.

5.3.1. Development Process Tests

In this stage, every tier and subtier tested like;
    a. Databases contain relevant datas
    b. Item gets data via Data Access Layer through Business Layer
    c. Item sends data via Data Access Layer throuh Business Layer
    d. Data presented via Presention Layer

In all step above, data watched carefully to verify all step working correctly.

General Test Process
    a. Setting data
    b. Getting data which corresponds setted data
    c. Data entered into module which is going to test
    d. Examining Results
    e. If it is correst, authenticate
    f. If it is not;
            i.   Test again
            ii.   Check setted and getted data
            iii. Debugging Module
    g. Fixing errors

General Test WorkFlow

    a. Data Tier -> Business Tier
    b. Business Tier -> Presentation Tier
    c. Presentation Tier -> Business Tier
    d. Business Tier -> Data Tier

Every module tested through tier that given above. New modules should tested by using process above.

5.3.2. Final Tests

These test implemented after designin user interface. Every module was tested with user interface by looking whole process. All bugs and errors are fixed and if it is required, test process continues in development process again.

6 EXPERIMENTAL RESULTS

Parents'Network:
Application tested with sample created users. By looking other competitors in the market and bencmarking with them, it shows that Parents'Network is enough for parents need and it can compete existing applications in the market.

ArtificialParent :
Application tested with initialized data. Test results show that system working with existing data. Artificial Intelligence techniques are implemented and system can refresh itself dynamicaly.

BabyNotCry :
Application tested with different voice samples. Test result show that application can interpret baby voice and it know one voice from another. It is working better than existing hardware solution in the market. Because system can refresh itself with its dynamic structure. Application improves its reliability with more voice sample which means application has machine learning cycle.
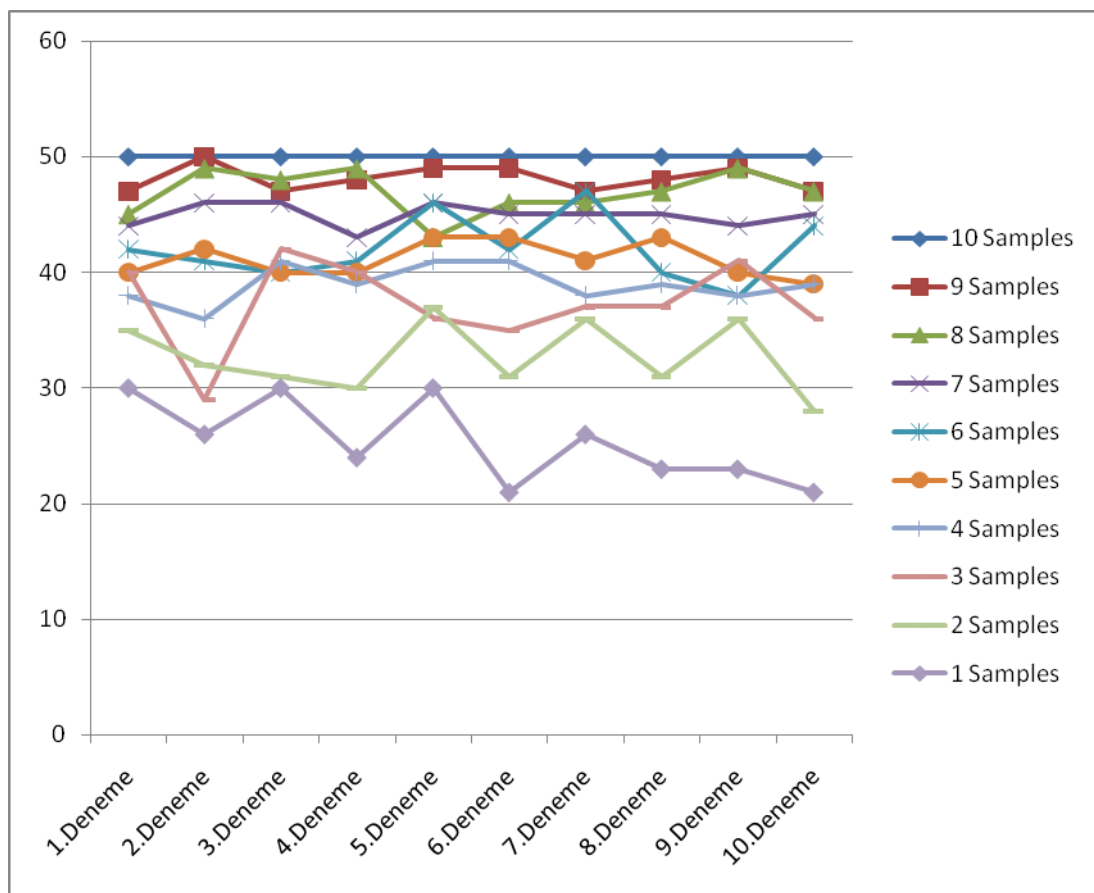
7 RESULTS AND SUGGESTIONS

7.1. Result

Although parents education problems are critical for parent education in the world, software solution has not been created yet with AI techniques. There are big amount of information and information sources about baby care and parent education like web sites, magazines, books etc. However, without filtering and indexing, these information is not utilizable. Moreover, parents can not share their experiences which turns tacit knowledge into explicit, in dynamic and multilanguage platform.

Low cost software solution for end-user.

Researches about baby voices show that baby voices are meaningful. Only "WhyCry" has been created to try to understand baby voice until now. However it is an hardware, offline, high priced and is not up-to-date. ImParent eliminates these disadvantages.

It collects feedback and it dissolves the boundaries between parents. It is a new invention about baby voice analyzing in researches.

7.2. Suggestions

Every day, web based information sources gain more importance. Knowledge based systems with AI will have vital role in future web. In this project, solutions are created by looking and considering future user and technological demands. System designed flexible for future integrations.

Moreover, system needs huge information and designed for that. In test process, initialized information is limiter for both parts. Because of that it is highly recommended that test system with information as big as possible.

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