THE LEARN SMART SYSTEM

(SYSTEM FOR PEOPLE WITH DISABILITY)

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THE LEARN SMART SYSTEM
(SYSTEM FOR PEOPLE WITH DISABILITY)

BY

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ABSTRACT

This document was produced as part of the final (forth) year project for the BSc. (Hons) Information Systems Degree program. The project was done to present and develop an effective way to enhance the technology utilisation to the individuals with different disabilities at different levels in the education sector. The project involves five basic phases namely introduction phase, planning phase, analysis phase, design phase and the implementation phase. The introduction phase introduces the basis of the project by identifying the existing challenges, information needs in the sector and provide proactive actions in meeting the needs. Planning phase focuses on analysing the feasibility and potential risk involved in the project in order to produce a project plan. The analysis phase identifies the users' requirements of the system and analyses the system improvement and development opportunities. Design phase is aimed at designing a new system which address the information needs of the organisations in this sector. The final stage (implementation phase) aims to put into effect the new system's design into its real working environment. Also included in this document are some of the important additional materials utilised in this project and useful material for the system's description. This was determined to be a feasible idea and the systems strength was on the weaknesses of the related currently existing systems.

DECLARATION

I, **Emmanuel Aaron Urombo,** hereby declare that I am the sole author of this dissertation. I authorize the **Midlands State University** to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature_____

Date_____

APPROVAL

This dissertation, entitled **"The Learn Smart System"** by **Emmanuel Aaron Urombo** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: …….

Date: ……...

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DEDICATION

I dedicate this work with love you to my parents, Mr and Mrs Urombo and all family members and friends for inspiring me and helping me in making my dreams to be a reality and all my lecturers for the knowledge they imparted. May the good Lord richly bless you. You awesome!

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The **Learn Smart System (System for the people with disability)** is basically virtual assistance system, a typical tool for the disabled and an easy to integrate system in any educational environment. The proposed system is aimed at eliminating barriers that is as a result of different individual's abilities and disabilities, hence it will be built with **Character Recognition, Voice Recognition and Sign Language** capabilities. The idea behind this proposed project/system is to provide equal opportunities to the people with different disabilities and maximise on their abilities rather than focusing on their disabilities. This first chapter of the project will highlight all the essential aspects of the proposed system inclusive of, the background of the study, problem definition, the aim, objective of the project and the other basic strategies for the project as explained below.

1.2 Background of the Study

There is a saying which goes like "there is a lot that joins us than what separate us as human beings", a lot of technologies have been brought forward bringing us closer to each other but in most of the technologies there is marginalisation of people with disabilities. This technology is aimed at finding a way of doing things better without any marginalisation. Though the system can be implemented in any environment, this research is primarily aimed on the Zimbabwean education sector. There has been an advancement in terms of technology implementation but most of those technologies are inaccessible to individual with some disabilities and this has resulted in a lot of inefficiencies in the sector which could have been avoided. Basically, the study is aimed at coming up with an easy to integrate technological innovations that provide an interpreter to individuals with different disabilities, provide access to educational systems and many other e-resources to the disabled so that they can get equal opportunities to unlock their full potential when it comes to their academic performance.

1.3 Problem definition

There are no currently systems on the market that integrates more than one communication languages available for the disabled. The other thing is that the closest options on the market are more hardware oriented which basically implies that there are not cheap technologies. Also, the other alternative involves hiring an expert, of which most individuals cannot afford and involves a lot of human errors. Also, there is a lot of negligence and marginalisation of individuals without some abilities, as most of the systems are built based on the abilities of

individuals which has resulted in these systems' effectiveness being only limited to the individuals who can use them and also making certain individuals to be more relying on others. The main problems that were identified are:

- There are a lot of systems being used in the educational sector and in a lot of them there are being successfully implemented but are marginalizing individuals with disabilities as the technologies of less important to them as they cannot use most of the technologies.
- People with disabilities rely more on the help the interpreters and the assistance from other individuals with the abilities that may be required at a particular situation, this always brings about a convenience problem as sometimes the people they rely on may be sometime occupied with other obligations.
- There is no any form of interaction between the system and people who are blind as most of the systems requires people to be prompting the system in form of type text and also the output form the system is given as scripted text.
- A lot of reading materials, in form of both e-resources and physical resources, are text scripted and not all are also available in **braille** which is used by the blind, thereby limiting the blind from gain access.
- Braille books are very expensive to produce making many school not to opt for the enrollment of the blind as they cannot afford to fully resource their education.
- Many schools do not enroll people that cannot speak as the teaching process can become almost impossible due to the lack of a universal communication system that can be understood by both, as the universal sign language requires some sort of a special training/course.
- Systems that attempts to address these situations, of which most are still under development, there involves large mass of hardware and mechanical parts which are expensive to build and sometimes not user friendly.

1.4 Aim

To provide an efficient and effective system, in terms of cost and performance, that minimises communication barriers and support the current systems. This is aimed at eliminating all forms of marginalisation and restrictions that comes about due to differences in individuals' abilities and disabilities in the educational system and other processes.

1.5 Objectives

The proposed system seeks to rectify most of the problems if not all problems stated in the

problem definition. The objectives for the proposed system includes:

- To allow individuals who are blind to interact with the system through the use of the **Voice Recognition function** that the system is supposed to have.
- To allow the blind people access to some text-scripted reading materials by providing a function that utilizes a camera or a scanner to capture the text from these materials through the **Character recognition capability** which the system is supposed to be having, and then read them allowed in voice format.
- To develop a system that has **Sign Language capabilities,** that can enable the sign language to text and voice translation through hand gesture recognition, and text and voice translation to sign language.
- Allow individuals who are blind to search for the reading materials both from the system and online through the use of the voice recognition.
- To allow two-way communication between individuals without the speaking ability and individuals who don't know the sign language.
- To provide summarized information for the blind about the student details when queried in the voice format.
- To provide a user friendly and affordable technology that make use of gesture reading rather than the use of hardware components.

1.6 INSTRUMENTS

The following are some of the information sources that will be utilised for the analysis of the project:

- Books
- Newspapers
- E-journals
- The internet/ Online resources

1.6.1 Database: MySQL

The project is intended to utilise a MySQL, which is the most popular and most used SQL relational database management system. This was developed, distributed and is supported by Oracle as an open source database management system. This was proposed to be used on the basis that it is the cheapest way create stable and more flexible form of databases which is

ideal for this project.

1.6.2 Documentation and Word Processing: Microsoft Office

For the documentation of this system development the Microsoft Office was selected. The selection was based on powerful word processing features it possesses and the packages that it offers which have all the essential tools need of the documentation process varying from plain text manipulation to graphical manipulators. The packages and file produced are supported by a number of operating system and application platforms, and it also carries a special security feature that helps in securing the documents.

1.6.3 Programming Languages: Vb.net

For the core modules of the system will be programmed in the VB.Net language. This .Net programming language in which most of modules of the system will be programmed in will be using windows form for good interface which is ideal for desktop applications. This language also supported the modern Metro-Forms and Metro-Graphics which plays well with the modern touch screen PCs. Many other libraries will also be referenced for other modules of the systems that requires complex algorithms in the data processing.

1.7 Information Gathering Methodologies

For an effective research, different fact-finding techniques will be implemented to gather information relating to the project. An investigation will be done to gather complete, consistent, accurate, feasible, verifiable and traceable facts and the below fact-finding techniques will be utilized.

1.7.1 Interviews

This technique is to be utilized because of the intimacy level it allows which is useful in getting an in-depth review of the situation on the ground that is not usually published by organization. A face-to-face interview will be used for individuals with different disabilities and those that works with them. The main purpose of using interviews are to:

- Find related facts
- Clarify on the facts
- Verify the facts
- Identify on the requirements which have to be met by the proposed system

One of the favourable characteristic of this technique that made it to become one of the options was that it allows for the acquiring of the first-hand information which is ideal to utilise as facts.

1.7.2 Questionnaires

These documents will be utilised for getting information in special cases, if any arise from the primary techniques. For this particular project, this method will/might be utilised on individuals that cannot speak and those not comfortable on directly sharing their views.

1.7.3 Observations

Special investigations are also intended to be carried out in the environments that the end product of this project have the potential of being implemented. The basic idea is to identify and study the process involved and how there are interlinked, and to come up with a way to optimise them so that they can be carried out in a more effective manner. This information will also be useful in simulating the environment on which this system will be tested on.

1.8 Justification and rationale

By realising the weakness of the current systems available on the market relating to this path, the need of an automated system that could resolve all these issues associated with people leaving with disability was realised. Coming up with a solution that could attempt to deal with this situation proved to be an effective step that can be viewed as a contribution effort towards humanity in the systems development. The implementation of the system being proposed will therefore reduce the probability of getting these same problems to be in between slim and none. Not only does this propose system address only the current challenges but also has the capacity to mitigate long-term problems in this research area.

1.9 Conclusion

Based on the available information, neglecting the current situation as it is will inevitably restricts and marginalise individuals with disabilities in many ways. The development of a new system will therefore be the best alternative.

Chapter 2: Planning Phase

2.1 Introduction

The main aim of this second chapter to assess the business value, the project feasibility, carrying out risk and stakeholder analysis and then establish a work plan for the project. Analysing the **business value** of the intended system will help us determine the success of the potential beneficiaries in terms of achieving long-term objectives and their well-being. The **feasibility study** will be useful in to ascertain the project's practicality, and according to Giuseppe (2015), this is supposed to consider the **technical, economic, social and operational** resource at our disposal and be able to determine whether is a best alternative to proceed with the development of the system proposed. This section will also involve a **risk analysis** that will enable the potential risk and threats identification and then come up with the measures to deal with these threats as a way to minimise the risk of the project failure. Another important procedure in this phase is stakeholder analysis, which is intended at identifying their interests. In an approach to put things into perspectives the work plan will be utilised to show detailed activities involved in the system's development process. Basically, from this **planning phase,** the project's potential risks of are turned into calculated risk to determine their overall imapact on the project, that is, to some extent reflecting green-light on the decision on whether to proceed with the project.

2.2 Business value

This is basically an assessment tool for the long-term objective achievement fostered by the information use by an organisation. Hartlen (2014) puts an emphasis on the fact that different individuals have different opinions when it comes to value determination, so it is therefore an important fact to not be limited to the monetary value of an information system but it is equally important to also consider the business value to system's potential users as well. The idea behind business value measurement then becomes centred on identifying of the capacity and opportunities in order to deliver satisfactory solutions. The business value is therefore not a one off definable term when it comes to system engineering and development but a combination of values with the potential to affect the business in a number of ways. Below are some of the values that may be helpful in arriving at the ultimate business value of this system/project.

2.2.1 Commercial Value

This a form of value that is directly dependent on the functionality of the system which directly have an impact on the business's profitability and/or can be quantified into monetary value. In terms of commercial value, this system is intended to eliminate cost of hiring experts (interpreters) by 100% and providing a cheaper alternative as compared to the currently existing hardware oriented systems which an average individual can hardly afford, thereby creating a commercial value.

2.2.3 Market Value

This is basically centred around the potential increase in the customers or users. This system is not only aimed at those individuals who already has the access to technology but mainly targets a whole set of individuals who have been deprived of the access to technology, thereby attracting a new line of users. Moreover, the Learn Smart System is supposed to be easily adaptive to any educational environment, which enables the harnessing of a large group of already structured potential user at a single goal.

2.2.4 Efficiency Value

The other value to consider is the cost reduction and the improvement on how things are done before and after the adoption of the system. The existing processes being currently utilised are subject to human errors and the available alternative are expensive and the other ones a simply concepts.

2.2.5 Customer Value

Customer value is more directly user oriented as it deals with things like user friendly of the system and the ability of the system to maintain its customer base without any dissatisfaction. The intended system is supposed to be as much user friendly as possible also having the fact in mind that not all user-friendly systems are also user friendly to the people with disability.

2.2.6 Future Value

The future value of a project involves the assessment of the potential value to be enjoyed in the long run after the adoption of the system and this can be considered even for the above values. The system is intended to gather some information about its usage for the better improvement of its functionality in the future.

Business value is therefore a product of more than one element that that affects the business well-being in the future. Considering all the factors that helps us arrive at what is considered value, this system can be easily identified as of value.

2.3 Analyse Feasibility

Just as pointed out by Greene (2011), it is very crucial when defining complex opportunity and problems to conduct a preliminary investigation commonly termed the feasibility study. It helps us assess the attainability of our aim through giving us an overview of the situation on the ground. The whole idea behind a feasibility study is defining the project and being able to identify things that may affect the success of a project. There are four basic areas that are mainly considered when carrying out a feasibility analysis namely: Technical feasibility, which focuses on the existing technologies' compatibility; the Economic feasibility which assess the cost effectiveness; the Operational feasibility to assess the capability of the change absorption; and lastly the Social feasibility, where there is consideration of the people's acceptance of the system. Considering each of these feasibility is necessary to evaluate the viability of this project.

2.3.1Technical Feasibility

Some of the writings by Hartlen (2014), points out that the technical feasibility is the major determiner of the resource requirements. This feasibility helps to know whether the currently existing technology in the system's environment is able to support the system and account for any additional requirements, if there are any. Technical feasibility is useful in identifying things like the need for technological upgrades, need for any special training and then determine if these needs are even realistic in terms of their attainability.

2.3.1.1 Technical Expertise

Except for the system's development and maintenance, the system requires the minimal computer knowledge and understanding when it comes to its operation. The main aim for this system, like any other virtual assistance system, is to be as much interactive as possible to every individual using it. For the users, there will be only need for the to be equipped with only some simple set of instructions, and some level training will be required for individuals would will be administering and maintaining the system.

2.3.1.2 Hardware Requirements

Based on the assumption that we are now living in the computer edge, the system is intended to utilise the already existing infrastructure. There will be only some few components that may be needed to be acquired for the system to operate as intended. Below is a list of the minimum hardware requirement for the system to be developed and implemented.

Item	Specifications	Quantity
Depth Camera		1 for every user PC
Desktop computer	2.2GHz Dual Core processor 2GB Ram 320GB Hard drive	Quantity depends on the expected average users.
Server Computer	3.5GHz Octa-Core Xeon processor 16GB Ram 4TB Hard drive	1
UPS	Power Backup 220V	1
PC (for development)	2.8GHz Quad-Core processor 4GB Ram 1TB Hard drive	1

Table 2.1 Hardware Specifications

In addition of the above, the system will require a properly operational networking environment for its operation.

2.3.1.3 Software Requirements

Also required, is a set of software packages to go along the hardware from the system's development up to its implementation. The required software packages include the below listed packages.

Package	Description	Quantity
Linux (ubuntu-14.04.-server and above)	Server Operating System	1
Window 10	User PC Operating System	1
Microsoft Visual Studio 2015	Development Platform	1
OpenCV	.Net Library	1
EmguCV	.Net Library	1
Xamp	Database API	1
Microsoft Office 2016		1

Table 2.2 Software Packages

For a proper development of this system, the components given are the minimal considerations for a successful development. Considering a variety of factor, enough funds and resource can be sourced to at least develop a working prototype of the system. Evident to this technical feasibility analysis, the system can be successfully developed.

2.3.2 Economic Feasibility

This has been traditionally said to be a bottom-line determinant in many project analysis and is sometimes termed as a cost benefit analysis. Brigham (2011) points out that, this section is supposed to clarify in the below areas.

- Evaluation based on the involved costs
- The type of hardware and software to select.
- Financial arrangements to finance the system's development
- The least cost for the system's development.
- Determining if the project is going to result in positive cash inflows

The basis of this section can be summarised as to evaluate the cost effectiveness of the project.

2.3.2.1 Development Costs

The development costs are the costs associated or involved in the project's initiation, that is there are incurred during the system development process. Usually, these costs are speculated

at the beginning of the project and as the system development process progress these costs are frequently altered to meet with the changes. To begin the development process the below list shows the costing of the items that needs to be acquired.

Item	Quantity	Cost ($)
Window 10	1	460
Depth Camera	1	550
Desktop computer	1	500
Server Computer	1	2500
UPS	1	850
PC (for development)	1	900
Internet Package		150
Labour		3500
Total		**9410**

Table 2.3 Development Costs

2.3.2.2 Operational Costs

Whilst the development costs cover only the initial cost to come up with system, the operational costs will cover all the costs that are to be incurred during the running of the system and these costs are usually variable in nature. Operational costs include the system maintenance costs, software licensing, system's consumables, software licenses only to mention but a few. These costs are usually weighed against the operational benefits to establish the system's cost effectiveness. Operational benefits to consider may include cost reductions and benefits that directly affects the efficiency. Since this project is not aimed at a particular organisation, the operational costs are sub-divided into those that affects the developer and those that affect an organisation or individual (client) that will acquire the system for a proper costing. Given below are some of the basic operational costs against their benefits.

Costs per financial period	Cost ($)
Software licenses	
Microsoft Office	360
Microsoft Windows	240
Hardware maintenance	600
Miscellaneous Costs	700
Maintenance Labour Allowances	6700
Total	**8600**

Table 2.4 Developer's Operational Costs

Benefits per financial Period	Cost ($)
Short-Term benefits	
Income from Licensing	10000
Installation and Consultancy Fees	15000
Long-Term Benefits	
Goodwill	5000
Total	**30000**

Table 2.5 Developer's Operational Benefits

Costs per financial period (per Client)	Cost ($)
License	150
Installation and Consultancy Fees	400
Total	550

Table 2.6 Client's Operational Costs

Benefits per financial Period	Cost ($)
Average savings	
Expert Hiring	4800
Hardware Maintenance (if there is use of current sophisticated systems)	1500
Total	6300

Table 2.7 Client's Operational Benefits

2.3.2.3 Cost Benefit Analysis

In order to evaluate our all our projected cost and benefit of the proposed system, a simply calculation was done to compare them against each other. Below is a Net Benefit calculation commonly known as the Cost Benefit calculation.

BENEFITS	$	$
Total Developer's Operational Benefits		30000
Total Client's Operational Benefits		6300
Total Benefits		**36300**
COSTS		
Total Development Costs	**9410**	
Total Developer's Operational Costs	**8600**	
Total Client's Operational Costs	**550**	
Less **Total Costs**		**18560**
Net Benefits		**17740**

Table 2.8 Costs Benefits calculation

This Cost Benefit analysis reflect a positive net benefit values, which implies that based on this criterion this project is favourable since the overall benefits of the project outweighs the costs that are likely to be incurred.

2.3.2.4 Return on Investment Analysis (ROI)

The return on investment is a profitability ratio that expresses the profit as a percentage of the initial investment. It measures the efficiency level for each dollar to be invested into this project in the context of profit to be generated. This is an ideal measure as it expresses the return of the investment on the project as a percentage that can be easily compared with other forms investments. Below is a calculation of the ROI for this project.

$$\text{ROI} = \frac{\text{investment revenue} - \text{investment costs}}{\text{investment costs}} \times 100\%$$

$$\text{ROI} = \frac{36300 - 9410}{9410} \times 100\%$$

$$\text{ROI} = 286\%$$

This ratio is a favourable one for an investment.

2.3.2.5 Payback Period

This can be best described as the time required for the cash inflows to offset the initial outlay of the project expressed as years and months. This basically indicates if we can be able to settle the borrow capital in time given that we use borrowed income to finance our project. A short payback period is more preferable as it reflect that we are able to meet with our financial obligations. Below is an analysis based on the payback period concept to establish this project.

Based on the cost benefit analysis, the initial outlay of the project (Total Development Cost) was $9410 and for the first financial period at least 25% of the average cash inflow (Total Developer's Operational Benefits) is expected and then raise to 70% the second financial year as the system will have been more embraced and then to the average from the second year going on wards. Based on these assumptions, the below analysis will result.

Year	Cash Flow ($)	Cumulated Cash Flow ($)
0	(9410)	(9410)
1	7500	(1910)
2	22500	20590
3	30000	-

Table 2.9 Payback Period

$$\text{payback period} = 1\text{year and } \left[\frac{1910}{22500} \times 12\text{months}\right]$$

$$\text{payback period} = 1\text{year and } 1\text{month}$$

Comment: Favourable

Based on this analysis this project has a favourable payback period, which implies that within a year and one month enough would have been raise to settle the initial out lay of the project.

2.3.2.5 Net Present Value

As agued by many authors, the payback period it is not a good basis to rely on fully as it overlooks the time value for money. McGraw (2010) points out that, 'a dollar today is worth more than a dollar the following year', this is basically due to the simple fact that it would have been invested and earn some extra interest and also there is subjection to inflation. The Net Present Value will be accounting for this through the use of a Discounting Factor to flex for the time value of money. Based on the average cost of capital of 15% in Zimbabwe, below is the procedural calculation to arrive at the net present value of this project in the next % years.

Discounting Factor Calculation:

Using the Formulae: $\text{Discounting factor} = \frac{1}{(1+\text{I})^{y}}$

where: I is the average Interest Rate; and Y is the year to be considered

I = 15% (current average cost of capital)

1st Year = 0.8696

2nd Year = 0.7561

3rd Year = 0.6575

4th Year = 0.5718

5th Year = 0.4972

Year	Cash Flow ($)	DCF (15%)	Present Value ($)
0	(9410)	-	(9410)
1	7500	0.8696	6522
2	22500	0.7561	17012
3	30000	0.6575	19725
4	30000	0.5718	17154
5	30000	0.4972	14916
Net Present Value			**65919**

Table 2.10 Net Present Value

After 5years when this technology is expected to have been extinct, this project is expected to have generated USD $65 919 equivalent of today's monetary value.

Summarising all the analysis carried out in the economic feasibility study, it can be viewed that this project can be an investment with a lot of potential when it comes to the its value to both the user and the developer.

2.3.3 Social Feasibility

Social feasibility basically assesses the likelihood of bringing a change to the society intended through the impact of a project. As also highlighted by Bierman (2010), the impact can be measured by putting into consideration the influence to the participating individuals, by accounting for job opportunities, extra incomes earned and improvement in the quality and standards of living among others. This section is of paramount importance because it considers the individuals whose response to the system is going to determine the system's success on the market. In a precise note, the main purpose of this part is to consider the computer skills of the targeted individuals, meeting of their needs, influence of the project in the labour market, what they need to learn, number of individual needed, what will be earned gained by individuals involved in the development and their working conditions. An effective analysis is useful in

building a good name and image for many other projects that may be done, which is loyalty earned without harming certain individuals lives.

- **Availability of the skills**

The product system of this project operations requires less of expert skills as the project's main is to simplifying technical issues being our looked by other systems. Some additional experts will be hired only during the development process.

- **Meeting of needs**

Efforts of the participating individuals will be acknowledged through an incentive for their effort, to some extent meeting some of their financial obligations and needs. Also considering the current level of unemployment their involvement in the development process may bring a certain level of satisfaction on the social needs.

- **Labour market appreciation of individuals participating**

The participating individuals are also expected to gain certain level skill and the also there can add their involvement to their resume, improving their labour market rankings.

- **Skills need to be learned on the job**

Some level of training will be conducted to those individuals that will be responsible of overseeing and maintenance of the system when it is implemented. This training will be able give a certain level of computer literacy that will be able to be implemented at any level.

- **What there will earn**

The additional labour may be required for the system's development and to appreciate their efforts and incentive will be given in relation to the amount of effort contributed.

- **Working conditions**

This project also aims to produce a working environment that is as safe as possible to the everyone involved in the development and use of the final system. This will be accomplished by creating a welcoming environment and not marginalising any individuals that are being targeted.

The social impact reflected for this project is a positive one, helping in arriving at a conclusion the project is social feasible and to the society it is of paramount importance.

2.3.4 Operational Feasibility

Operational feasibility can be seen to be a reflection of the situation at hand's urgency and the attention need to the problem and assessing the proposed solution's acceptability that is according to Brigham (2011). This includes the assessment of social, external and internal issues that may that may have an impact of the system operations. The need for utilising this

type of an assessment is to project on if the solution being offered if it is a workable solution, because our end system may work but it an important thing determine if the system will work in the given environment. This literally requires the evaluation of the impact the system will give on the end-user and the organisation that will adopt it, and also how they feel about the system as a way to understand the level of compromising that may be involved and the opportunities created. Usually, this study is never undertaken without considering the Whether's PIECES Framework since it is a problem analysis and solving technique, this is according to Mary (2018).

Performance- The idea behind will imply having a small throughput and the shortest possible response time. This solution is aim to achieve reduced workload which is expected to be attained by minimising the done over a particular timeframe.

Information- The solution will be enhancing the communication by providing better data processing possibilities through the human errors elimination.

Economic- The other thing that the solution seeks to address is an issue of cost-effectiveness utilising some priceless and innovative technologies, rather than some expensive hardware oriented technologies.

Control and Security- The solution involves attaching different privileges and access levels to different users. Also, it aims to utilise some extended security measure, inclusive of the data **encryption** and **decryption** as a way to respect the user's privacy.

Efficiency- This also seeks to aim to make maximum use of the available resources by utilising the readily available hardwire and bringing them together as a change that deliver in a timely manner.

Service- One of the main intension of this solution the provision of a reliable service that can be primarily defined by flexibility and its ability to expand.

As an addition to the operational feasibility, Brigham (2011) was able point out some additional factors that can be put into consideration. The emphasis was on the fact that a system can work but evaluating whether it 'will work' based on the resistance and accessibility is even more crucial. This is being expected to be dealt with by accompanying the system's implementation by a quick and informative form of training.

Overall Comment on feasibility: This feasibility study was able to do an evaluation of the project and raise facts that can support initiation proving that this project is an idea that can be successfully brought to reality, thereby allowing the process to proceed.

2.4 Risk analysis

According to the IEEE computer society, a risk analysis is basically a way of bringing together necessary information regarding the project, then evaluate it based on threats, vulnerabilities, impacts and probability associated with the project, and understanding risk's impact and potential on the organisation's success. In simple terms, the risk analysis involves the identification and management of the potential problems that may undermine our whole project. McGraw (2010) proposed that the risk analysis must be carried out as a three-step risk approach for it to yield some visible results. The steps that were identified are given below.

Threat Identification

This first step is aimed at the identification of the existing and possible threats that are likely to be encountered. With the consideration of many different aspects certain risks were identified at our disposal, and these included:

- Producing user interface that is wrong
- Coming up with schedules that cannot be met
- Spending beyond what was budgeted for
- Technical risk

Risk Estimation

The risk estimation is able to put things in to perspective by expressing into number the risk occurrence's likelihood and its possible impact and then calculated to see their monetary impact. This process express real threats of the project into calculated risks that could managed. Looking at the above identified threats not all of them can be expressed into monetary terms, disabling the calculation potential for all of them but only for the few ones. To do the calculations for the ones that are expressible into monetary terms, a formula which involves multiplying potential loss prompted by the event by the probability of its occurrence.

Formulae: $\text{Risk Value} = \text{Probability of Event} \times \text{Cost of Event}$

Calculations

1. Running over budget: the probability is 0.4 and the amount to exceed the budget is $1200 $\text{Risk Value} = 0.4 \times \$1200$

   $= \$480$

2. Unrealistic schedules: the probability is 0.65 and this may trigger an overspending of $1450

   $$\text{Risk Value} = 0.65 \times \$1450$$

   $= \$942.50$

Risk Management

After identifying and estimating the risk, there is need to come up with ways to effectively manage these risks. The process of managing the risk effectively involves individually consider the risks and then deduce a cost-effective approach to risk management. Risk management process also has many different approaches. Among all the available alternatives, the risk avoidance mostly proves it self to be a lot less costly than others especially when it comes to the software designing operations and projects as it brings forward the counter measures. Listed below are the above identified risks and their related counter measures to deal with the risk.

- **Producing user interface that is wrong**
  - Prototyping
- **Coming up with schedules that cannot be met**
  - Design to cost
  - Estimated schedules
- **Spending beyond what was budgeted for**
  - Creating budgets that are time valuated
  - Looking for the cheapest alternatives
- **Technical risk**
  - Conducting a series of tests that involves the experts before the system's implementation

The above analysis was able to break down the identified potential risks of this project by estimating their impact on the overall project and the produce ways that could effectively

manage their impact and occurrence. It has been proven therefore, regardless of their potential to hinder the project's progress, the system's development is viable with the right tools in place to control them.

2.5 Stakeholder analysis

This is intended at identifying individuals and parties that are affected or has the potential to influence the project's impact. Roberta (2011), states that the analysis can be utilised in:

- Getting an in depth understanding of the stakeholders' requirements
- Interests of all the affected parties
- Stakeholders' influence
- Negative and positive result that can be fostered by other parties
- Knowing if there is need for any alliances to enhances the project

The table below was formulated to better analyse the stakeholders associated with this project identifying certain elements and attribute they possess.

STAKEHOLDERS	INTEREST	LIKELY IMPACT OF THE PROJECT	PRIORITY
The Disabled Individuals	Non-marginalising service and security	Positive	1
Employees	Income and reduced work load	Negative	3
Experts (Interpreters)	Provides with their expertise at a cost	Negative	2
Community	Maintenance of their ethics and values	Negative	2
Organisations	There are the major buyers of the technology	Positive	1
Government and Authorities	Taxes and meeting of the obligations	Negative	1

Table 2.11 Stakeholder's Table

The priorities were allocated to their interests to determine which ones needs to be satisfied first. The interests with lower priority values are the one that will be addressed firstly then with the high values lastly.

2.6 Work plan

According to Brigham (2011), this section's main focus is to deduce an estimated time that may be needed for the execution of the project expressed in weeks. The development process to be used for this project is primarily centred on the **System Development Life Cycle** model inclusive of all its activities. The adoption of this model in this process is due to:

- Its adherence to the **software engineering** requirements and principles
- The clearly defined stages as it is a **linear approach**
- Also, it has a distinguished task break down of the project phases
- Utilises time as a standard for each and every phase
- Activities are better coordinated
- Makes provision for the system's documentation that is a useful tool for the system's maintenance and further researches.

2.6.1 Project Schedule

Expanding on the views by Brigham (2011), scheduling the project is an effect way as a starting point to represent the project's work plan.

Task	Estimated time (days)	Actual Time (days)	Task Start Date	Task End Date	Deliverables
Project Proposal	7	7	02-05-2018 (resubmission)	09-05-2018 (approval)	System request form
Project Introduction	5	5	05-09-2018	10-09-2018	System request
Planning	12	11	10-09-2018	21-09-2016	Technical Report Stakeholder Analysis Report Operational Report Cost Benefit Analysis Risk Assessment Report Work Plan Schedule
Analysis	12	10	22-09-2018	02-10-2018	Analysis results report
Design	17	20	07-10-2018	27-10-2018	Design Models and structures
Implementation	7	On going	On going	On going	Release version Training report
Maintenance (annual review)	7	On going	On going	On going	Back-up Report Review Report

Table 2.12 Project schedule

2.6.2 Gant Chart

According to Roberta (2011), the Gant Chart by Henry Gantt is a very effective tool when it comes to the representation of the project schedule and project scheduling. The project was scheduled and the below Gant Chart was produced.

Activity	Week1	Week2	Week3	Week5	Week6	Week7	Week8	Week9	Week1
Project proposal									
Introduction									
Planning									
Analysis									
Design									
Implementation									
Maintenance									
Documentation									

Fig 2.1 Gant Chart

Key

Coverage

The above visual stand as a yard-stick for the whole process as it is able to represent the expected project's commencement expressed in weeks.

2.7 Conclusion

This planning phase enabled us to plan ahead before the development process could start. The process enabled the assessment and evaluation of the viability for this project, through a feasibility study and the utilisation of many other analyses. This phase was able to reflect a positive result which proves the viability of the project as all the requirements that were identified can be attained. The next phase will therefore be primarily focused on the analysis of the situation on the ground as a way of establishing this research.

Chapter 3: Analysis Phase

3.1 Introduction

The idea behind the analysis phase revolves around the requirements gathering as a way of determining the overall direction of the project. According to Land (2012), this phase shows information at a high-level description, this information basically includes the users' expectations, the problem statement and the success criteria. Booth (2012) also states that this section helps to analyse different options or alternative available at our disposal, the maintenance of consistency with other established systems, customer demands and stating out the path that will be followed by the project. To successfully accomplish these aims, this chapter will also review some the researches and writings by many other authors in the form of a literature review.

3.2 Literature Review

Many other authors, researchers and writers in the past also showed their interest on this particular area that this project is focusing on. Though some of most of their work did not necessarily cover all the areas of interests but there are a great resource to help us establish this project as a point of reference. Below are some of the importance researches and works that may be useful in the establishment of this project.

In a research by Hutchinson (2012), it was identified that in machine translation most of the systems focuses mostly in a single specific part without integrating all the translation in a single system. She also highlighted the lack of a standardised form of notation between the recognition of the Sign Language and its translation to text as many of the existing systems utilise different notations which includes GLOSS notation, Sign-Writing, the Stokoe's notation and the HamNoSys notation. Hutchinson concluded by highlighting that the scaling to large systems of the machine translation is lacking because the existing projects focuses mostly on the recognition of small datasets and does not muchly considers the output annotation nor have the process to allow large system scaling.

In another research by Waterfield and West (2014), it was pointed out that a student is expected to deal with the work load in the most effective manner that can be achieved, this is a different case considering individuals who are visually impaired as they need more time to handle the same amount of work and an additional good organisational skill is needed. In addition, it was also identified that it takes thrice the amount of time to read braille and also it does not allow skim reading, making braille not the best alternative. Waterfield and West also showed that for the visually impaired the document that have diagrams, pictures, new vocabulary and many other

types of visuals sometimes they can be problematic unless if they are provided with some addition text to clarify. A solution they gave was to be sure that the that course outlines and reading list are provided in advance as a way to device alternatives for the visually impaired, for example, for the Brailling and Tapping of the reading material as a way the improve the reading materials dating.

A research done by Krolick (2015) points out that the visually impaired can utilise a computer to independently prepare their papers and lessons by utilising the speech output and have a finished copy they can get their hands on. He also says, their percentage of the visually impaired that are learning braille skills is very small. The thing was, many schools teaches braille to those individuals who are totally blind, intelligent and those with parents that are demanding for their children. He specified a series of challenges which included associated with the process of bringing the technology to those who are visually handicapped. This publication also showed that many other problems can be identified that may affect the visually impaired individuals, for instant the availability of the computers in schools there will be learning as the others will be limited and also some special equipment is needed for their learning environment and the teachers' attitude for some of these students.

These are basically some of the literatures by other researchers that was useful in the establishment of this idea behind this project. From these writings challenges affecting the targeted individuals were clarified and some of the ideas for the solutions that could be administered were brought forward.

3.3 Weaknesses of the existing systems

On today's software market, most of the system are mostly designed for either people with no disability only or the people with disability. For the few ones that attempts to cater for both sides, none of them integrates more than communication method for the disable. Also, these few options are more hardware oriented which are not user friendly nor affordable technologies for an average person. The best alternative that a lot of individuals has been most relying on is hiring of an expert which is also by no means, a cheaper alternative. Summing up all that these existing systems are capable of, the below weaknesses were identified from the existing systems.

- There is a lot of negligence and marginalisation of individuals with disabilities as most of the technologies are of less important to them as they cannot use most of the technologies.

- Available systems that attempts to address this problem utilizes a lot of hardware components which makes them not comfortable or easy to use.
- With these systems being hardware oriented, it makes them some expensive piece of technology that only a few individuals can afford.
- Most of the disable individuals rely more on the help from the interpreters and the assistance from other individuals with the abilities that may be required at a particular situation, this always brings about a convenience problem as sometimes the people they rely on may be sometime occupied and have other obligations.
- There is less interaction between the systems and people who are blind as most of the systems are design for only those who are not visually impaired.
- Not all of the reading materials which are text scripted can be also available in braille, which is a limitation to the individuals who are visually impaired.
- Most of the virtual assistance systems on the market are only meant to minimize efforts not to assist the people who really needs assistance.
- One of the major issue is that the systems that closely attempts to address these areas most of them are still under development.

3.4 Rationale of the proposed system

This is best known as a supportive argument to the proposed system's implementation. This is achieved by providing enough evidence to justify the need of the project in that particular field that the research is based on. Based on the above stated problems, there is there for need for considering a measure to deal with all these identified issues. The proposed system can be that measure as it deals with each and every one of the problems identified above. The proposed system aims to provide an efficient and effective system, in terms of cost and performance, that minimises communication barriers and support the currently systems. It also aims to eliminating all forms of marginalisation and restrictions that comes about due to differences in individuals' abilities and disabilities in the educational system and other processes. The main objectives of this system are summarised as shown below.

- To provide the voice recognition based system that can allow individuals who are blind to interact with the system by utilizing
- The system will utilize a camera or a scanner to capture the text from text-scripted reading materials and convert it to voice format to assist those who are visually impaired.

- The system will also have sign language machine translation function**,** that can enable the sign language to text and voice translation.
- It also aims to allow individuals who are blind to search for the reading materials both from the system and online through the use of the voice recognition.
- To provide a user friendly and affordable technology that make use of gesture reading rather than the use of hardware components.

With enough resources to support this project, the system may be the long-time searched for solution for currently faced challenges in this particular area.

3.5 Evaluate Alternatives

Considering the weaknesses of the currently existing systems, some of which has been noted above, it is a fact that something really has to be done in order to mitigate the existing challenges still in existence in the presence of all the systems on the market. In the previous chapter, a feasibility analysis was carried out primarily focusing on the development of a new system. The result from this feasibility study showed that the system development was a viable project after considering the technical, economic, social and operational factors that may impact the project. There are however, other two options that may be considered for this particular project which are to Outsource the production or to just make improvement of the already existing systems on the market.

3.5.1 Outsourcing

According to Benson (2014), this process is when the system development process is carried out outside the organisation's parameters, that is, through totally handing it over to an external specialist to supply the system or hiring the external experts to come and administer the process. Usually by handing over the process to the external parties, those parties will be solely responsible for the high-level administration of the system. The user requirements and all the necessary resources are provided to the external developer for the process. This can be considerable based on the fact tahat this is a quicker way as the system will be done by a separate developer at the same time directing our effort to the other areas of the project. This alternative though it looked promising, there are other negative factors that list below that made this alternative not the very best for this particular project.

3.5.1.1 Disadvantages

This alternative was primarily not chosen because of it disadvantages which seemed to outweigh its advantages and these particular disadvantages that were considered included:

- It is very expensive to implement, that is the available options have a high initial cash outlay
- Since the high-level administration is done by the developer, this may translate in a higher long-run cost as maintence and upgrades needs are in the hands of this external developer who will be doing it all at a fee.
- This also may compromise the privacy of our potential clients/users
- The hardship in familiarisation of the system's environment may at the end make it difficult for the system to be easily adaptive to its environment
- There is also a risk of the development of another side system that can be a competitor to this system

3.5.2 Improvement

The other option that was considered was the improvement, this was viewed at a wider angle as there was a lot of options that would bring about improvement. It was put into consideration to achieve improvement by bringing together a lot of packages that address this particular subject, to work together as a way of overcoming each other's weaknesses. The other option that was available was to look for an open source software that would be manipulated to meet with our situation. These options literally proved to be cost and time effective, and were the simplest and easiest methods of solving some of the existing challenges. Regardless of their overwhelming merits this was not considered the best alternative based on the below reasons.

3.5.2.1 Reasons for Not Choosing This Alternative

- Available packages could not be easily integrated
- Most open-source alternatives available are still work-in-progress with a lot of work that still needs to be done.
- The other alternatives are available are still ideas not practically implementable solutions.
- The cumulative cost of licenses of the other packages could be integrated were very high.

3.5.3 Development

The other option that has to be considered was an indoor development, where the system development will be our full responsibility. This approach is an efficient and cheaper alternative as the development costs will be minimal and the long-run maintenance and

upgrades costs are minimised. It was proven that this option to have nothing that would be enough to restrict it as the adequate resources and expertise was readily available. The alternative was also analysed based on the advantages and disadvantages associated as specified below. Most of the advantages were influenced by the IEEE society's publications (2012).

3.5.3.1 Advantages of Development of a New System

- Protection of user privacy can be guaranteed
- **Tailor made**- This approach allows the development of a custom system which uniquely addresses the situation on the ground basing on the requirements at hand.
- **Minimal cost**- The approach also minimises the long-run cost and eliminates some of the unnecessary costs.
- **Maintenance and upgrade**- The other unique feature that separates this alternative is that the system can be solely maintained and upgraded to allow changes with respect to the varying user requirements and also process allows for the proper documentation that can be used as a reference point in the future.
- **Integration**- The system can be also customised for an easy integration with the other systems that are being utilised by the organisations that the system will be implemented with respect to what is required by different clients.
- **Support**- The best support is experienced due to the direct access to the technical team which was responsible for the development process.
- **Feasible**- With reference to the feasibility study that was carried out for this project it was proven that the alternative is technically, economically, operationally and socially feasible.

3.5.3.2 Disadvantages of Development of a New System

- It consumes a lot of time as compared to the other alternatives
- The initial outlay/cost is also high.

3.5.4 Recommended alternative

The decision was made on the best way to deal with the situation and the **development alternative** was considered the best. It is the most effective and efficient way to address the situation on the ground, as it is associated with lower costs and the solution is expected to be a unique missing piece to deal with the situation on the ground.

3.6 Requirements Analysis

As viewed by O'Brien (2010), requirements analysis is the stage that marks the beginning of the systems engineering and the software development process. This is made up of tasks that are responsible of demarcating the specific requirements that we are to actually address by the use of the system given a wide range of the conflicting user requirements. For a better analysis, this part will be looking at the functional requirements and the non-functional requirements and then some potential constrains will be identified. This part is supposed to provide with ways that can directly deal with the situation on the ground.

3.6.1 Functional Requirements

High lighting the kind of service and functionality that the system is intended to provide is an important task. This part of the analysis identifies the system's behaviour to a particular situation and its reactions to given inputs, and this is what is supposed to make up the system's functionality. The below identified is the functionality that the system is supposed to have.

- **Direct interaction**

  The system must be developed in a virtual assistance form as a way to allow as much interaction with the users as possible. This may also in the same processes allow the system to learn more about the user which may be more useful in gathering information that may be used for security and to improve the interaction further.

- **Text to speech conversion**

  The system must be able to convert text to audio output as a way to allow the blind access to some text scripts and documents.

- **Sign language translation**

  The other intended function of the system is sign language machine translation. Instead of having an expert to translate sign language, the system must have sign language recognition then convert it to text or voice.

- **Object character recognition**

  As another way to assist the blind the system is supposed to have this function to be able to identify text/characters on printed documents and also identify other objects as well.

- **Security**

  As a security measure to restrict unauthorised access, authentication processes will be utilised to identify the type of a user using the system and there will be also different access levels to the system for the users. As an additional security feature to protect

some of the confidential information being handled by the system, encryption will also be utilised.

3.6.2 Non-functional requirements

According to Land (2012), these requirements stands as a criterion for the measurement of the system's operation rather that solely basing on specific behaviours. This is attained by defining the system's constraints and its potential properties.

3.6.2.1 Properties

- **Good interfacing**

Scientists has proven that our performance relies mostly on impressions projected to us, the system is supposed to bring a good impression to the users so that there can perform better

- **Simple system**

The system to be developed is supposed to be simpler to understand and use so that the users will not have hard time with the system.

- **Data transport**

The use of an active hub will enable the transmitted signal to be amplified increasing the transmission speed.

- **Response time**

This is the elapsed time between an input for execution and moment it will give back an output, this is supposed to be as short as possible.

3.6.2.2 Constraints

- **I/O Ports**

Most of the desktop computers usually comes without some of the compatible ports for some of the components required, which make the system require additional devices to convert the signals into compatible input or output.

- **Storage requirements**

For the system to function best requires a high storage memory and the storage space utilised must be minimized

- **Robustness**

The time to recover from failure and the frequency of the failure occurrences are supposed to be minimised, which is not common with the systems being dealt with.

3.7 Conclusion

This phase was able to foster a better system's understanding as required and enabled the analysis and consideration of the currently existing systems and other researches that were done in the past as a way to come up with some better system requirements. The information and evidence that this phase was able to bring forward was solid enough to be able redress the challenge and to come up with the best design that can be utilised for a better system.

Chapter 4: Design Phase

4.1 Introduction

With the help of the previous section, an in-depth scrutiny of the currently existing systems and the situation on the ground, enabled an understanding of the kind of a system that could be better redressed to improve the situation. This phase now primarily focused the designing of a new system that best implements the system's requirements identified based on the analysis results available. Galin (2014) explains that, the main idea behind is to at the end produce a physical and logical design of the proposed system through utilising the requirements identified from users and the gathered information. Basically, this phase will show the design process through an outline of the deferent aspects of the system inclusive of its physical, architectural, interface and database designs, also considering security design and show a pseudo code of the proposed system.

4.2 System Design

The basic notion of the system design is to highlight how the proposed system is intended to work. The greater part of the proposed system's functionality is mainly to simplify the currently existing systems and addressing some of the challenges that there are not addressing. The final system's quality is going to be determined on how well this phase is carried out. As identified by Levin (2015), there are some basic components that are used to define a well-designed system these includes:

Effectiveness and Efficiency- the system which is well designed is supposed to perform tasks as intended also minimising the costs. This system will address this by minimising on the hardware through maximising on some simple development libraries and making it as much user friendly as possible.

Reliability- this system also intended to have a minimised failure rate producing accurate results as a way to achieve a good design.

Maintainability- the system's design is intended to provide room for upgrades and correction, as a way to improve its flexibility and adaptability to environmental and the technological needs to the technological changes providing room for any alterations the adding of any other additional requirements that may rise.

4.2.1 Proposed system's Description

The Learn Smart System is basically a virtual assistance system intended specifically for the people with various disabilities. Basically, the system will adopt different functionalities from the related currently existing systems and have some additional functionalities that addresses

will try to address the weaknesses of the existing systems. The proposed system will be carrying four basic modules namely the speech recognition, sign language, touchless control and a machine learning module. As a first stage of the system, the system will be utilising some form of authentication to allow access to the system in accordance to the user's privileges and access level. Once the user is logged in then he/she will now be able to access the system's functionality or the system's modules.

The **speech recognition module** is comprised of two basic functionalities which are the text-speech machine translation and an audio based virtual assistant all designed to assist those who visually impaired. The text-speech machine translation function will enable the text-to-speech and speech-to-text translation. The audio based virtual assistant will enable the interaction with the computer using voice, it will allow some basic control possible using voice commands, for example searching for things online using voice commands.

The **sign language machine translation module** is intended to utilise gesture reading/recognition as a way to allow communication between the deaf, the dumb and individuals who can speak and hear. This module is supposed to do a sign language translation by reading the hand-gesture converting it to either text or speech.

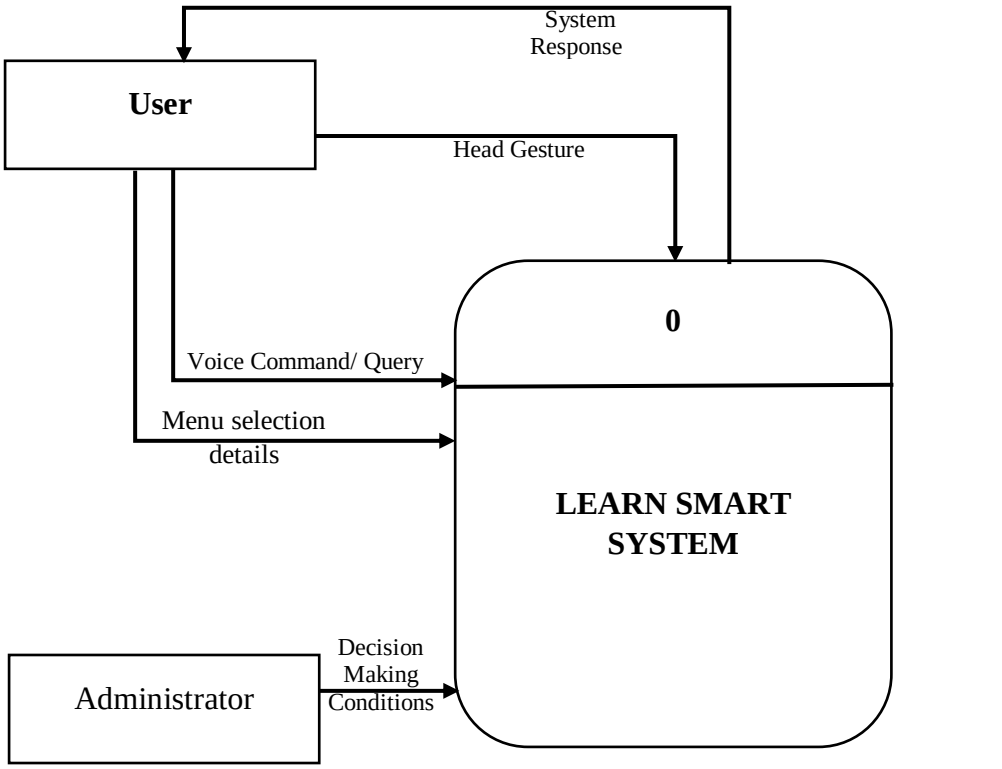
The **touchless control module** is intended to assist individuals without arms to browse through certain sections without any physical contact with the system. The touchless function will be using certain gestures to control the system, for instance utilising head movement to select certain options.

The final intended module is the **machine learning module**, this will basically involve inputting of data that will be utilised for some functions' operation and allowing the system to learn from some of the operations it will be carrying out. This module will be the one responsible for the updating, upgrading and maintenance of the system to meet with its operational environment's requirements.

This is basically the system's main functionality with some of the addition functions that maybe useful support the operation of the system, that may include the customised reports and others.

4.2.1 Context Diagram of the proposed system

According to Jaakkola and Thalheim (2011), a context diagram summarises the whole interaction of the entities within the system and at this same time defining boundaries of the system.



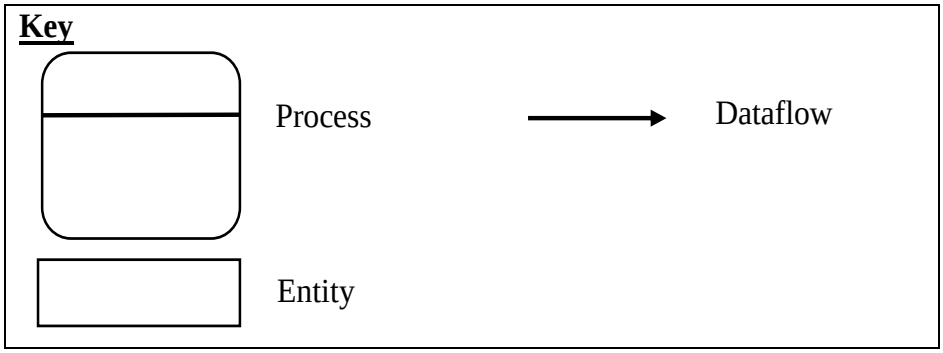


Fig 4.1 Proposed System Context Diagram

4.2.3 DFD of the proposed System

This is basically a graphical representation that shows expected dataflows within the proposed system and for this system this can be shown as below.

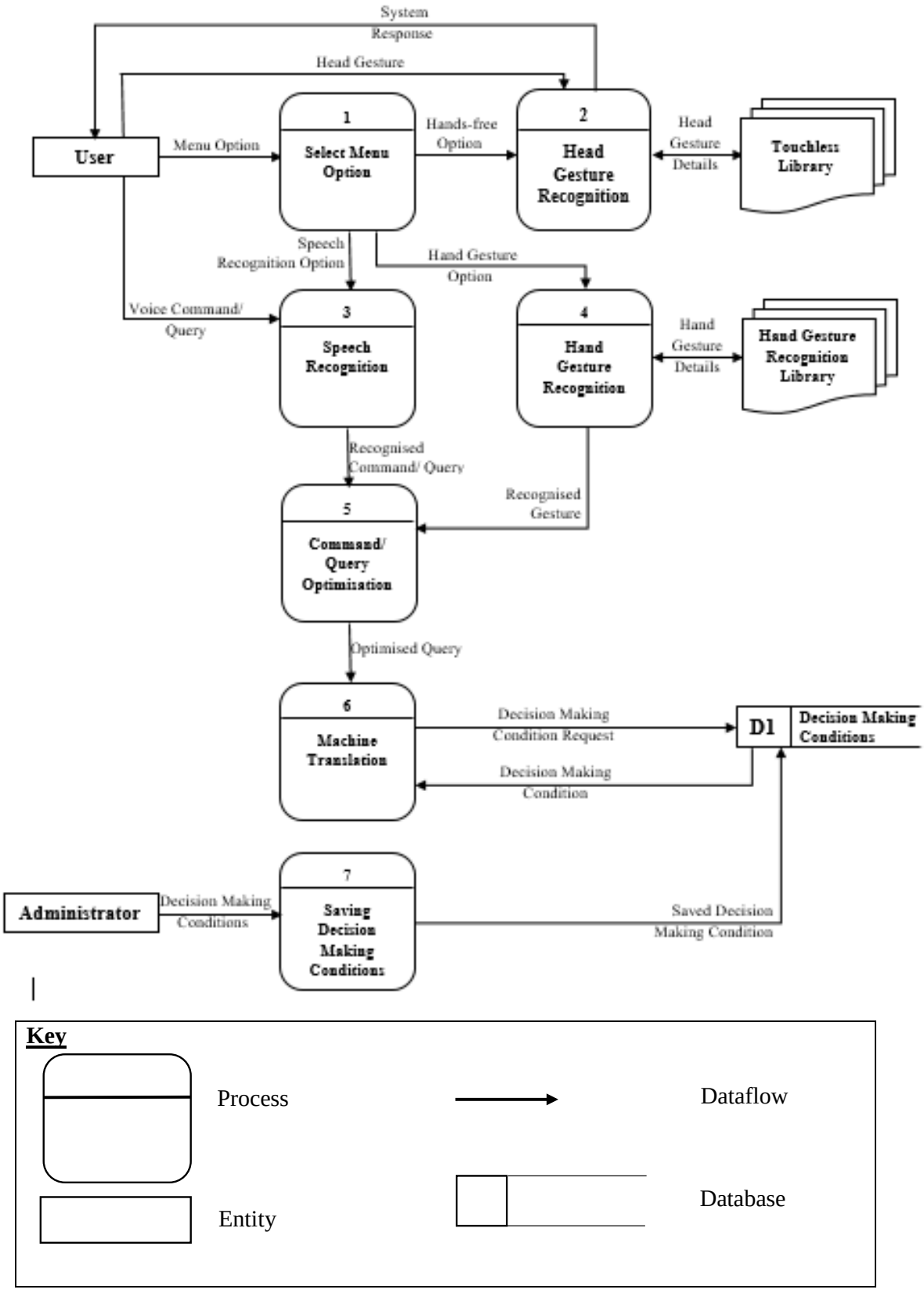


Fig 4.2 Dataflow Diagram of the Proposed system

4.3 Architectural Design

This is commonly known to be system's highest abstract version and the basic notion of having this design is that every system is a combination of many components that will interacting. For this particular proposed system, it will be useful to show the developers the system's domain and to foster understanding on the overall setup and dependences. This enables us to structure the proposed system's frame through the defining of the hardware and software components and their interfaces. Otero (2017) defined this is as a high-level model defining the criteria aspects that is understandable by the stakeholders and it provides properties evaluation before the real system can be built. It is also useful in the devising of the tools and techniques that could aid the development process. For the proposed system, a simplified architecture can be shown as below.

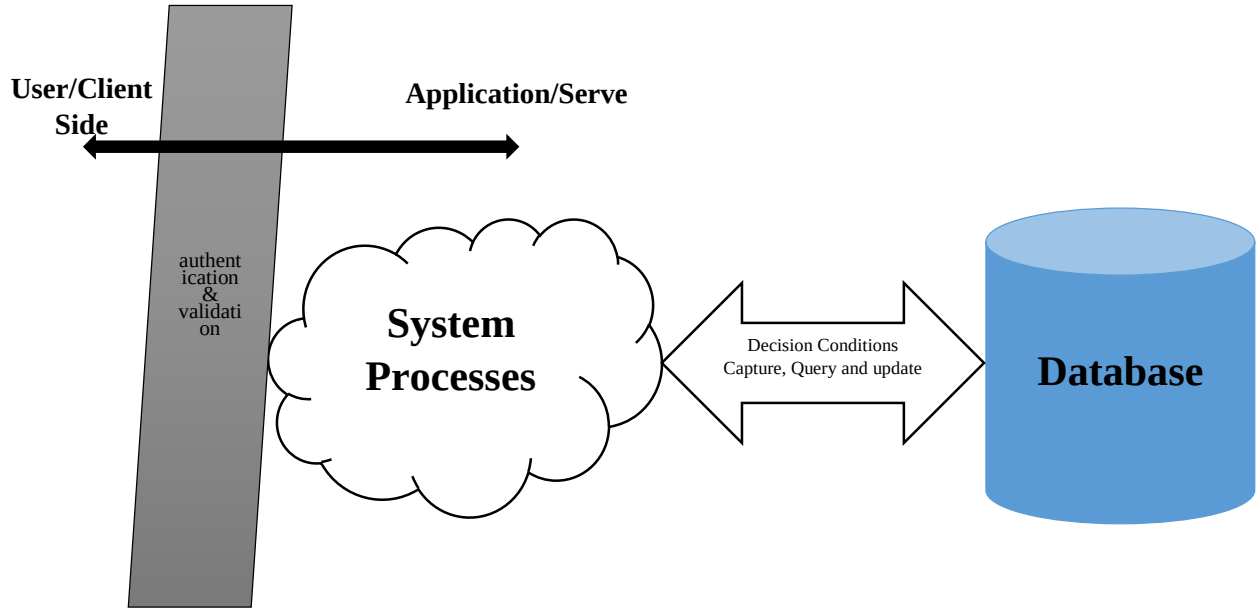


Fig 4.3 Learn Smart System Architectural Design

The system is to be made in such a way that the general user be having full access to all the system's features but cannot manipulate the way the system operates. Access levels will be differentiated based on the type of the user and the privileges associated with that particular user, which is determined through an authentication process. The authentication process validates and verify the user by making use of the user credentials as a security measure and the process will also incapacitate data encryption. The user with the administrative privileges will be the one responsible for the system's manipulation.

One of the major purpose of the architectural design is to help define the hardware and software components that makes up the system. The choice on the proper hardware and software will help to improve the reliability and efficiency of the system, at the same time minimising any bottlenecks. Basically, the hardware and software will make up the platform on which the system will be running on. For a good platform of the proposed system, the below hardware software combination was defined.

4.3.1 Hardware Requirements

- Depth Camera
- UPS
- User computer at least a dual core
- 3.2 GHz Octa-Core Server
- Switch
- Cat e5 network cable
- RJ45 Connectors and Mount Boxes

4.3.2 Software Requirements

- Linux (ubuntu-14.04.-server and above)
- Window 10
- Microsoft Visual Studio 2015
- OpenCV
- EmguCV
- Xamp
- Microsoft Office 2016
- Avast Pro antivirus

4.4 Physical Design

According to Sherwani (2011), it is a very important task to understand software-hardware interaction during system's development process as it is a base at which the system can be developed. Involved in this system are basically two types of users separated by their privileges. The users include the **disabled individual** who are the main intended individuals for this system and their access to the system will be relative dependent on their disabilities. The other type of the users of the system is the **administrator** who will be able to manipulate the system by training it so as to be able to independently make its own decisions. These access

levels are strategically devised to uniquely meet the information needs for each type of an individual involved within the process.

The hardware components are connected in such a way for every user in the system will have some level of access to the associated functional libraries and the system's server. The basic idea is that the system will be a combination of programs that are written uniquely to interface with the user at the same time directly communicating with the hardware, prompting it to act in a certain way. Different algorithms utilised by this application's libraries will be used to break down and solve the query into an intended outcome. Also the operating system will play a crucial role as the programmes will be utilising it to allow all these operations to take place. Below is the basic expected physical setup for this particular system's network presented as a visual.

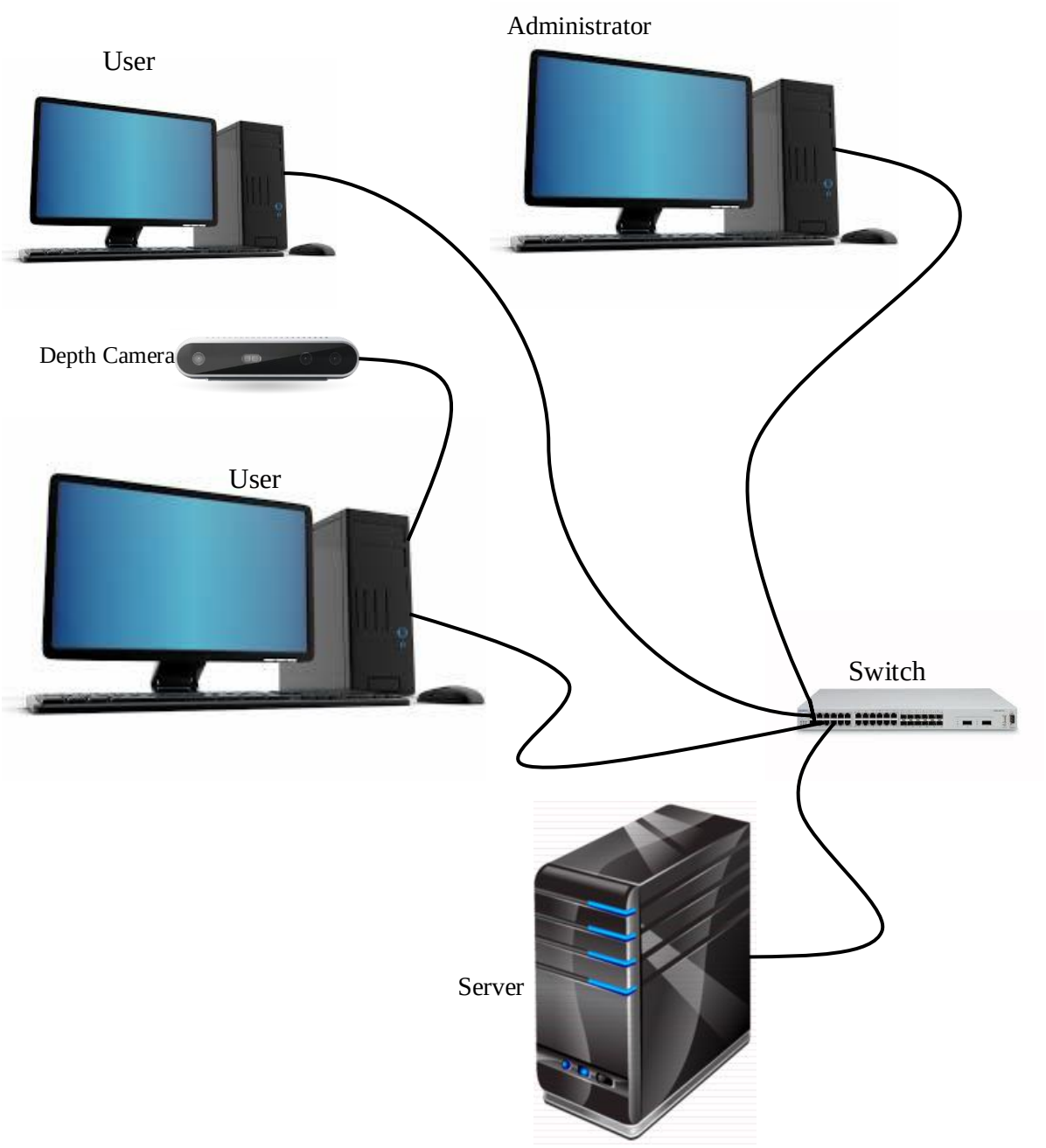


Fig 4.4 Learn Smart System Physical setup of the Network

4.5 Database design

According to Dixon (2015), the database design process is a very important stage in the system development process and appropriate methods have to be used to enhance the system's robustness and allow the system's maintainability. Due to the fact that the databases are the core of the system solid decisions have to be made on how there can be best defined. A good database design can be achieved by considering the below basic components that an important in this process.

Media Storage- there is need to determine the database size, access speed and the way the database is supposed to be best laid on various media.

The change over time of the database- there must be a provision new attributes to be added on the tables of the database and the database must be flexible to allow for additional features that may be added in the future.

Security- adequate restrictions on the database access are supposed to be enforced as a way of securing the information it holds and additional passwords and encryption must also be utilised where possible.

Database Architecture- this type of a system can be best served by a centralised database as an attempt to minimise on the data duplication and data redundancies, and this will also help in determining on how best the database can be partitioned amongst different hosts.

4.5.1 Entity Relation (ER) Diagram

An ER diagram is a helpful tool when identifying how the entities involved are related to each other within the proposed system's setup. Dixon (2015) states that this is a visualisation of a relational database, in this context an entity represents a database table having all its attributes presented. This is a basic tool that can enable a quick professional database design, minimisation of the errors and allow better maintenance. Below is an ER diagram for the proposed system followed by an Enhanced Entity Relation Diagram.

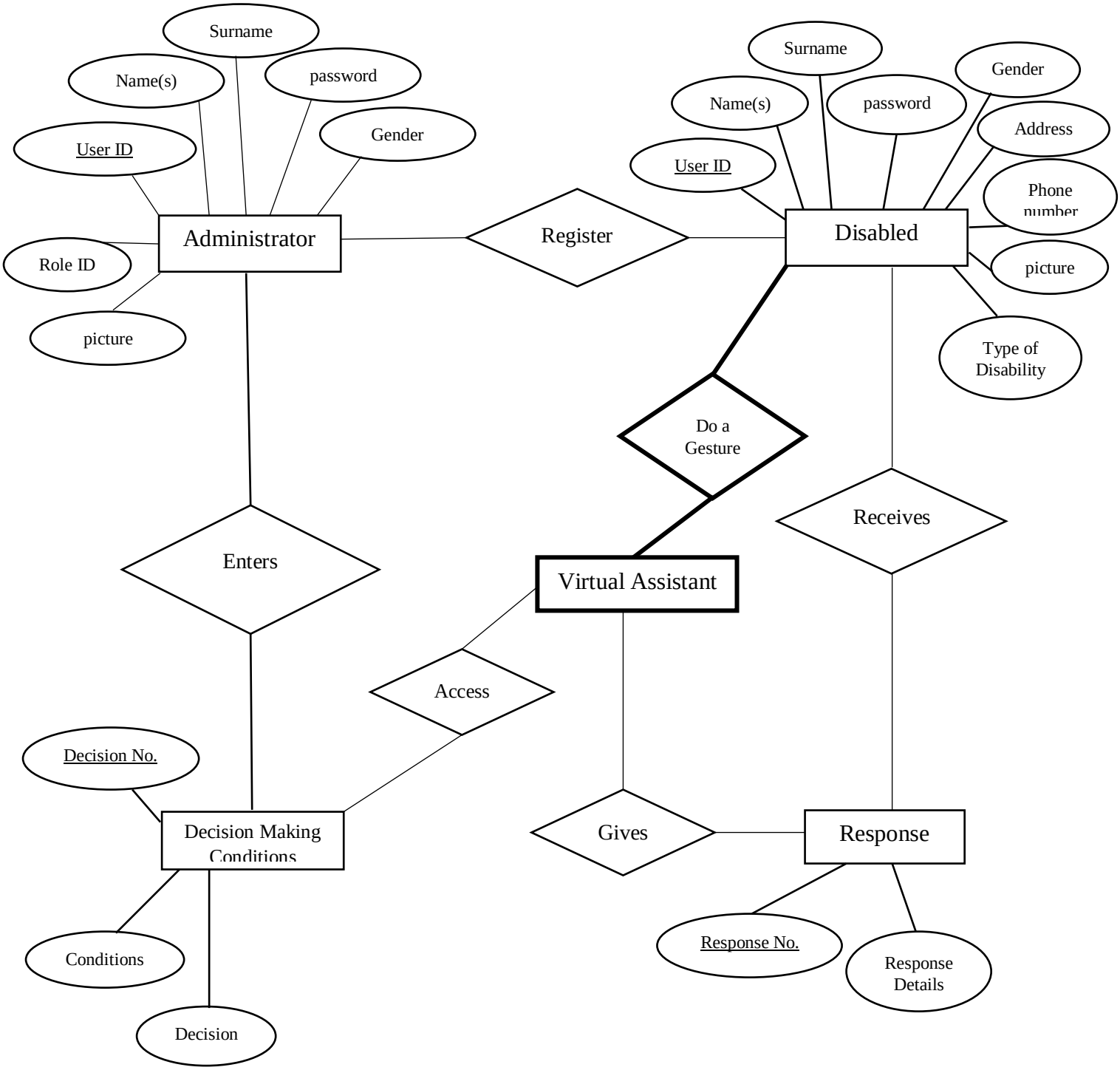


Fig 4.5 Learn Smart System's Entity Relation Diagram

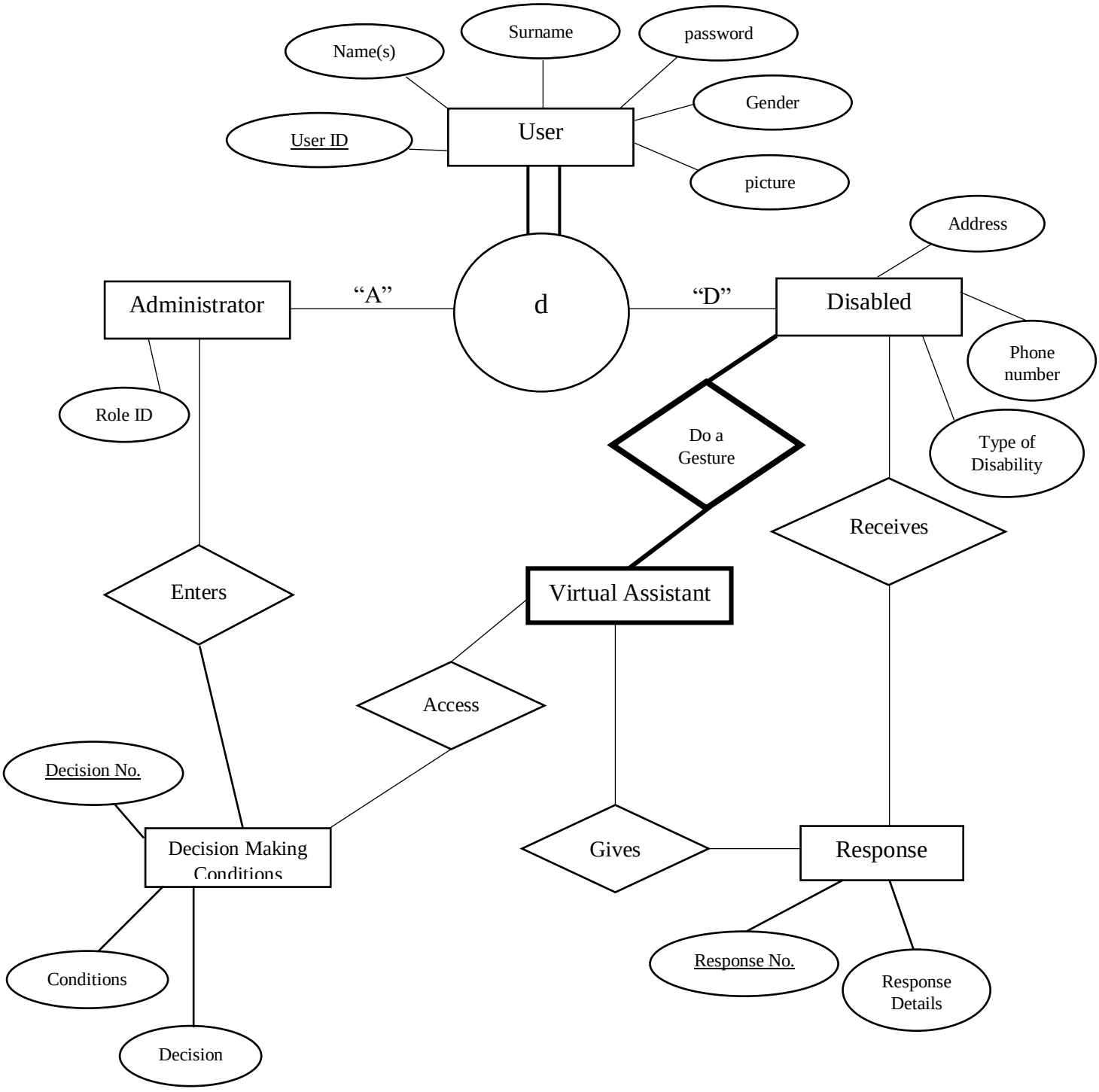


Fig 4.6 Learn Smart System's Enhanced Entity Relation Diagram

4.6 Program design

As a way to furtherly explain and simplify the system's design, the below advanced program design diagrams were utilised as a way to identify the dependences between different the systems subsections and entities.

4.6.1 Package Diagram of the Learn Smart system

This particular diagram is basically a Unified Modelling Language (UML) diagram composed only of packages and their dependencies. In simple terms package can be defined as a UML construct that enables model elements organisation, and this includes use cases or classes, into groups. Below is the package diagram for the Learn Smart system.

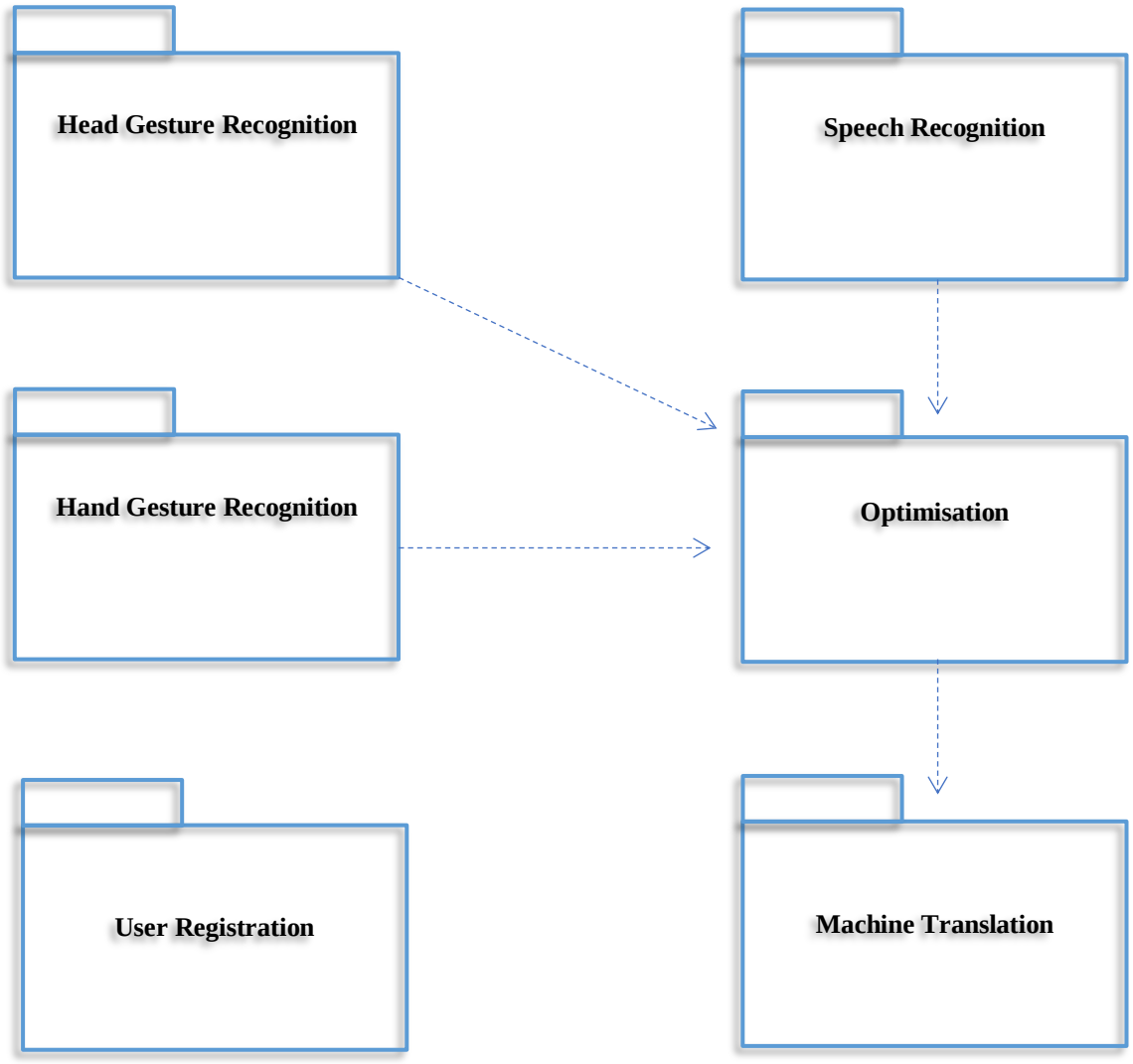


Fig 4.7 Package Diagram of the Learn Smart system

4.6.2 Class Diagram of the Learn Smart system

The Class diagrams is another useful of a diagram in the UML because of its ability to clearly map out the system structure through a modelling process of its classes, attributes, operations, and relationships between objects. It is also another way of defining the database table structure by uniquely identifying the attributes' datatypes. Below is the class diagram of the Learn Smart

system.

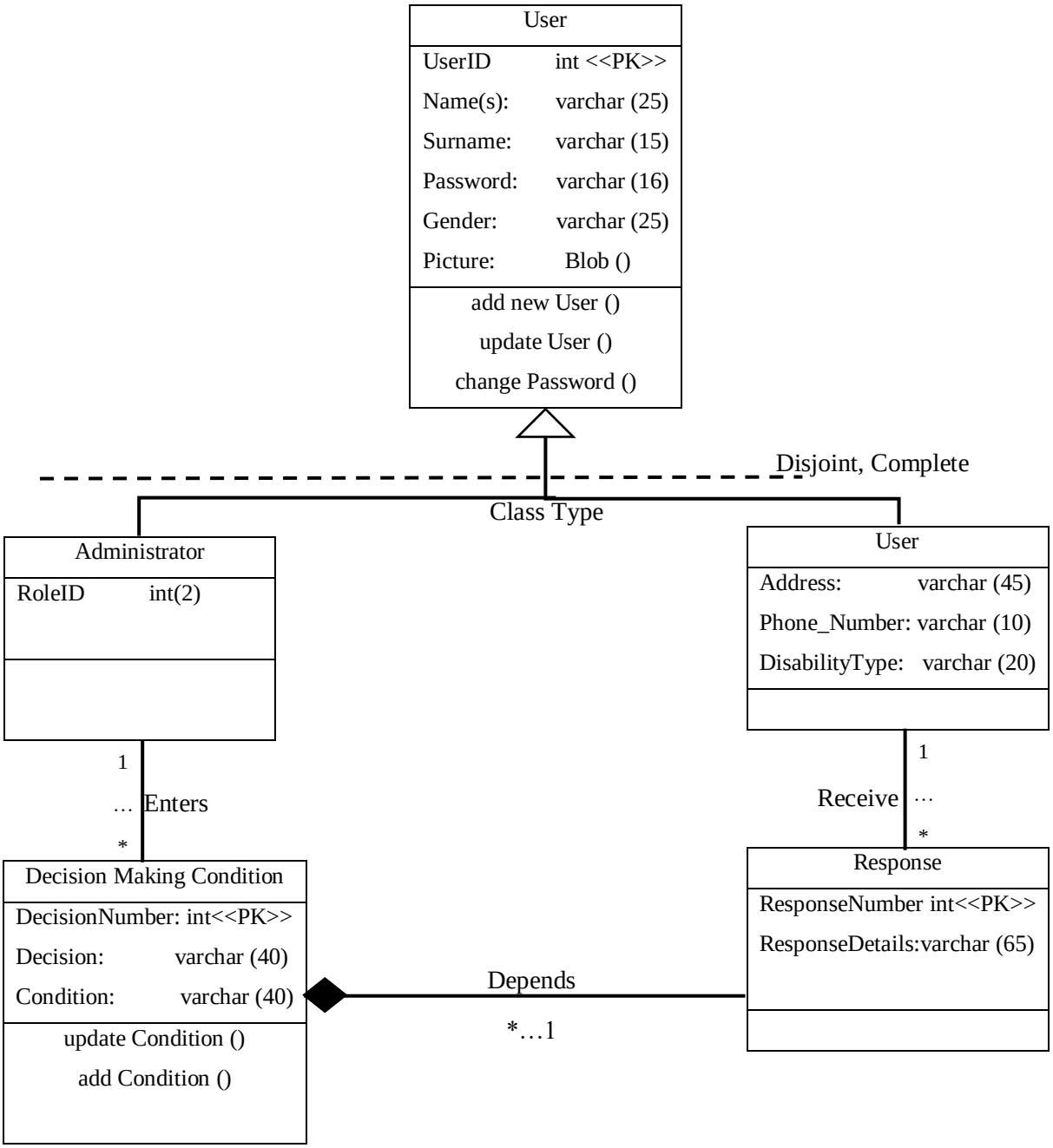


Fig 4.8 Class Diagram of the Learn Smart system

4.6.3 Sequence Diagram of the Learn Smart system

This is also usually termed as an event diagram and it provide the description of the interactions among classes in terms of an exchange of messages over time. This can be mostly utilized to visualize and validate various runtime scenarios which is useful in predicting system's behaviour and to discover responsibilities a class may need to have in the process of modelling a new system. In layman's terms, this is intended to measure the time of the entire process that specific modules of the system will be active. The sequence diagram for the proposed system

is show below.

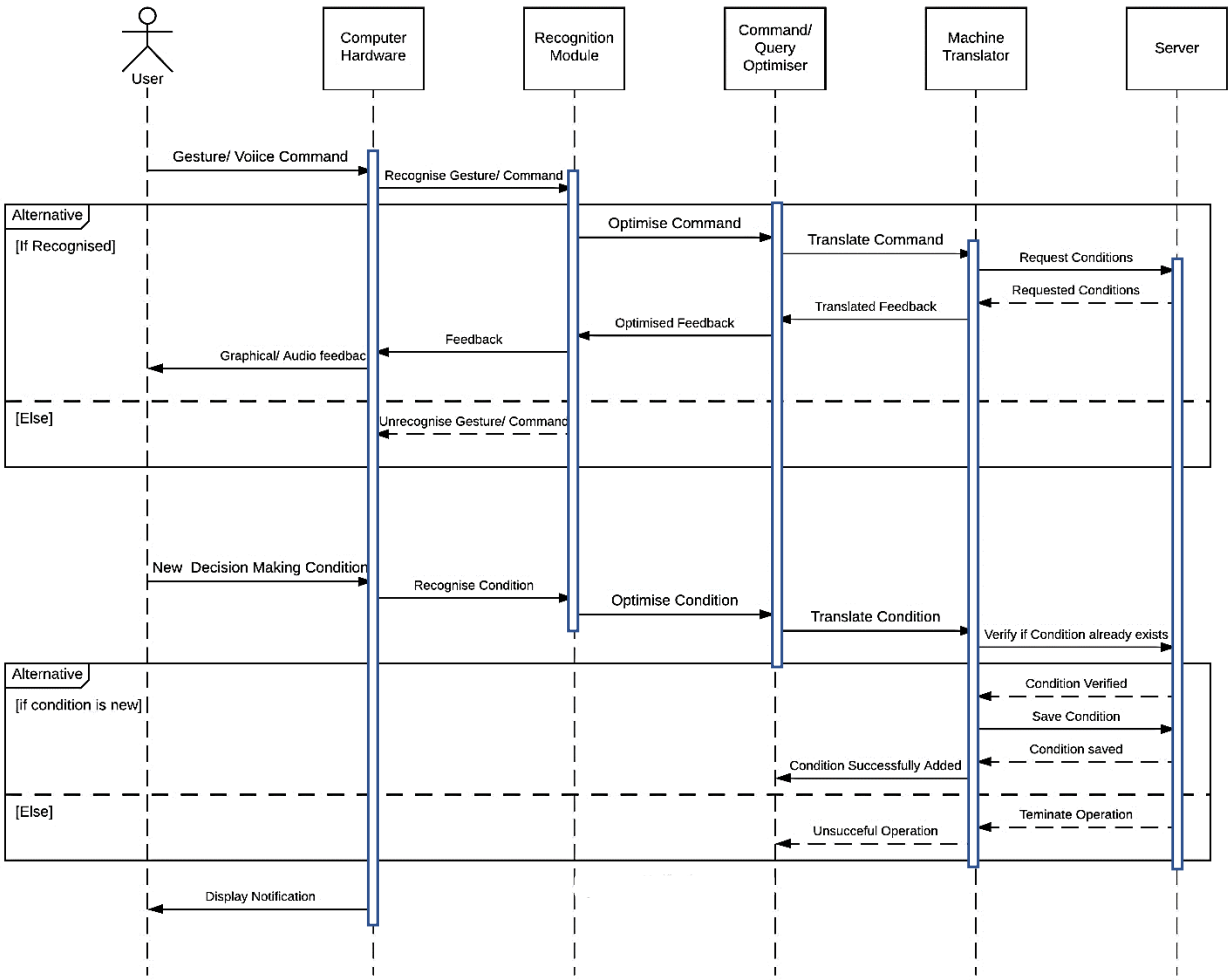


Fig 4.9 Sequence Diagram of the Learn Smart system

4.7 Interface design

The contributions by Hardcastle (2011) showed that, for the system's user to undertake tasks in the system thy make used of the user interface, which allows for the user interaction with the system. To a greater extent this is responsible for the determining of the system's usability due to the kind of impression it give to the user making this part an important part of the system design process. There a number of approaches that may be utilised in the interface design.

User-Centred Design- this approach is user oriented as it maximises on user involvement as a way to produce good interface and an interface that the user will be understanding and comfortable to deal with.

A structured interface design process was adopted as a way to enhance the design. Girish (2014)

encourages the use of the five step approach to the interface design process under the structural process and the steps includes:

Scenario development- this makes best use of the gather information relating to the user requirements and the process will be fostered by the UML tools.

Interface structure design- at this stage the basic layout is illustrated by showing the structures of all the input and output forms to be utilised for user interaction.

Interface standard design- the previous form structures are furtherly simplified to the system's basic elements to stand as the guidelines of the for the interface that will be developed.

Interface design prototyping- a series of prototypes of the system will be developed and presented to the users. Each prototype will be carrying alterations proposed on the prvious one by the user until a satisfactory interface is design.

Interface evaluation- for every prototype made the evaluations of the acceptance criteria will be solely dependent on the user. The final prototype that is satisfactory to the user will then be implemented in the best way possible.

4.7.1 Menu design

To interact with the users the system will be utilising different types of the forms depending on the function it ought to perform. The basic classifications of the forms include the main menu, sub-menus input and output form. These forms will be presented in a hierarchical structure for good coordination of the system's functions in the eyes of the user.

4.7.1.1 Main menu

For this particular system, this is the main access point for every user of this system. This will be designed in such a way that that summarises all the system's functionality and allow the grouping of the related modules. This will make user of many controls that are strategically selected to accomplish its main purpose and to enhance the appearance the system will utilise the Metro-GUI library to borrow some of the modern controls for the system. Given below is a replication of the of the intended main menu design as a simplified design.

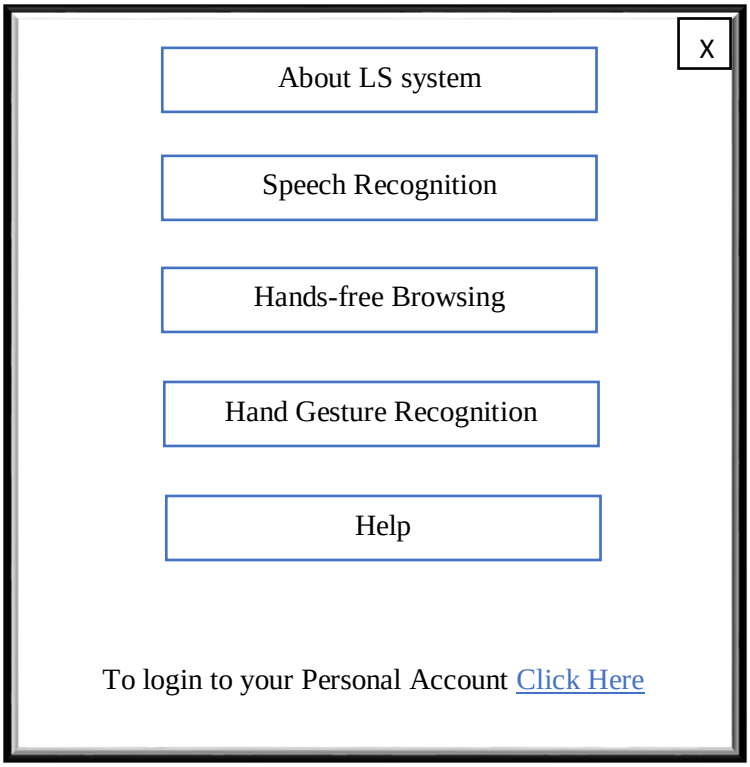


Fig 4.10 Main Menu Design

4.7.1.2 Sub-menus

Sub-menus will be utilised to show the grouped options available for every main menu functions and each sub-menu will be carrying related option of the system. The sub-menus for this system are inclusive of the below give expected designs.

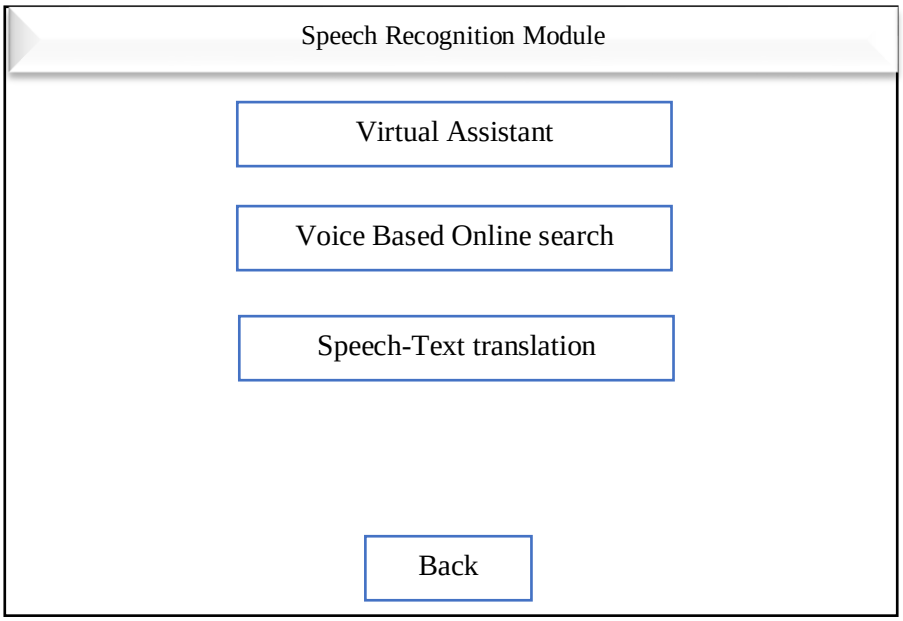


Fig 4.11 Speech Recognition Sub-Menu Design

The above sub-menu is for the speech recognition module and the design was influenced by a quest to bring a better layout of the system's functions.

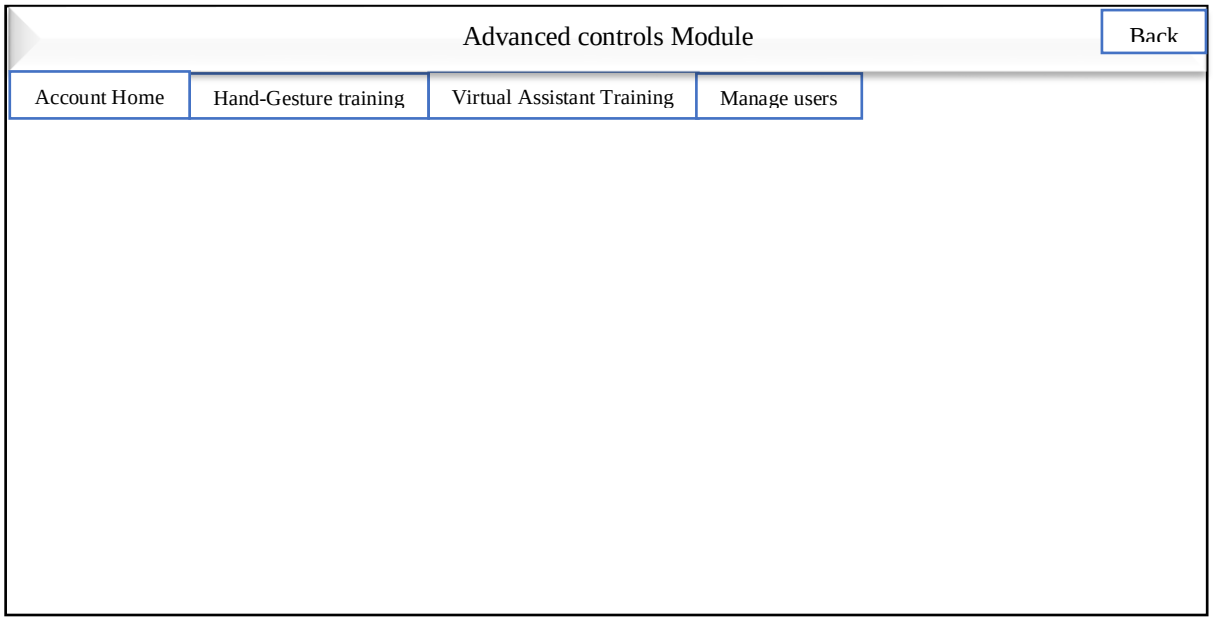


Fig 4.12 Advanced Controls Sub-Menu Design

This sub-menu utilises the tabs and this particular design was chosen because of its ability to bring all the function closely accessible.

4.7.2 Input design

Special types of forms will be utilised for the system to accept data inputs at different levels. The design of the input forms will be dependent on its intended function. The below given designs shows the system's intended input forms.

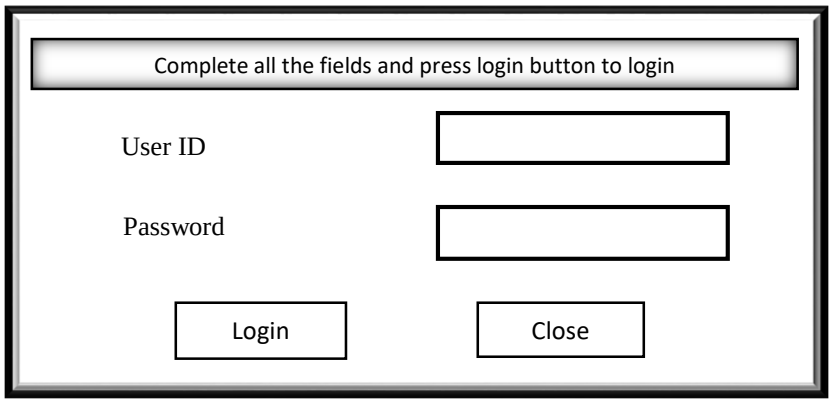


Fig 4.13 Login Design Form

The above is a basic authentication form that will be used to enable advance controls of the system.

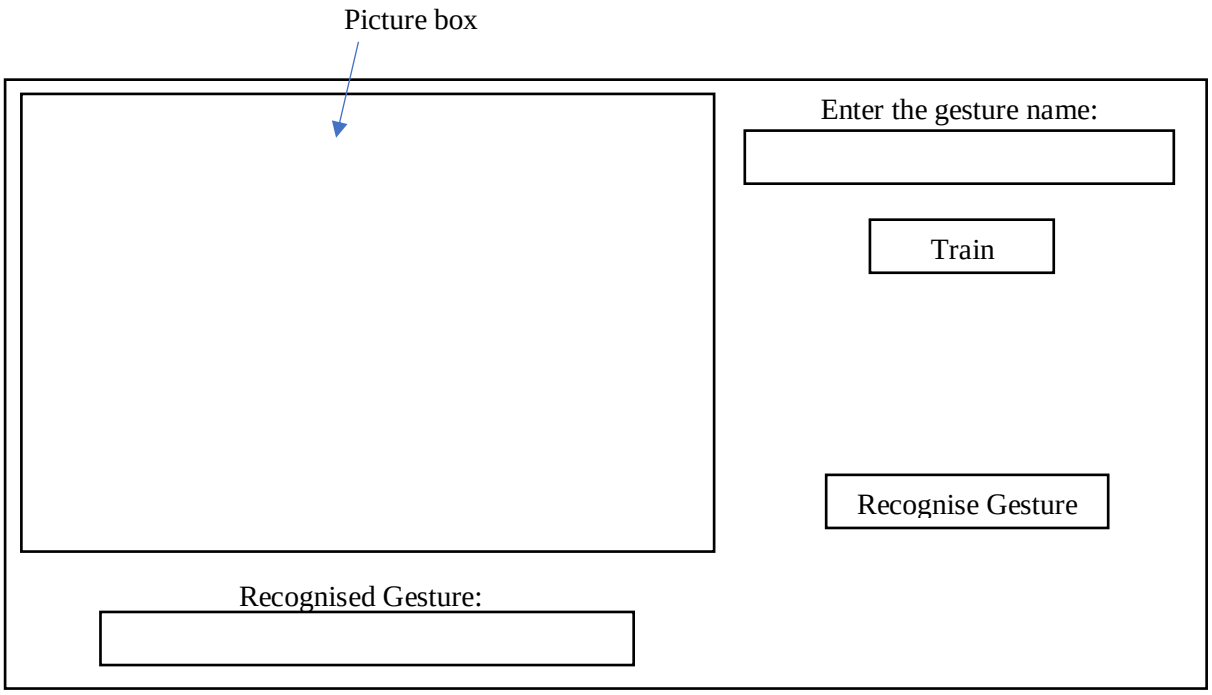


Fig 4.14 Hand-Gesture Training Module

This form is an administrative input form for the system's training, the form will be having a picture box linked to the camera or the image input and a textbox that will be used to name the gesture.

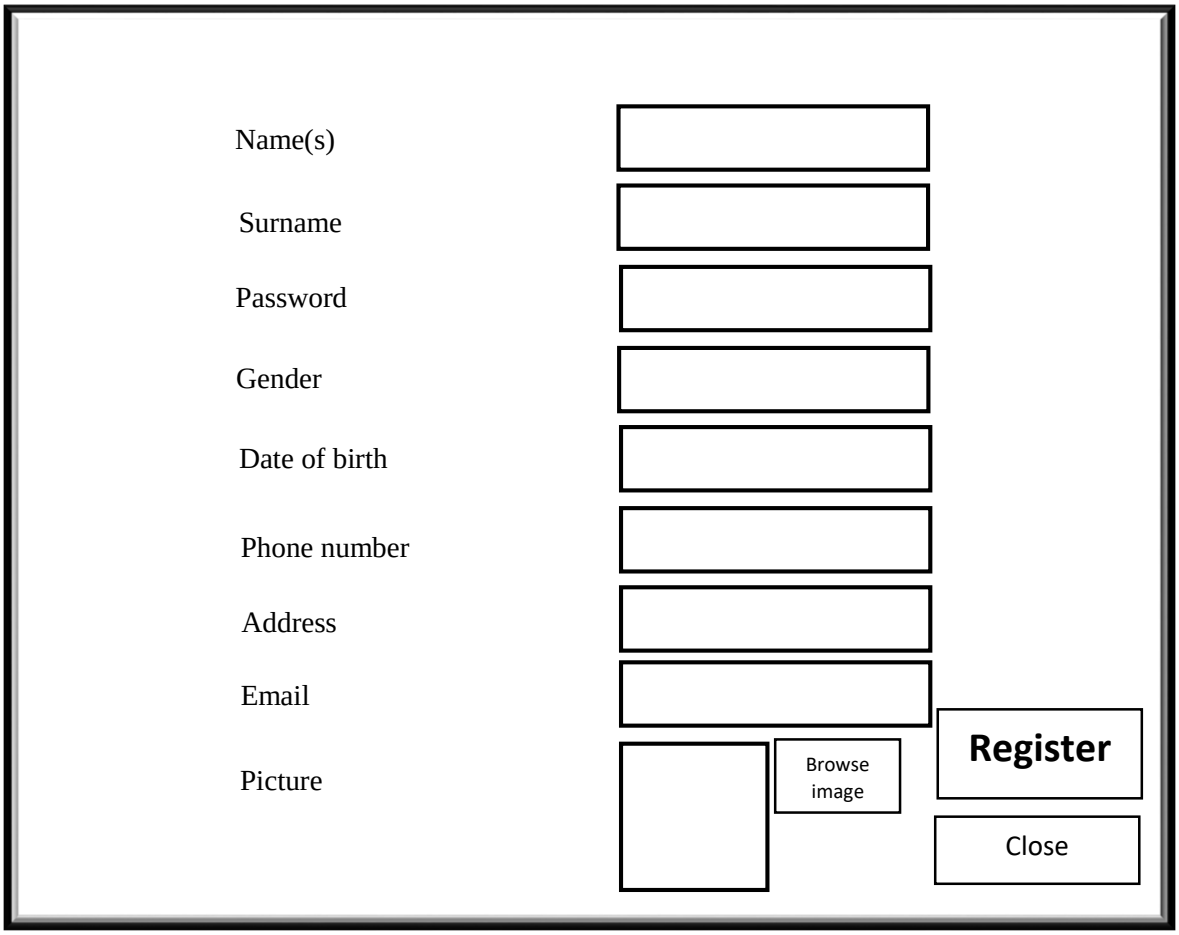


Fig 4.15 User Registration Form Design

This particular form is intended to be utilised user registration process.

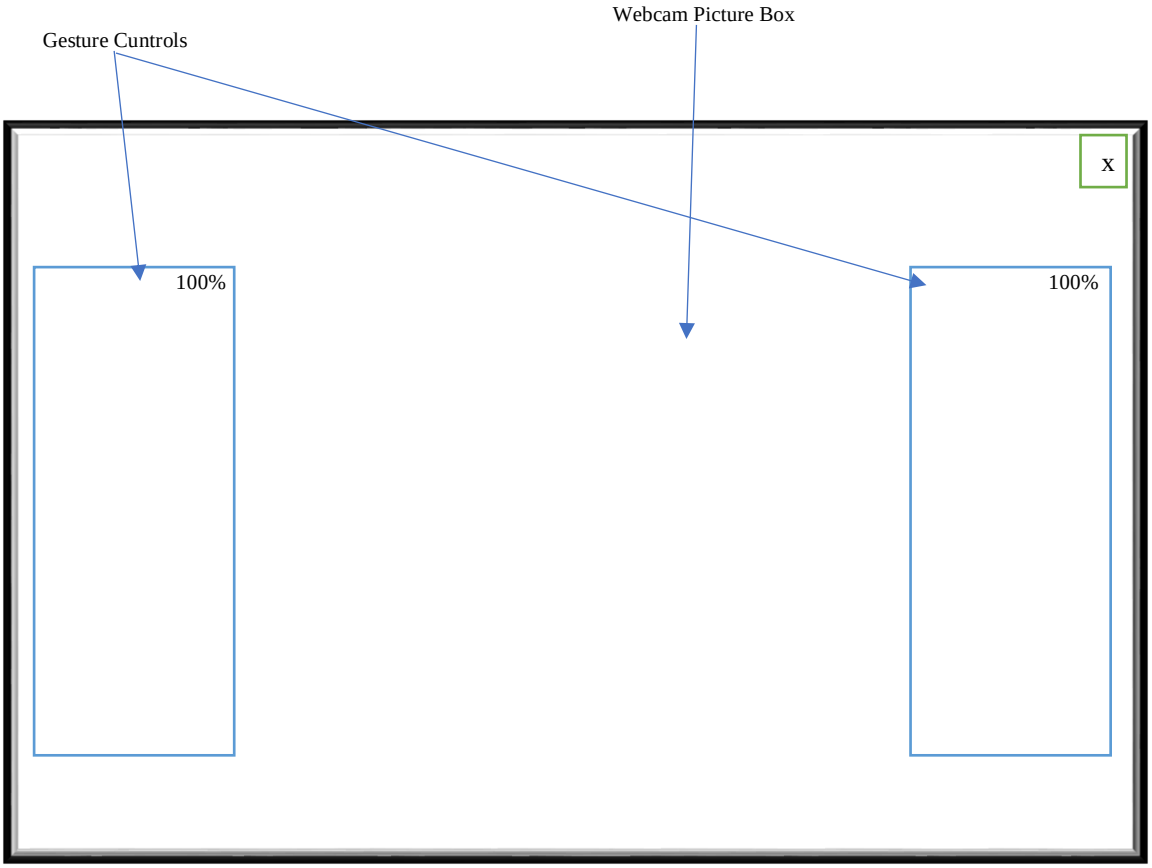


Fig 4.16 Head Gesture Recognition Form Design

The system will utilise this form to recognise user head-gestures and the form will be directly linked to the camera input to define its parameters.

4.7.3 Output design

For the output design, the system will also utilising unique forms and customised reports for every form output that it will be handling. These specialised types of forms will be used at different stages of the system depending on the form of data it is supposed to represent.

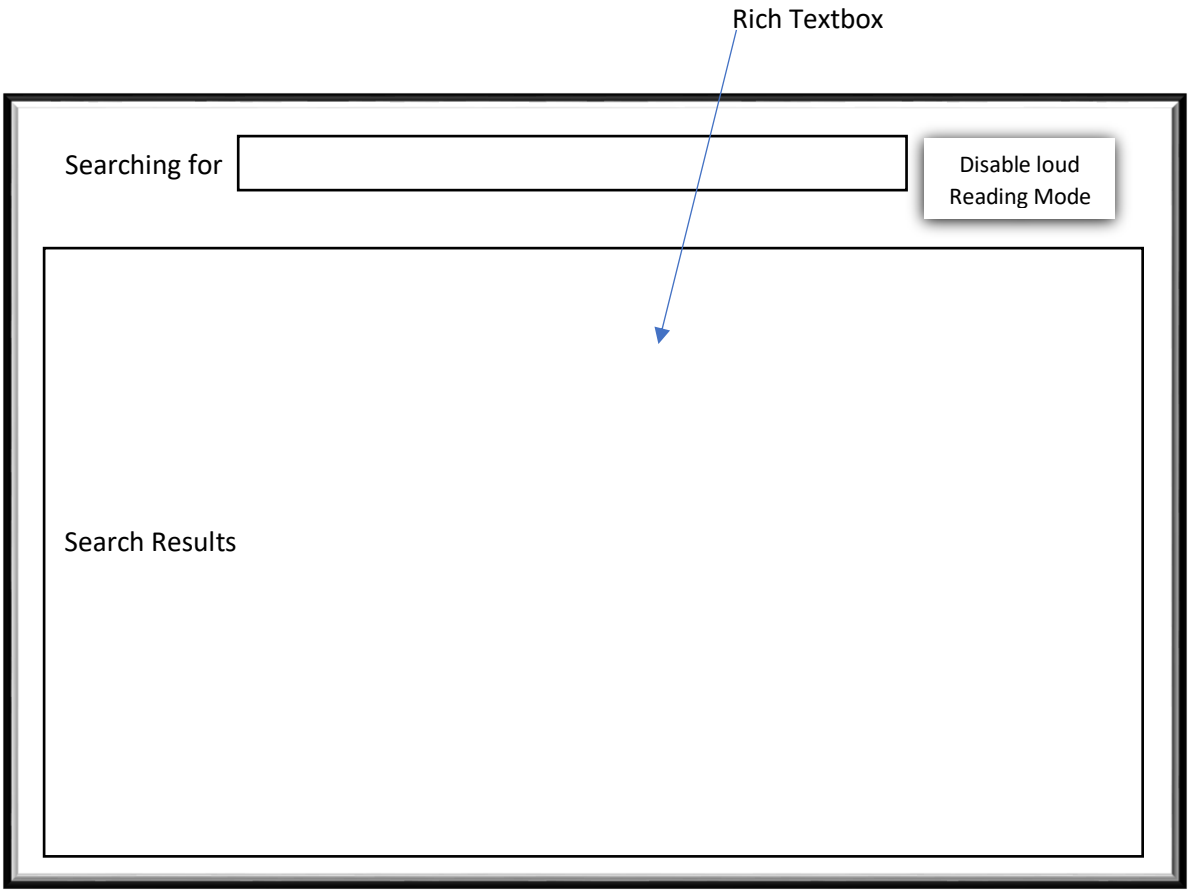


Fig 4.17 Voice-Based Search form

This form is to be utilised during voice based browsing, and though there will be also an audio output, this was chosen to accompany in the cases where the user will not be visually impaired.

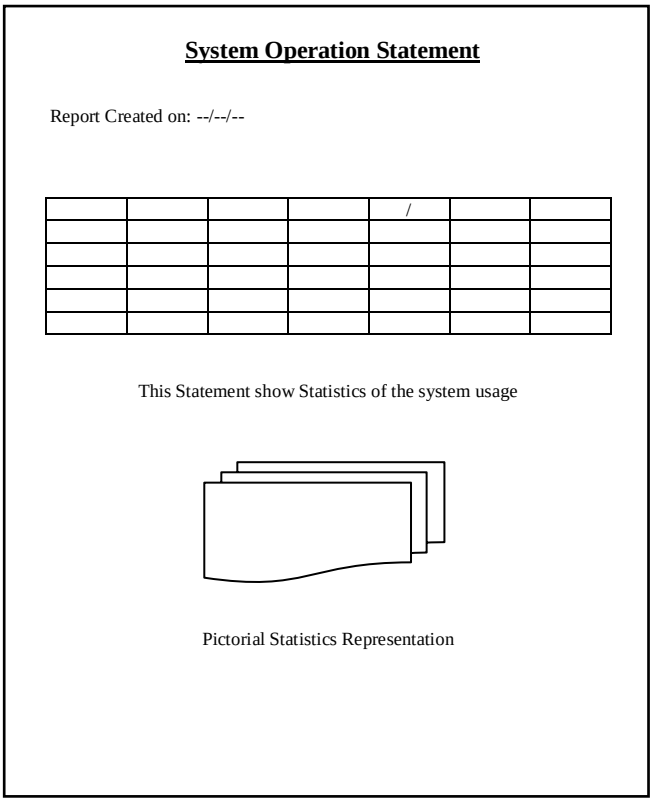


Fig 4.18 System Statistics Report Design

Statistics on the system's operations will also be represented in the form of reports as a way to allow for the system's further analysis.

4.8 Pseudo Code

This is basically a summarised code in the form of plain statements to replicate the original code that was utilised for this system and this is optimised to be understood by an average human. Below is the pseudo code for some of the operations of the system and the code is based on the visual basic (VB.Net) language.

For login

User login credentials

If table has role then

Enable the advanced controls

Else

Invalid login credentials

End if

Adding a Record

Validate the input data

If data input is valid Then

Save

Else

Show an error message

End if

Updating Record

Check if the record exists use key field

If the record exists

Validate the update data

If the data is valid

Update

Else

Show an error message

End if

Else

Report error

End if

Deleting record

Get the key field record

If record exist Then

Display the record

Confirm the action

If the action is confirmed Then

Execute the deletion action

Else Terminate the action

Else

Report error

End if

Reacting to a command (gesture or voice)

If action specified exists in the databas Then

Execute action

Save details of the action as successful

Else

Report action as not found

Save action as unsuccessful

End if

Validation checks for input data

- **Data length (e.g. password)-** The inputted character number must suit the specified acceptance range as a way to minimise errors and meeting the security standards.
- **Inputted datatype (e.g. digit/text characters)-** Character inputs must be validated accordingly as a way to minimise the data biases.
- **Format (e.g. time/date)-** To maintain standardised formats the specialised controls must be used for example utilisation of the date time picker.

  Appropriate Message box must be used to provide instant feedback to the user on the successful, unsuccessful operations and the errors that will be encountered.

4.9 Security design

Every information system requires its own unique security design to evaluate its quality and to enhance its functionality. For Learn Smart system unique security mechanisms are designed accordingly at every level of the system development and below are some of the measures that are to be put in place for this system.

4.9.1 Physical security

This refers to the physical measure toward the protection of the building sites and all the equipment (hardware and all its contents) against intruders, vandalism, theft, damages' and natural disaster. The physical security in relation to the system will be highly dependent on the organisational current physical security. To mitigate some of the popular physical security issues popular in this line of the organisations the system will bw implemented, a set of some basic security measure will be provided as a standard of the system's operation environment's security. Some of these physical measures will be inclusive of:

- Physically Restricting unauthorised access
- Provide with some form of a solid and physically secure environment for the computers

4.9.2 Network security

Some form of a computer network is created by the interlinking the computers and connecting different components together. This literally implies that a single attack on one of the nodes may compromise the safety of the other nodes. The first measure to be considered for all the nodes was to individual secure them by an anti-virus software to minimise the impact of a threat on the network once realised. The other additional measures includes:

- For internet connection, the gateway of the will be having some robust rules that will be governing the connection
- For the computers that will have the access to the internet, each will be having its own independent firewall.
- Internet connected computers will also access the internet through the proxy server which will be standing as barrier for threat to reach users' computers
- The server will be set to allow access to the only data that the destination user requires.

4.9.3 Operational security

Once the system is place there is need to identify information assets and device measures to protect these assets and all the involved data. Some of the measure in place to insure operational security includes:

- **Database security**- the DBMS that this system is intended to utilised have its own ways to restrict the unauthorised access like the use of password to access its data.
- **Password encryption**- another level of security the system intend to utilise is the encryption of some of the confidential user details which includes the passwords.
- **Character hiding**- also in addition, some of the text fields used to input confidential data will be defaulted to hide characters and typing by using either a hushing (#) method or by utilising the dot character.

In addition to the above security measures it will come as a requirement for the organisation to include the standards and security measures of the system in the organisation's IT Policy that is documented in order to ensure a secure and robust system's operation.

4.10 Conclusion

Based on all the areas covered by this phase a solid base for the proposed system's implementation has been laid, and the best design for the system from many aspects is now clarified and confirmed. The next chapter will therefore cover the implementation of the design that came as a result of this phase.

Chapter 5: Implementation Phase

5.1 Introduction

The preceding phase (Design phase) was able to providing guidelines and produce the most appropriate and the best design that could be adopted for the Learn Smart system. The previous phases were successful in their mission of fostering the understanding of the situation at stake and coming up with the most appropriate design for the system. The implementation phase is primarily based on putting into effect the appropriate changes into the real-world environment through the use of the new system. Hardcastle (2011) describes this phase as a phase which is mainly into the practical issues inclusive of the infrastructural assurance, that is, putting into place the system's hardware and networking every component of the system. It also involves the testing of the system and equipping the different users involved in the system's operations with enough understanding of the system. This chapter will therefore, be documenting the implementation phase's activities which involves **coding** which is the writing of the lines of codes for the system, **testing** which involves the identification of areas that need changes and errors and then redress them, system's **installation** in its operating environment, issues to do with the system's maintenance and the disposition that is recommendation for future or further system development. Basically, this phase adopts the final stages of the traditional System Development Life Cycle (SDLC).

5.2 Coding

Commonly referred to by many as the programming phase, the coding stage is the beginning of the implementation phase. Milner (2010), summarises coding as a practice of writing, debugging, testing and preserving the system's code. Coding is not only about writing the lines of code, but it also involves making use of the best suitable programming language to come up with an efficient and error-free executable modules/programmes. The Learn Smart System coding was primarily done in the Visual Basic .Net Language with an aim to simplify thing as much as possible at the same time meeting the intended objectives. In addition to the select programming language, to meet some of the system's objective an integration to some libraries and SDKs was also done. The system was intended and built to run on an MySQL database which is one of the standardised open source database management system. Including the entire code for the full system including all its modules would technically mean that this documentation was to increase in size by at least half its size, so this documentation only includes a simplified and summarised version in form of a pseudo code and part of the code will also be included in the appendix as an attachment.

5.3 Testing

As identified by Scheibmeir and Herschmann (2018), the gateway to a reliable software development is an early error discovery and the ability to device a remedy for the error. Testing is therefore cantered around verification of the system's ability to seamlessly satisfy set objectives in terms of its performance, characteristics and abilities, enabling a side by side comparison of the system and its intended requirements. To ensure a successful testing process of the system it was through an intense process that was carried out.

5.3.1 Test Strategies

As a way to ensure the minimum level of performance intended for this system a number of testing strategies were utilised focusing more on the output of each module independently and the final integrated system as a whole. Code reviews, syntax error, logical error identification and many other testing strategies were implemented as a way to meet our requirements. For a successful testing process, we adopted the IEEE standards suggestion to view the testing as an iterating process. The below diagram summarises the way the testing process was carried out.

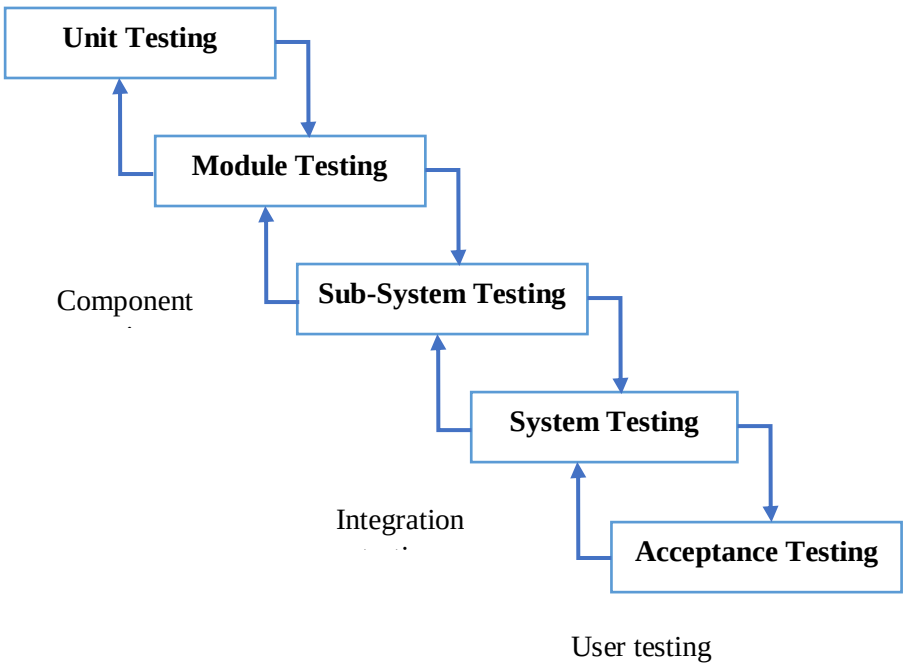


Fig 5.1 System Testing Process

5.3.1.1 Unit Testing

The unit testing stage involved the scrutinising the system's smallest components individually and independently. Kucharski (2011), proposed two scenarios which were adopted in carrying out this type of testing as shown below.

Fig 5.2 Black Box Testing

According to Chandra (2010), the black-box testing involves the testing of the system without directly knowing the internal structure/design of the module being tested. By utilising this type of testing, incorrect or missing functions, interface errors, data structure and external database access errors, initialisation error and performance errors were some of the errors identified.
The other level of testing that was also utilised at this particular stage was the white-box testing. Unlike the black-box testing, in this particular testing strategy the internal structure/design of the unit being tested was well known, so basically helped in identifying the consistence and the inconsistences of the system. There were inputs chosen with appropriate output in order to test if the system was working as intended and even in the absents of the appropriate interface this process commenced.

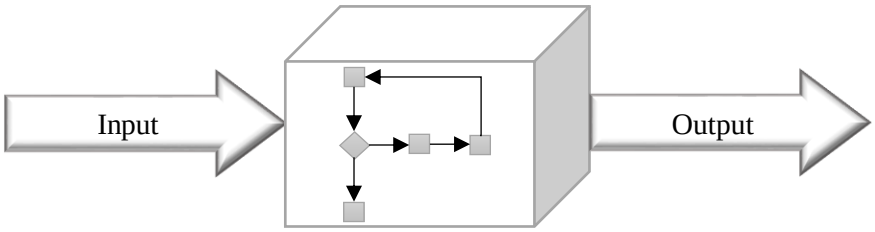


Fig 5.3 White Box Testing

With the help of white-box testing strategy a lot of referenced libraries and SDKs that were not properly configured were identified, as error that were reviewed during testing could help with some additional information about the error then show directly where there was neeed for alterations. The below figure shows one of the errors that was resolved at this particular stage with the help of the white-box testing.

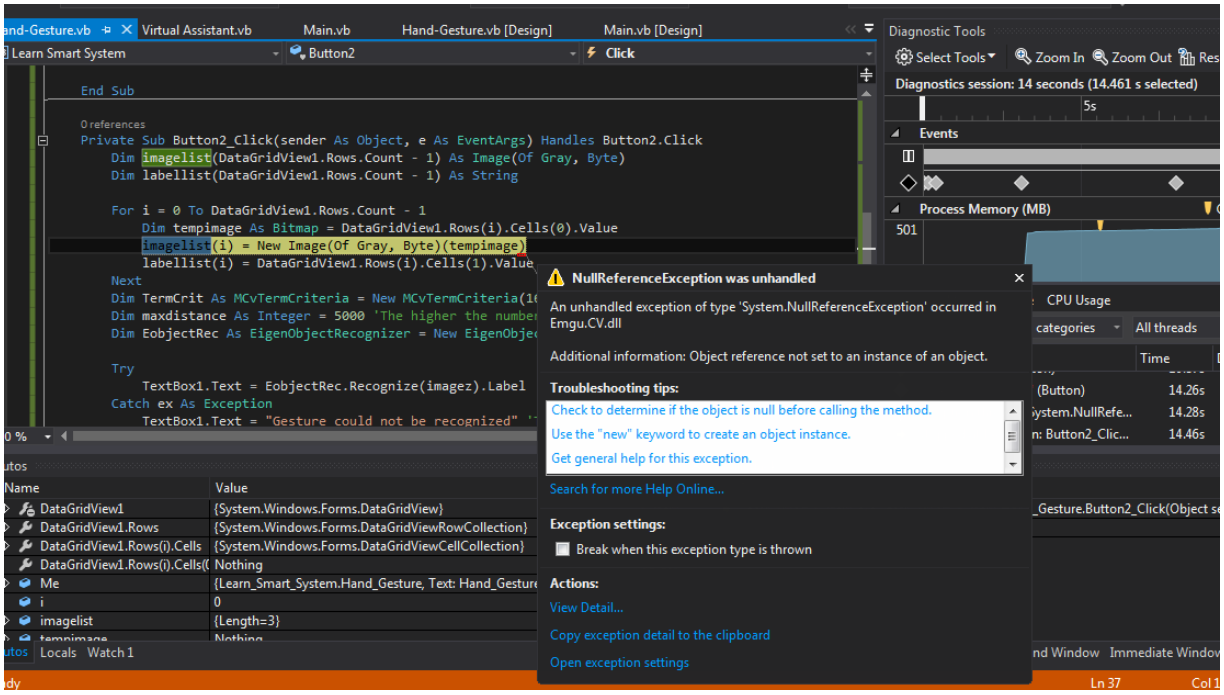


Fig 5.4 Error Reviewed by a White-Box Test

5.3.1.2 Module Testing

Another strategy proposed by Huang (2012) was also adopted whereby separate system's units/components were combined according to similarity and functions in the system to form the system's modules. Although this involved both black-box and white-box testing, the tests that were carried out in this phase were more of the white-box and parallel testing was done to the modules, that is, the modules were tested simultaneously for convenience's sake. Smaller chunks errors were successfully identified and despite the test's complexity it was easily manageable. The system was tested for its ability to link with the libraries it is supposed to communicate with and also database connection was tested to see if it was successfully updating data and accessing it as intended. This was repeatedly carried out until satisfactory outcomes were abstained.

At this level of testing the best image rendering quality that would enable a better hand-gesture recognition was identified. Experiments were conducted using the Aforge Image Filters and other image filters to identify the one that would yield better outcome. Below is a figure showing the hand-gesture recognition training module with the image quality identified for better image processing.

Fig 5.5 Hand-Gesture Recognition Module

The other thing that was identified was that the image was better recognised when the specified level of similarity for image comparison was high within the code.

5.3.1.3 Sub-System Testing

The sub-system testing is usually done as a practical way to keep complexity and scope at a manageable level. Marquet (2010) says that testing at this level is done as a way to assess the system's compliance to requirements specified when then the system is still semi-complete. It utilises more of black-box testing since at this level less review of the system code and less expert knowledge is applied. Like any other integration testing it must be able to detect any inconsistences that may occur from integrating system's components. Many inconsistences were identified at this

stage and measures were taken as a way to mitigate the identified inconsistences.

5.3.1.4 System Testing

This level of testing, the methods utilised were more or less likely to the sub-system testing's except that this was now conducted on the integrated system and most of the tests were conducted in the system's operating environment. Guided by the IEEE systems testing guidelines; volume tests, stress tests, performance tests, security tests, procedure tests, among other, were carried out on the integrated system to identify need for any alterations. There were however, some modules that were unable to instantly adapt to the integration and some

adjustments were done to make the integration possible. As this was the first 'end-to-end' test to be conducted, the application and need for validation and verification was identified stage.

5.3.1.5 Acceptance Testing

As alluded by Houser (2011), acceptance testing marks the end of the testing process at the same time paving way to system's acceptance for the operational use. At this stage, the system was given to some potential users to get their view and criticism on what may enhance the system in the eye of the user. The level of engagement that was fostered by this testing process was able raise flags on the areas that were left out to enhance the system and to allow for some final fine tuning of the final system. This testing strategy proved to be of greater importance as it was able to review also some of the errors and omissions that no other test was able to review. One of the areas that the acceptance testing was able to contribute on was on the process of coming up with the appropriate interfaces as contributions made by different individuals were put into consideration and below was part of the result arrived at.

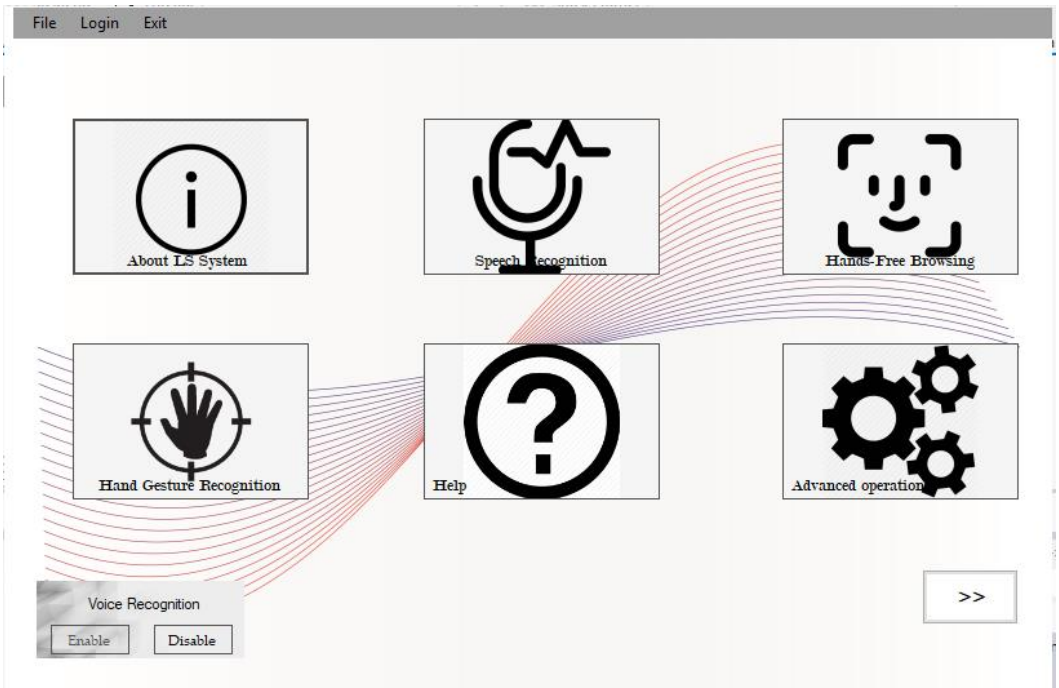


Fig 5.6 The Main Menu Interface

As part of the acceptance testing two separate types of testing were particularly carried out and this stage and the process is described below.

5.3.1.5.1 Alpha Testing

At this particular stage, the system was given to different individual that were aware of the development, particularly not the disabled. These individuals did some test runs of the system to verify on the meeting of requirement that were initially proposed and on the system performance.

5.3.1.5.2 Beta Testing (Field Testing)

At this stage, a real-world operation environment was simulated and some individuals with disability were introduced to the environment. The test was of great importance as some of the areas that were over looked were pin-pointed and need of certain adjustments was reviewed.

5.3.1.6 Validation

This strategy was utilised to evaluate the system's operation looking at various aspects of the system particularly looking at how it handles data it is presented with. The guidelines that were used to support this strategy were primarily adapted from the International Council on Systems Engineering (INCOSE)'s handbook. The process involved the making the import text-fields to only allow specified characters rejecting any other inputs that does not tally with the requirements, for instance, letting the text field for ID numbers to only accept numerical inputs at button press event and alpha-numeric characters for password. This was also utilised on the voice recognition process, where the only keyword in the system could be identified and processed leaving all the other parts. The goal was to at the end deploy a system that was highly validated as a way to minimise or eliminate errors.

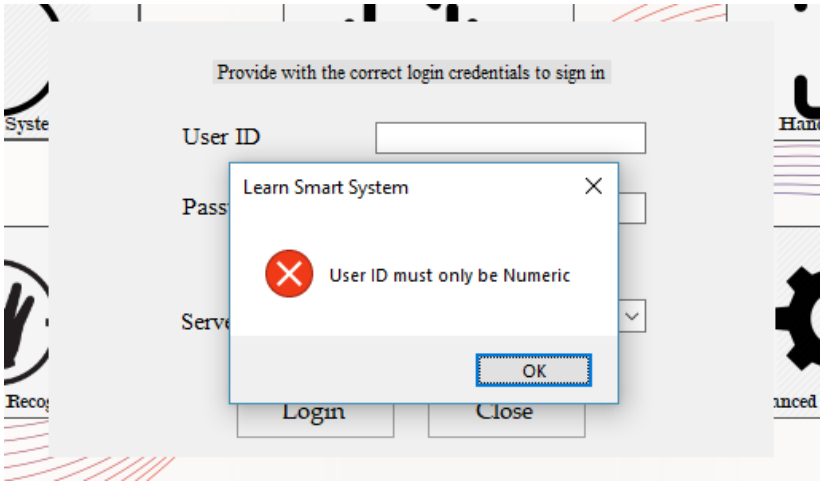


Fig 5.7 Validated User Id Field

5.3.1.7 Verification

The guidelines from the INCOSE's handbook were also utilised in the verification process to confirm the conformity of the system to the business requirements at the same time to utilising the proper methodologies and specifications for the system development. This was able to test for the system's adherence to the design specifications mainly focusing set specifications. The system maybe fully functional but in the wrong direction not meeting the user requirements, this process was targeting to eliminate this kind of a risk. The process involved inputting data with already known output into the system to see if the proper results were being produced by the system. This was able to test the system for error, faults (also known as bugs) and failures up to until satisfactory results were produced. These tests were not only applied to final integrated system, but also to the individual modules of the system.

5.3.1.8 System Security Testing

This stage enabled the successful implementation of the security design that was produced in the preceding phase. Since this system will be dealing with confidential information of individuals there was need for the implementation of proper security measures. The produced application software was tested to see if it meets the minimum satisfactory physical, networking and software standards. Many security measures were put in place and identified as crucial in any environment the system will be used, and these were inclusive of physical access restrictions, password use, data encryption and decryption, the use of firewalls and antiviruses among others. The other security level that was implemented was on the server side, the system minimum server requirements specifies a none GUI (graphical user interface) to restrict access for the none experts and also it was seen to be crucial for the databases to be password secured and backed up frequently as part of system's operational environment security requirements.

5.3.1.9 Destruction, disruption and disasters Control measures

Virus Prevention- It is one of the requirements for every computer that will be utilised for this system to at least have an anti-virus package installed as preventive measure for any computer virus attack. The previous chapters highlighted the recommended packages for this system.

Sever security- In addition to the above security measures for the server mention above the other requirement for the servers of the system is a professionally regulated server room.

Memory management- It is also a recommendation for the computers that the system will be operating on, to have memory optimisation and utility tools to improve and maintain the system

performance. The system administrator will also be expected to manage the server's memory by trying to satisfy the memory extension and creation needs at a particular point of time.

Disaster control- Though the system's operating infrastructure is expected to be sound, backups for the system are expect at least once a week for support in the case of the unexpected events.

Power-cuts management- A power back device specified is expected to be always in place to prevent damages to the server and to allow for updates to be complete processed in the case of a power cut. All devices in the system are also expected to be powered through a surge protector in case of an electrical surge.

Error minimisation- many validation strategies are in place for the system to minimise the error likely to occur during operation.

5.3.1.9 Software security

The system's users are regulated in their access according to their access levels. An ordinary user has full access to all the system modules but have no privileges to anyhow manipulate the system. An administrator is the only one granted administrative privileges that allow for the placement of the conditions that the system uses to make decisions. The administrative privileges also are attached to a unique Identity number that may be used to also track the administrator's activities. The other level of security that was identified to be effective the enhancement of the system's security was the encryption and decryption of the confidential user information like passwords. Below is a part of the user database table showing the encrypted password that any who would get access to the system's database will see.

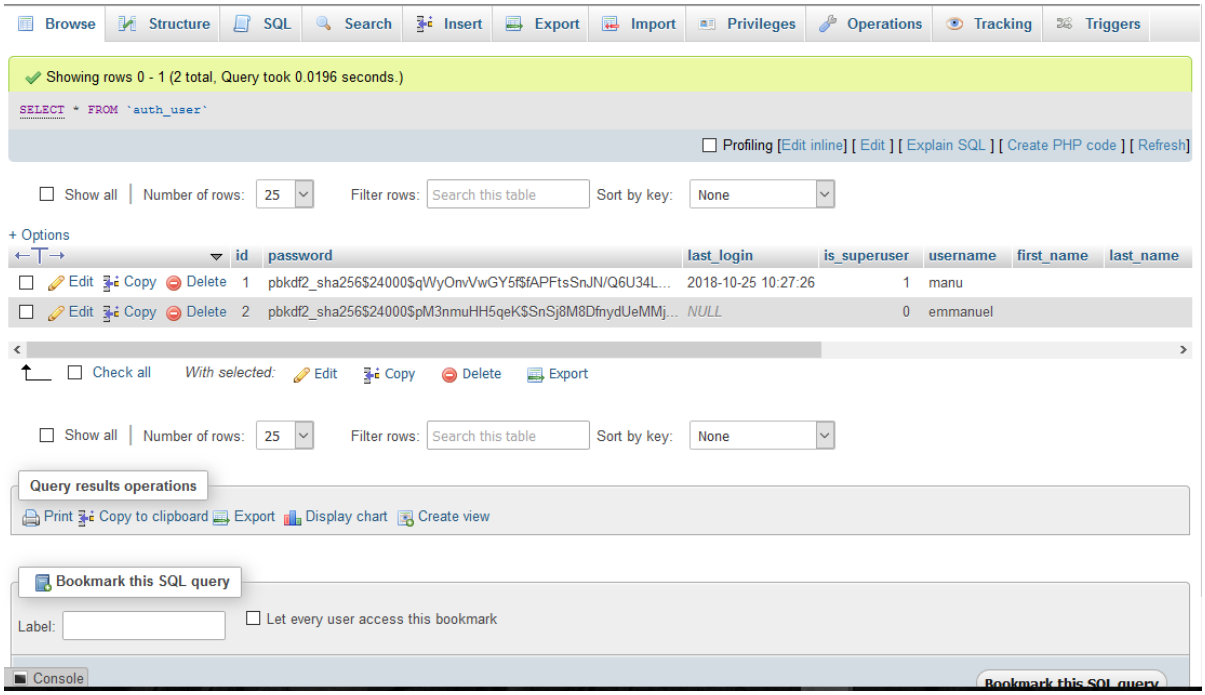


Fig 5.8 User Database Table with Encrypted Password

5.4 Installation

The installation stage can be best described as a system implementation level where the actual final product, which is the software application, is made ready for its final purpose and being tested and being approved of its purpose. For this system, this stage might not actually describe an event that was already done since this project was not primarily based on a specific organisation, but it will give the installation guideline and requirements for its potential operational environment. To begin with, in every installation of this system it is important to realise that the operation of the system require at least the hardware components specified in the early chapters for the system to operate as required. This stage will describe and document the user training required, file conversion, system changeover strategies or methodologies that can be adopted and the recommendations. This is intended to fully equip the organisations to adopt this system.

5.4.1 User Training

For an effective implementation of the Learn Smart System there is need for a quick implementation training plan for the targeted users of the system particularly for the system administrators and those who will be providing assistance to the disabled individuals. One of the basic requirement for the Learn Smart System was to be much simplified as possible for its users which makes it to require less to none of the training to at least use the system. The

training for the administrators and the assistance providers will require few days to make the training process more interesting but can be conducted in a single day. The training must have a two-way form of communication to be sure that all the areas are clarified regarding the system and open up for the contributions to make the system better. In addition to the training a summarised user-guide or a user manual will be provided as a point of reference during the system's operation. This user manual will be a useful tool to all users of the system.

The standard schedule for the training process is supposed to fit within four working days and it can be done in parallel to other processes involved in the installation stage. Below is a quick summarised schedule for the training process.

DAYS				
ACTIVITY	1	2	3	4
	Meeting with staff to be trained.	Orientation	System functionality and operations explanation.	Hands-on system review and training
		Tips on using the user manual	Hands-on system review and training	Questions and training summarisation

Table 5.1 User Training Schedule

5.4.2 Operational Environment

The system environment's impact must never be under estimated as it directly affects the overall performance of the system. To test the environment actual data must be used to see if there are any changes required and the changes must be verified to obtain the user approval. Also, the components that might have an impact on the system's operations must be examined independently to come up to a conclusion that the environment is conducive and convenient for the system. The basic components that makes up the system's operation environment that must examined includes:

- Network resource
- Hardware
- Software configuration
- Utilities
- Application software packages
- Operating systems

5.4.3 File conversion

It has to be determined if there is any need for the conversion of the files of the existing systems in the cases where the system need to be integrated with the organisational systems. The conversion must follow the training process, just soon after the system's environment is successfully tested and proven to be an appropriate environment for the establishment of the Learn Smart System. The file conversion can be best implemented outside of working hour so

that the normal operations may not be affected.

5.4.4 System Changeover

The system is designed as a supporting tool to the already existing systems, but in the case that this system is to be implemented to substitute the already existing supporting tool with the functionalities at the same level with the system, some techniques have to be consider to successfully implement the system. The changeover process is basically concerned with retiring the old system and putting the new system in place. There are four basic techniques or approaches that can be considered for this particular system and they can be adopted as given below.

Direct Changeover – this practically means totally stopping the old system and then introduce the new system to immediately replace the old one. Though this is a quicker way of transition but it is very important to utilise it in a situation with calculated risks and below are some of the advantages and disadvantages associated with the direct changeover strategy.

Advantages

- Minimises the operational costs associated with both the systems
- Data duplications are also minimised

Disadvantages

- Risk of data loss in the case when an error occur that was not identified during the testing process
- Works best of a system with planning and testing processes which are done to perfection.
- A firm is not able to revert to the previous system as the alternative/backup.

Parallel Conversion- the other available option is allowing both the old and the new system to run in parallel for some time until the new system proves to full satisfying the requirements. This a play safe kind of approach and below are the advantages and dis advantages that were identified being associated with this type of approach.

Advantages

- The risk is minimised due to the backup characteristic of this approach.
- If any need for alterations arise the system can be safely altered without affecting the old system

Disadvantages

- Associated with high costs of running both systems at the same time as a result of double resource consumption.

- It promotes data duplication
- This may increase the work-load and errors as the user is required to use both systems simultaneously

Pilot Operation- the other useful strategy involves fully implementing the new system on one part of the organisation, known as a pilot, will the rest of the organisation continue to use the old one until results being produced by the system proves to be satisfactory. The advantages and disadvantages associated with the strategy includes:

Advantages

- The pilot site can be utilised as a training site
- Minimized risk of failure
- Relatively lower costs are incurred only at the experimental site

Disadvantages

- The test site may be affected or influenced by different circumstances as for the other parts of the organisation

Phased Changeover- this strategy requires the system to be implemented in modules part -by-part phasing out the old system little by little and below are the advantages and disadvantages it comes with.

Advantages

- As the system is implemented as modules, moderate costs are incurred
- Risks will only be associated with specific modules

Disadvantages

- Its only applicable to systems that can be sub-divided into modules

5.4.5 Justification

An of the above strategies can be chosen for this system's implementation in the case that there is a similar system already running but the parallel conversion strategy is the one strongly recommended for this particular system. The criteria for choosing that parallel as the best for this system was primarily based on:

- Backup is available in the form of the old system, minimising the risk.
- Provides verification standard for the new system in the form of the old system
- Provide ample time for the users to familiarise with the new system.

5.5 Maintenance

Maintenance is a process that includes monitoring, evaluating and modifying operations of an information system to make necessary improvements with relation to the changes in the system's operational environment. According to the IEEE standards the need for maintenance is simply triggered by the business environment, operations and situation changes. The level of training require for this system is aimed at also equipping the user with some level of maintenance skill and the ability to make the system keep on operational. During the initial implementation of the system, it may be fully operational but the case may be different in the long-run. Also, some level of code updates is required frequently in accordance to the technological and end-user's requirements changes. The process is supposed to continuously carried out throughout the system's existence and behind this level of maintenance there is a team responsible. The maintenance will be delivered in two ways given below.

Structured Maintenance- a request form will be utilised and every time it is submitted it is analysed and plans to consider for a new release are put into place if necessary. The release planning will be involving elements of perfective, corrective and adaptive maintenance.

Unstructured Maintenance- whenever the system needs a quick repair for the continuous operation, this will be applied. Users will request for a certain change or correction, then the system's code is analysed as per request and make necessary changes and the system is delivered when the request's details are met.

5.5.1 Types of Maintenance

Depending on the nature and size of the maintenance, it is delivered in different ways and for this particular system the below given types can be utilised.

Corrective Maintenance – system's updates and modifications will be done with an intension to correct and fix problems discovered by users or stated by the user-error report.

Adaptive Maintenance – as a way to keep the system up-to date and adaptive to the ever-changing environment in terms of technology, updating and modifications will be applied to the system.

Perfective Maintenance – whenever there is need for new features to be added to the system and changes in the user requirements updates and modifications will be done as a way to make

the software relevant over a long time-period and to refine the system and improve its performance and reliability.

Preventive Maintenance - also modifications and updates that are future oriented will be done as a way to sustain the system's future relevance.

5.5.2 Recommendations on maintenance

Maintenance was considered a necessity for the purpose of a sustainable quality software delivery. To minimise on the on the operational costs for the organisation adopting this system some of the trained user are equipped to deliver some basic maintenance but in the case where maintenance that may include the code manipulations and other exceptional changes, there will be a team waiting to attend to those situations. Also, depending on the situation different types of maintenance can be adopted to deliver the rightful form of alteration required.

5.5.3 System Reviews

Frequent system reviews will be continuously done as a way to assure the objectives are continuously met. The system users will be doing some audits to identify error, if any, that needs to be corrected, as part of reviews. The idea is to verify if objectives are being continuously met and if there are no longer being met, the reason must be identified and rectified as soon as possible to deal with the shortfalls. The reviews also verify on the system's maintainability and flexibility and checks on the whether the users are still using the system in a correct manner.

5.5.4 System Back-up Services

The system is supposed to be running along with a server supporting the required back-up requirements. Some additional external back-up services may be required in the case of the server failure. In addition, the system will be generating reports that can be printed out or saved on local machine, these reports can also stand as part of the secondary back-up system. Since this system is not that much of a data oriented system these few back-up plans are expected to be good enough for the system's operation.

5.5.5 User Manual

A document that will be carrying some quick information on how the system operates and ought to be operated will be provided along with the system. This can be utilised as quick review tool for the users and to boost user confidence when using the system by providing a point of reference. This can also aid the training process by allowing users to see illustrations

of the concepts. This document also comes with the user manual attached in the appendix.

5.6 Recommendations for future/further development

Basing on the entire intense process and all its gatherings it guaranteed the success of the system's implementation at the same time approving the system as of good quality. The recommendation that I can now give is for the system to be introduced to the market for its intended users. In every area and environment that the system will be implemented the guidelines provided by this particular documentation must be religiously adhered to and the user manual must be also followed with respect. For any procedural operations of the system steps involved must be adhere to without any by-pass of a single step. The tests that were carried out proved the system as a secure system, any violation of the security procedures will be having associated consequences and this system is also regulated by the IT Policies of the organisations that will adopt this system. Continuous audits must be done to be sure that the system serves its intended purpose. I strong recommend a proper maintenance process that of endless during the system life until the speculated life expectance is reached. This system can also be utilised as a standard for the future development of similar systems and for further researches in the same area.

5.7 Conclusion

The project has been successfully conducted with adherence to the system development requirements and standard to assure the delivery of a quality system. Most of the information relating to the system and project is documented in this document and some additional information will available attached to the document. Any special information can be provided on request when the request is communicated with the development team.

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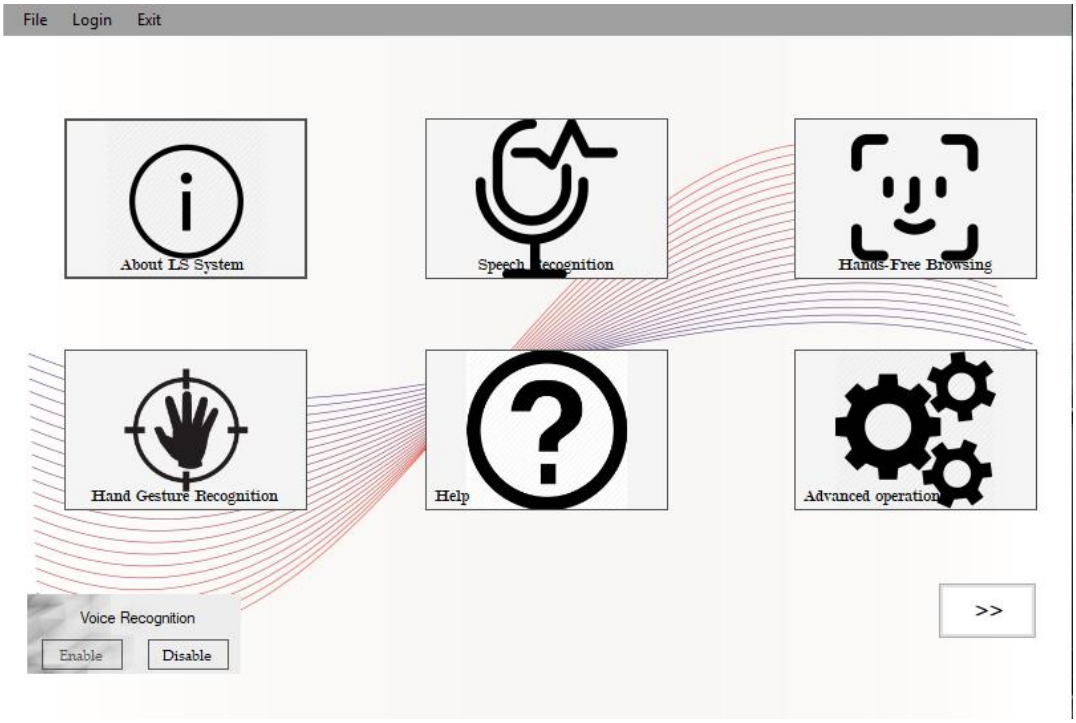
APPENDICES
APPENDIX A USERS MANUAL

Main Menu



Step 1

If the user disability does not require voice recognition to be active, it must be disabled on the main menu.

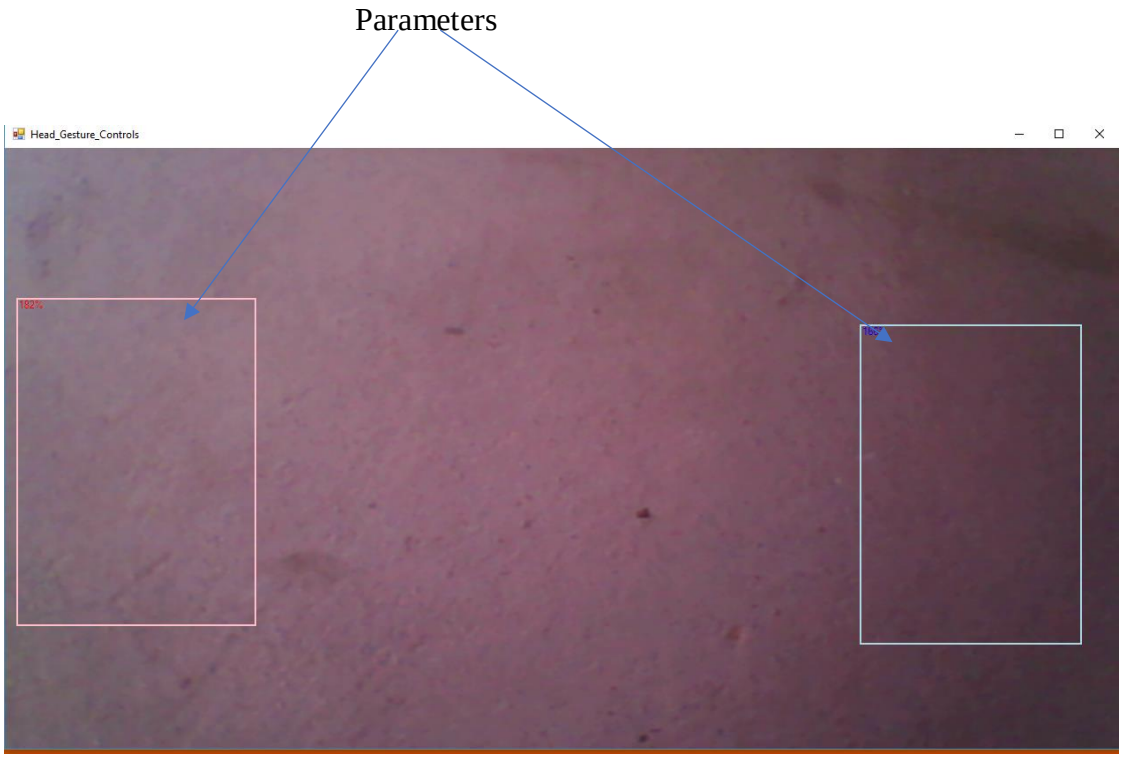
Step 2

On the main menu select the function needed or use a voice command to select the option.

For more options click on the right arrow below or user a voice command ‘More’ to get the controls.

Hands-Free Function

For the touchless function, the parameters for heard gesture recognition must be set by the system’s assistant.

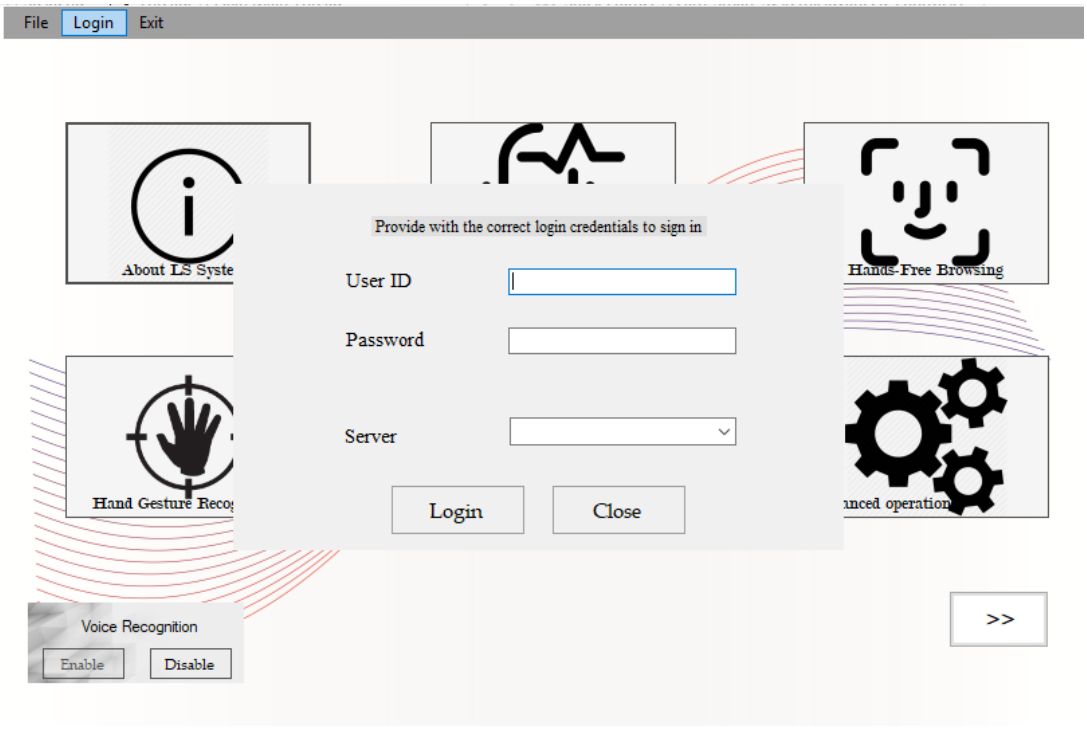


Once the parameters are set, the user can now user the visual assistant to browse through file.

Hand-Gesture Recognition

For this function make sure that the gesture is within the frame.

Advanced Controls



This requires the user to login as an administrator. It allows for the system's training.

APPENDIX B: INTERVIEW CHECKLIST

Section 1

Name of interviewer……

Interviewee Disability……

Section 2: Questions

1.Briefly tell us more about your disabilities.

2.Can you briefly describe the process you use to communicate and access the information systems that you are using, how does it work and what processes involved?

3. Is it really working well and meeting your needs according to your disability?

4. What problems are you facing with your disability?

5. Which most important areas do you think should be addressed? And are there any additional information system needs that you require?

6. So if the mentioned areas are improved, do you think your business operations will improve because of the information system?

7. In order to satisfy your educational needs, what do you think should be done to the available systems?

APPENDIX C: QUESTIONNAIRE

QUESTIONNAIRES

MAY YOU KINDLY ANSWER THE FOLLOWING QUESTIONS GIVING YOUR HONEST OPINIONS

1. HOW DO YOU RATE THE CURRENTLY AVAILABLE INFORMATION SYSTEMS ON THE MARKET?

EXCELLENT ☐ GOOD ☐ FAIR ☐ POOR ☐

2. ARE YOU PLEASED WITH YOUR CURRENT INFORMATION SYSTEM AND IS IT MAKING YOUR WORK EASY? YES ☐ NO ☐

IF NO, WHY? ……

……

……

……

……

3. WHAT PROBLEMS ARE YOU FACING WITH THE CURRENT INFORMATION SYSTEMS AVAILABLE?

……

……

……

……

……

4. WHAT DO YOU THINK MUST BE DONE MUST BE DONE IN ORDER TO ADDRESS THESE PROBLEMS?

……

……

……

……

……

……

(Thank you for your cooperation)

APPENDIX D: OBSERVATION SCORE SHEET

Name of observant: ……

Name of observer: ……...

Date: _____ Time: _____

Focus of observation:

……

Brief description of processes:

…….

…….

……

Areas of strength:

……..

……..

……

Areas of development:

……

……

……

Signed:…… **Date:……**

Signed:…… **Date:…….**

APPENDIX B: CODE SNIPPERTS

```
Imports Emgu.CV
Imports Emgu.Util
Imports Emgu.CV.Util
Imports Emgu.CV.Structure

Public Class Advanced_controls
    Dim capturez As Capture = New Capture
    Dim imagez As Image(Of Gray, Byte)

    Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Timer1.Tick
        imagez = capturez.RetrieveGrayFrame
        imagez._EqualizeHist() 'Makes for closer comparisons
        PictureBox1.Image = imagez.ToBitmap
    End Sub
    Private Sub Button5_Click(sender As Object, e As EventArgs) Handles Button5.Click
        'Datagridview has 2 columns, the first is an image column, the second is a
text column.
        'The first image column has a imagelayout of stretch.
        DataGridView1.Rows.Add()
        DataGridView1.Rows(DataGridView1.Rows.Count - 1).Cells(0).Value =
imagez.ToBitmap
        DataGridView1.Rows(DataGridView1.Rows.Count - 1).Height =
DataGridView1.Columns(0).Width * 0.75
        'Putting a 0.75 * width for the height keeps it at 4:3 aspect ratio, so it
looks normal.
        DataGridView1.Rows(DataGridView1.Rows.Count - 1).Cells(1).Value =
txtgesturemn.Text '"Image" & DataGridView1.Rows.Count - 1

    End Sub

    Private Sub Advanced_controls_Load(sender As Object, e As EventArgs) Handles
MyBase.Load
        DataGridView1.AutoSizeColumnsMode = DataGridViewAutoSizeColumnsMode.Fill
        DataGridView1.RowTemplate.Height = 81
        DataGridView1.AllowUserToAddRows = False
        Timer1.Enabled = True
    End Sub

    Private Sub Button4_Click(sender As Object, e As EventArgs) Handles Button4.Click
        Dim imagelist(DataGridView1.Rows.Count - 1) As Image(Of Gray, Byte)
        Dim labellist(DataGridView1.Rows.Count - 1) As String


        Try

            For i = 0 To DataGridView1.Rows.Count - 1
                Dim tempimage As Bitmap = DataGridView1.Rows(i).Cells(0).Value


                imagelist(i) = New Image(Of Gray, Byte)(tempimage)
                labellist(i) = DataGridView1.Rows(i).Cells(1).Value
            Next
        Catch ex As Exception
            MessageBox.Show(ex.Message)

        End Try

        Dim TermCrit As MCvTermCriteria = New MCvTermCriteria(16, 0.001)
```

```
        Dim maxdistance As Integer = 5000 'The higher the number, the difference is
allowed
        Dim EobjectRec As EigenObjectRecognizer = New EigenObjectRecognizer(imagelist,
labellist, maxdistance, TermCrit)

        Try
            TextBox1.Text = EobjectRec.Recognize(imagez).Label
        Catch ex As Exception
            TextBox1.Text = "Gesture could not be recognized" 'This means nothing was
close enough for a good match
        End Try

    End Sub

    Private Sub Button3_Click(sender As Object, e As EventArgs) Handles Button3.Click
        DataGridView1.Rows.Clear()
    End Sub

    Private Sub Panel1_Paint(sender As Object, e As PaintEventArgs) Handles
Panel1.Paint

    End Sub
End Class
```