

Heaven's Light is Our Guide

# **Rajshahi University of Engineering and Technology**

Department of Computer Science & Engineering



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**Title: Information system analysis and design of 'Automatic Attendance System' project of Leadsas Limited**

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# Chapter 1

## Introduction

### 1.1 Introduction to The Company

The company we are analysing the system of is Leadsas Limited. Leadsas is the first one-stop educational service provider of Bangladesh, which was established on October 15th, 2015 by Mr. Sadik Al Sarker.

### 1.2 Vision

Leadsas has already provided digital solutions to more than 30 national and international educational institutions. Leadsas is working with the vision of bringing every educational institution of our country into a single digital network and expand their service all over Asia and further around the world.



Fig 1.1: Logo of Leadsas Limited

### 1.3 Mission

Leadsas is the pioneer of digitalising the education system of Bangladesh. They provide digital solutions to the existing traditional education and educational management system of our

country. Their mission is to bring the educational institutions under the umbrella of advanced technological solutions.

## 1.4 Products and Services

Leadsas provides various digital solutions for the educational Institutions of Bangladesh and abroad. Their products consist of both software and hardware parts. Leadsas is also working with a view to creating a digital online platform for all the students of Bangladesh where they can share knowledge, ideas and resources. Some of their products and services are:

- Smart ID Card
- Automated Attendance System
- Advanced Multimedia Equipment
- Surveillance Cameras
- Educational Management Software etc.

Leadsas is always working hard to improve the quality of their products and make their services more versatile. They also provide maintenance service of software and database to their clients.

## 1.5 Management Hierarchy

There are more than 50 employees working for Leadsas limited now. The management hierarchy is as follows:

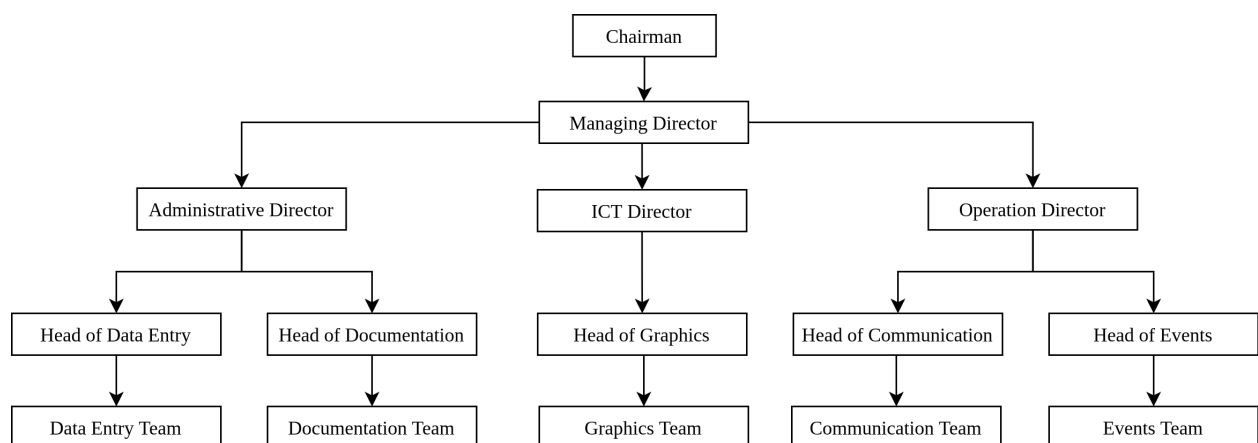


Fig 1.2: Employee hierarchy of Leadsas.

The number of employees of Leadsas has increased a lot over the years. The pandemic situation has allowed the company to utilise the best of online communication system. Leadsas is currently implementing work from home policy. Thus, they can hire employees from anywhere in Bangladesh.

### **1.5.1 The Management Team**

Here is a brief introduction to the members of the management team of Leadsas:

- Nuruzzaman Sarker, Chairman
- Sadik Al Sarker, Managing Director
- Shamima Easmin Munia, Administrative Director
- Fahim Sarker, ICT Director
- MD Golam Morshed, Operation Director
- Jannatul Ferdous Aysha, Head of Data Entry
- Sipan Gain, Head of Graphics Design
- Nazia Tabassum, Head of Communication
- Nazmus Sakib, Head of Documentation
- Asha Dev Api, Head of Events

Also, there are the Head of Marketing, Clients Service Manager, Photography, Videography and Editing Team. Most of the employees are working remotely in the pandemic. There are different management teams and groups of employees for the sister concerns of Leadsas Limited.

## **1.6 Sister Concerns of Leadsas Limited**

Leadsas Limited has been operating with some of its sister concerns with the same kind of growth and reputation.

### **1.6.1 EMS Pro**

Sister concern of Leadsas Limited specialised for developing Education Management Software.

### **1.6.2 ProDoc**

Digital service agency for all types of legal documents.

### **1.6.3 SASFly**

An international travel agency.

### **1.6.4 Action For Campus**

Digital Networking Platform for connecting the university campuses of Asia. The goal of this organisation is to create a digital platform where students of all the Asian universities can interact, share and discuss innovations and enhance their skills through various exclusive events and projects.

## **1.7 Awards and Achievements**

Over the years Leadsas Limited have been awarded numerous awards in the National and International arena. They have also been featured in National Daily very frequently. Some of their notable awards and achievements are listed here.

### **1.7.1 Education Watch Award, 2018**

Leadsas Limited achieved the Education Watch Award in 2018 for having remarkable influence in the education sector of Bangladesh. Famous university based magazine Education Watch arranged the award giving ceremony on May 6, 2018. Founder and Managing Director of Leadsas Limited Mr. Sadik Al Sarker received the award from Dr. Md. Akhtarzzaman, the honourable vice chancellor of Dhaka University.

### **1.7.2 The White Heart Award, 2018**

Leadsas Limited won the White Heart Award for contributing in the field of digitalisation on July 3, 2018. This award giving ceremony was organised by SADf and supported by the department of Narcotics Control and ministry of home affairs of Bangladesh.

## **1.8 Partnerships and Sponsorships**

Leadsas Limited is the logistics partner of Global Entrepreneurship Bootcamp(GEB) since 2018. GEB is the biggest summit of entrepreneurs of Asia and one of the biggest in the world which takes place in different countries of Asia each year. Leadsas has also been crest and logistics sponsor of more than Hult Prize on Campus events of more than five universities including RUET for three years. The company has also sponsored many more local educational and entrepreneurship events in Bangladesh.

## **1.9 Conclusion**

Leadsas limited is a leading organization working relentlessly to digitalize the education sector of Bangladesh. We are grateful to be able to analysis the system and process of such an impactful company. We hope to have a great analysis and report for this project.

# Chapter 2

## Problems Statement

### 2.1 Introduction

As per the aim of Leadsas Limited to digitize educational institutions, they have been running numerous projects over the years to fulfill their aim. After their launch in 2015, along with all their accomplishments, they have faced a lot of problems along with their journey. We have interviewed Sadik Al Sarker, the Managing Director of the company, to know details about their journey and troublesome issues they faced. It was great to have them on board and they have discussed freely about their shortcomings and difficulties they faced over those projects.

Our main concerning project is ‘Digital ID Card and Automatic Attendance System’. We have tried to analyze their issues and pointed out some of the main problems to analyze further and provide some hypothetical solution along with each problem. After analyzing in a greater depth in the future, we will reach to some conclusion that would overcome the shortcomings. We hope that our analysis of the problems may improve the system as a whole.

#### 2.1.1 Subject of Analysis

We have considered three schools for our case study, each with 700 students on average. The schools are —

- Bibi Marium Girls High School, Narayanganj
- K K Government High School, Munshiganj
- Mirhajirbag Adorsho High School, Dhaka

After collecting and analyzing the data, we have decided to work on the ‘Smart-ID card and Automatic Attendance System’ project of Bibi Marium Girls High School, Narayanganj.



## **2.2 Problem Identification**

At first, we pointed out some of the problems they faced in their project ‘Digital ID Card and Automatic Attendance System’ which concerns us the most as per the interview.

### **2.2.1 Problem with detailed contract and other paper works**

We have pointed out some of the problems regarding the detailed contract and paperwork of the project. There were some issues related to the contract which the company had faced later on and it caused them both time and money in the long run. Here are some of the problems we found:

- **No proper Memorandum of Understanding (MoU) was signed**

No MoU was signed with the client while the agreement about the project with the clients. Which caused the ignorance of a lot of details. It is very essential to sign detailed contracts concerning two or more bodies in an agreement. Otherwise, the whole project may fail or face a lot of difficulties at the time of implementation.

- **No Software and Privacy Policy were discussed**

There were no detailed Software and Privacy Policy discussed at the time of the agreement. As this project involves sensitive data of the institution and its students, a proper privacy policy is very crucial in this kind of project. Lack of proper policies led the company to some misunderstandings later on with the client organization.

### **2.2.2 Problem with cost calculation and estimating the future growth**

There are problems with proper cost calculation and estimation of future growth in this project too. The total cost of the project was miscalculated at first and the development team could not estimate the future growth and maintenance cost of the project properly, which caused loss to the company. Here are some of the problems regarding costing and future growth:

- **Hidden costs were not taken into account**

At the very first phase of the project, proper cost calculation was not done for all the aspects of this project. Some hidden costs were not considered and due to some misunderstanding for a not detailed and well-described contract caused time delay and economical loss for the company.

- **Wrong estimation of future growth**

Estimating the future problems was a plus for the startups which may save a fortune. But due to uncertainty in a developing country like ours and lack of intuition from the management, future growth prediction was done poorly which also led to some cumbersome processes. Overcoming these issues may serve the company well in the long run.

### **2.2.3 Problem with planning and data collection**

Proper planning collecting the data in a mannered way are two vital parts of a software project like this. The software development team did not do very well planning the overall timeline and structure of this project according to our analysis. Some issues had arisen while collecting and preprocessing the data of the students as well. Here are some of the problems related to planning and data collection:

- **Spelling error of the names**

First, they collected the students' names in Bangla only, and at the time of data entry to the system, they transliterated them to English which led to a lot of spelling mistakes. After some progression, these misspelled names were corrected again which causes a big waste of time and budget.

- **Improper proofreading**

There was no proper sampling in the first place and furthermore, no proofreading was done. Causing this kind of error may lead to dissatisfaction of the customer and affect the company's reputation badly.

## **2.3 Initial Feasibility Study**

In this section, we will analyze the feasibility of each problem we have discussed above. We will discuss the details of our findings and state our recommendations.

### **2.3.1 Feasibility study of detailed contract and other paper works**

Here we have the feasibility study of contract and paperworks. We have stated the statement, summery and details of the problem. Also recommended our solutions.

**Statement of the problem:** Problem with improper detailed contract and other paperworks of the software agreement.

**Summery of the findings:** No MoU and software privacy policy were discussed and signed with the client while the agreement about the project with the clients.

**Details of the findings:** Lack of MoU caused the ignorance of a lot of details of the contract. It is essential to sign detailed contracts concerning two or more bodies while an agreement. As this project involves data of the institution and its students, a proper privacy policy is also very crucial. Lack of proper policies led the company to some misunderstandings later on with the client organization.

**Recommendations and Conclusion:** Business development is essential for a startup like Leadsas Limited. Revolutionizing educational institutions is a huge task to do and because of their aim, they need to develop their business strategy properly. All the proper paperwork could be done in a well mannered way if they introduce a business development position in their company. In the company management hierarchy, this position is missing currently. A Business Developer works to improve an organization's market position and achieve financial growth. This person's job is to work with the internal team, marketing staff, and managers to increase sales opportunities and thereby maximize revenue for their organization.

### **2.3.2 Feasibility study of cost calculation and estimating the future growth**

Here we have the feasibility study of cost calculation and future growth. We have stated the statement, summery and details of the problem. Also recommended our solutions.

**Statement of the problem:** Problem with improper cost calculation and wrong estimation of future growth.

**Summery of the findings:** Cost of the project was calculated wrong and there was a wrong estimation of future growth of the project.

**Details of the findings:** Some hidden costs were not considered which caused misunderstandings and that caused time delay and economical loss for the company. Estimating the future problems was a must for the startups which may save a fortune. But future growth prediction was done poorly which also led to some cumbersome processes. Overcoming these issues may serve the company well in the long run.

**Recommendations and Conclusion:** Proper work distribution and management is a must for any successful project. It is also an important parameter of leadership of the management. We sense there was a misqueue in their work distribution which led the project to unorganized.

### **2.3.3 Feasibility study of planning and data collection**

Here we have the feasibility study of planning and data collection. We have stated the statement, summery and details of the problem. Also recommended our solutions.

**Statement of the problem:** Problem with data collection and proof reading.

**Summery of the findings:** Data was collected in a manual fashion and there were a lot of spelling error. No proper proofreading was done.

**Details of the findings:** They collected the students' names in Bangla only, and at the time of data entry to the system, they transliterated them to English which led to a lot of spelling mistakes. These misspelled names were corrected again which causes a big waste of time and budget. There was no proper sampling in the first place and furthermore, no proofreading was done.

**Recommendations and conclusion:** As per the growth of the company, human resource management is necessary. We propose to introduce one (more in the future) HR manager position for getting the work swiftly. Human resources managers plan, coordinate, and direct the administrative functions of an organization. They oversee the recruiting, interviewing, and hiring of new staff; consult with top executives on strategic planning; and serve as a link between an organization's management and its employees.

## **2.4 Conclusion**

In light of the above circumstances, we are positive that implementing our hypothetical solutions may help Leadsas Limited to overcome those problems and tackle the future challenges swiftly.

# Chapter 3

## Information Analysis

### 3.1 Introduction

In this chapter, we are going to visualize and analyse the information obtained from the company. We will try to visualize various aspects of the company and try to present the overview of the existing system with a Data Flow Diagram (Data Flow Diagram). We will also try to find out some problems of the system by analysing the Data Flow Diagram.

### 3.2 Overview of the Existing System

In this section we will overview the current system of the company. We will use some visualising tools to present some of the aspects of Leadsas. We are also going to create a Data Flow Diagram of the overall process of the automatic attendance system project.

#### 3.2.1 Information Visualisation

We are going to visualise and analyse the growth and different types of services of Leadsas over the years. We are also going to analyse how the pandemic situation has affected the company.

##### 3.2.1.1 Visualising Company's Growth Over Time

We can present the company's growth and impact by visualising it with a bar chart. It helps us understand how they increased the range of their service, the number of students benefited by digitalisation, how they increased the number of employees and how many educational institutions they have worked with over the years.

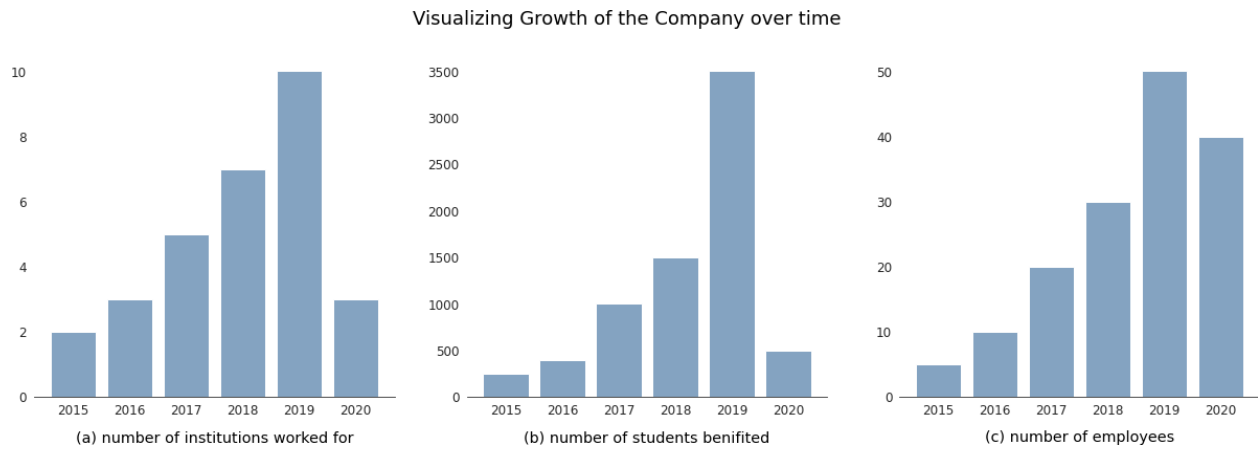


Fig 3.1: Growth of Leadsas over time.

As we can see, the number of institutions, benefited students and number of employees have grown very quickly over the years till 2019. But the Covid-19 pandemic has affected the education business of Bangladesh just like the rest of the world in 2020. And Leadsas is also affected by this. As a result, all the figures have dropped drastically in 2020.

### 3.2.1.2 Visualising The Services

We can present the company's services by plotting the total projects and their types in a Pie Chart. We can see which types of services are received most by the educational institutions of Bangladesh.

Leadsas has completed total 40 projects with 30 educational institutions of the country. These projects consist of automatic attendance system, smart ID card, multimedia equipment, education management software etc. They also provide surveillance camera, projectors, printers and such hardware.

Leadsas is thinking of expanding the versatility of their products and services. As the importance of digitalisation in education has increased even more due to the pandemic.

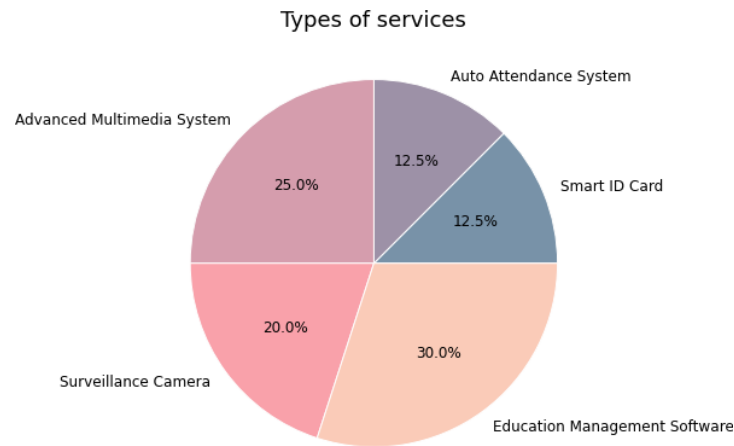


Fig 3.2: Pie chart of the services provided so far by leadsas.

As we can see, the most received services are education management software and surveillance camera. As more and more institutions are being digitalised, education management software are getting high demand these days.

So is the case with surveillance cameras. Security gets much stronger with the presence of proper surveillance which is a vital issue in any educational institution. We can see the least received services are smart ID card and auto attendance systems. Budget might be a reason for this. Leadsas is looking to find more efficient ways to create these systems so that more institutions can avail them.

### 3.2.2 Data Flow Diagram of Existing System

A data-flow diagram is a way of representing a flow of data through a process or a system. The Data Flow Diagram also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops. Here is a Data Flow Diagram of the Automatic Attendance System project of Leadsas:

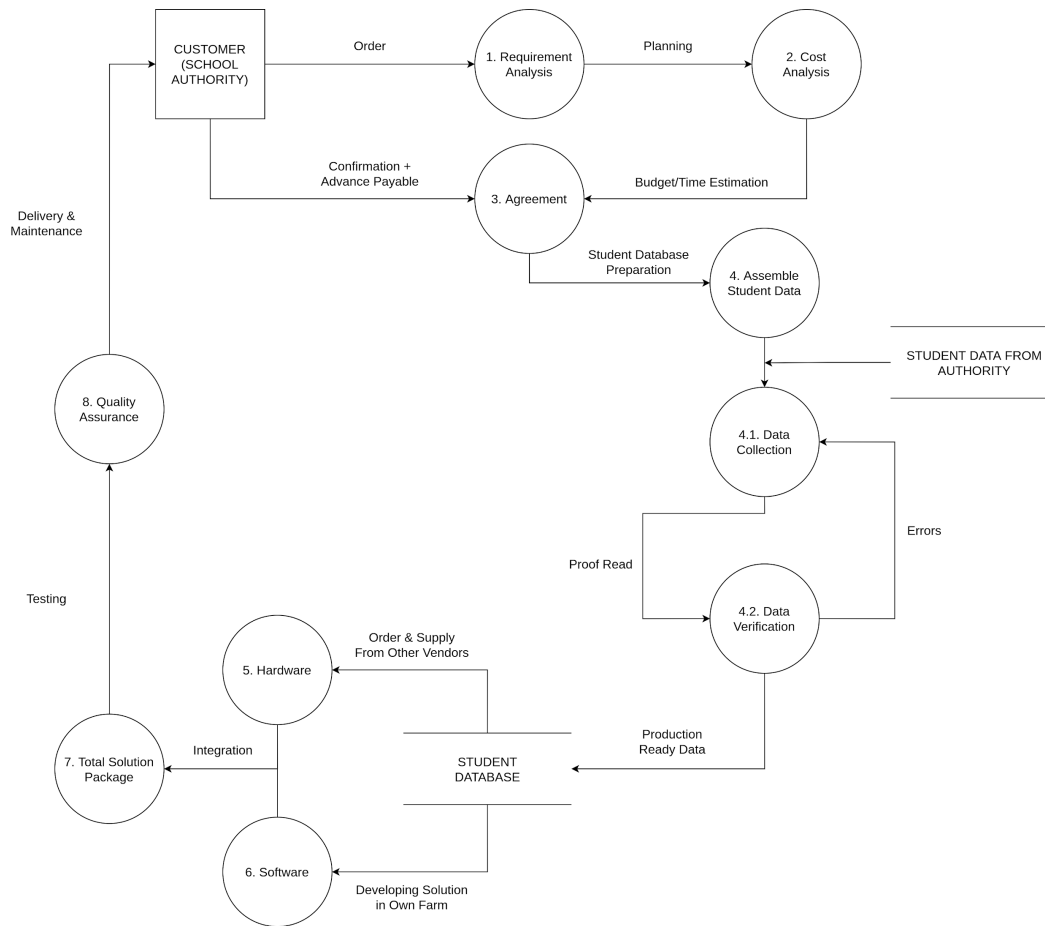


Fig 3.3: Data Flow Diagram of Automatic Attendance System project of Leadsas

### 3.2.3 Description of Data Flow Diagram

The scenario about the whole process of the project can be assumed from this Data Flow Diagram figure. Requirement and cost analysis, data collection and verification, software and hardware development are some of the key points of this process. We have interviewed Sadik Al Sarker, the Managing Director of the company, to know details about their journey and troublesome issues they faced. It was great to have them on board and they have discussed freely about their shortcomings and difficulties they faced over those projects.

Our main concerning project is ‘Digital ID Card and Automatic Attendance System’. According to the collected information the data flow diagram is described below.



### 3.2.3.1 Introduction to the Basic Components of the Data Flow Diagram

There are mainly three main components in a Data Flow Diagram

- **Source and Destination:** The customers are the source and destination in our design. They will order according to their requirement and the company will hand over the project to them when its completed.
- **Data Flow:** An arrow from one place to another determines the data flow as output from a source or process or data store to another process or a destination as input.
- **Data Store:** An open rectangle representing data store means data at rest or temporary repository of data. It acts as data storage for input in a project.

### 3.2.3.2 Elaboration of the Components of the Data Flow Diagram

Here we elaborately discussed about the components of the Data Flow Diagram.

#### 1. Requirement Analysis

After receiving the order, there is a phase of requirement analysis. In this phase, the required technical resources and data is estimated. When a customer orders according to their requirement at first the company goes through this process. In this process the communication team takes order from the source which works as input to this process and the managing director starts planning according to the requirements which works as output shown by data flow.

#### 2. Cost Analysis

This is the phase where required cost and budget of the project is estimated. According to the planning the documentation team analyze the cost and time estimation for every raw materials needed. In this process planning from the requirement process works as input to this process and budget and time estimation works as output shown by data flow.

#### 3. Agreement

In this section, agreement with the client happens. After analyzing the estimated time and budget the communication team forwards it to the customer

for advance payment. If the customer is satisfied with the budget and estimated time then they confirm their order. With the approval of customer the data entry team starts to collect student information according to their plan.

In this process budget and time estimation from the cost analysis process and confirmation with advance payment from source works as input to this process and student database preparation works as output shown by data flow.

#### **4. Assembling Student Data**

This process is divided into two sub problems, data of the students for the ID card and attendance software are collected and verified in this part. The two sub parts are:

**4.1. Data Collection:** The data entry team collects data from school authority under the supervision of administrative director. Here ‘STUDENT DATA FROM AUTHORITY’ acts as a data store for collecting data about students and Proof reading of the collected data acts as output to next sub process.

**4.2. Data Verification:** After proof reading the collected data is verified through individual students. If there is any error found then data is corrected and proof reading is done once more. After the data is ready it acts as output from the process and as input to the DATA STORE Student Database.

#### **5. Hardware**

According to the prepared database raw materials needed for the project is ordered from other vendors.

#### **6. Software**

A website is created for the users from prepared database under the surveillance of ICT director. Then combining the raw materials and website the events team prepare the solution package for their customers.

## **7. Total Solution Package**

The package is tested after preparing by the events team for any modification and the quality of the package is ensured under the supervision of managing director.

## **8. Quality Assurance and Maintenance**

When the package is ready it is delivered to the customer finally by the communication team under the supervision of operation director. Testing from the total solution package process works as input to this process and delivery and maintenance works as output shown by data flow.

## **3.3 Problems**

We Have Found From The Data Flow Diagram By analyzing the Data Flow Diagram of the Automatic Attendance System project, we have found a few problems. Solving these issues can make the whole process a lot more cost and time efficient. Keeping these things in mind can help the company finish more projects more efficiently in the future. The problems we have found are:

### **3.3.1 No MoU Signed**

We have been informed by the company that there was no detailed Memorandum of Understanding (MoU) signed with the clients during the agreement of the order. This lead to some misunderstandings about some of the features of the software after delivering the project. No privacy policy was discussed as well which might cause serious issues in the future.

### **3.3.2 No Business Development Team**

As we can see in the Data Flow Diagram, there is no specific team for business development and analysis. We learned from the managing director of the company that the pre-analysis and meetings with clients along with the agreement were done by the software

development team which is of a totally different expertise. A business development team should be there for analyzing these business related topics before starting the project to reduce loss.

### **3.3.3 Data Collection Process Can Be Improved**

The data collection process was undertaken manually. After collecting the data, it took a lot of time to verify them. Some of the data needed to be recollected due to spelling error. Developing an automatic data collection and verification system can make the whole process a lot more efficient in the long run.

## **3.4 Conclusion**

We discovered some of the problems more systematically through analysing the Data Flow Diagram. Solving these issues will prevent a lot of loss in the future projects. We will discuss the solution process later in this report.

# Chapter 4

## Feasibility Analysis

### 4.1 Introduction

In this chapter, we will analyze the feasibility of our proposed solutions to the problems the company has with the automated attendance project. We will go through the feasibility constraints and explore the characteristics of our candidate systems.

A feasibility study examines all of a project's pertinent variables, including economic, technical, legal, and scheduling concerns, in order to determine the possibility of the project's successful completion. Before investing a lot of time and money into a project, project managers conduct feasibility studies to determine the benefits and drawbacks of doing so.

### 4.2 Proposed Solutions

By analyzing the found problems in chapter 2, we have come with three solutions that can help to mitigate the loss and instability of the project. The feasibility study of the contract and documentation are shown here. We've presented the problem's statement, summary, and specifics.

- 1. Hiring a Business Developer:** A business development manager's responsibilities include identifying sales leads, pitching new clients on products or services, and maintaining positive working relationships with new contacts. Setting up meetings and following up on new business prospects. Presentation planning and preparation. Hiring one or a group of business developers or can solve the problems with contracts and agreements with the clients. Ensuring proper **MoU** is also a major role of a business developer.
- 2. Forming a Planning Team:** As we can see, this project did not have a proper cost estimation. Some hidden expenses were not anticipated and owing to misunderstandings over a contract that was not comprehensive and well-described, time was wasted and money was lost. Forming a proper planning team consisting of the Managing Director and chief members of the five groups can help to solve the planning issues for each project and save a lot of loss.
- 3. Appointing an HR Manager:** As there was an imbalance of work distribution in

this project, an HR manager or an HR team is necessary for the proper recruitment process in the future. Human resource management is important for the company's growth. We suggest creating one (and perhaps more) HR manager position in order to expedite the task. Human resources managers plan, organize, and direct an organization's administrative tasks. They are in charge of recruiting, interviewing, and employing new workers, as well as consulting with senior executives on strategic planning and acting as a liaison between management and employees.

These are the solutions we think are applicable for Leadsas limited with this project. We will discuss the feasibility of these candidate systems now.

### **4.3 Feasibility Considerations**

We will discuss the various feasibility constraints in this section. Economic, technical and behavioural aspects of each system will be discussed here. Feasibility analysis assesses a project's chances of success, perceived neutrality is a critical component in the study's credibility with possible investors and further growth of the business.

#### **4.3.1 Feasibility considerations for solution 1 (Hiring a Business Developer)**

Some of the issues with the project's comprehensive contract and paperwork have been raised by us. Later on, the firm ran into some contract difficulties, which cost them both time and money. That is why we suggest our client hire a business developer to manage those tasks. Here are the three aspects of feasibility of our candidate system.

- **Economic Feasibility**

Economic feasibility is a type of cost-benefit analysis that determines whether or not a project can be implemented. This phrase refers to the objective and reasonable identification of a project's strengths, weaknesses, opportunities, and risks, as well as the resources required to accomplish the project and an estimate of its chances of success, to help the decision-making process.

Although, the salary amount should be in consideration, this step will payback way more for the company in future. Because, a lot of misunderstanding and miscalculation will be avoided by a skilled business developer which will save both time and money.

- **Technical Feasibility**

The focus of this evaluation is on the organization's technological resources. It assists businesses in determining whether technical resources are adequate for the job and

whether the technical team is capable of turning concepts into functional systems. The hardware, software, and other technical requirements of the proposed system are also evaluated for technical feasibility.

A Business Development manager will not need any complicated technical resources or skills to contribute to the system. We may presume that a professional business development manager already possesses the necessary soft skills and is capable of managing technical resources.

- **Behavioural Feasibility**

This evaluation of behavioural feasibility deals with how well the proposed system can satisfy the employees and management of the system. Mental satisfaction is a significant consideration at this point. Operational feasibility studies also look at how a project plan meets the requirements specified during the system development's requirements analysis phase.

If they hire a business development manager, they will be able to handle all of the necessary documentation in a professional manner. This will make the whole process a lot simpler and easier. There will be less corrections and misunderstandings afterwards and thus it will ensure employee satisfaction.

#### **4.3.2 Feasibility considerations for solution 2 (Forming a Planning Team)**

In this project, there are issues with appropriate cost computation and future growth prediction. The project's overall cost was initially underestimated, and the development team was unable to accurately predict the project's future growth and maintenance costs, resulting in a loss to the company. So, we suggest forming a planning team with the chief members of each major group and the managing director. The role of the team would be to plan and estimate the cost and growth of each project before starting to work. Here goes the feasibility considerations of this system.

- **Economic Feasibility**

Economic feasibility is a form of cost-benefit analysis that assesses if a project can be carried out. To aid in the decision-making process, this term refers to the objective and reasonable assessment of a project's strengths, weaknesses, opportunities, and risks, as well as the resources necessary to complete the project and an estimate of its chances of success.

Salary for the HR team members will be required in order for this team to function successfully. While the cost should be considered, this choice will be beneficial to the company in the long term. With effective management and estimating, this team will be able to complete the project quickly and efficiently, saving both time and money.

- **Technical Feasibility**

This evaluation focuses on the organization's technical resources. It helps companies determine whether technical resources are enough for the project and whether the technical team is capable of turning thoughts into functional solutions. The hardware, software, and other technical requirements of the proposed system are also evaluated for technical viability.

There might be a necessity of technical training for the team members depending on the type of the project, but we think it is not a big of an issue. Investing some resources and time gathering knowledge about the project before confirming the order will make the team more substantial and efficient for the future projects.

- **Behavioural Feasibility**

This behavioural feasibility assessment looks at how well the proposed system can satisfy the system's employees and management. At this time, mental pleasure is a major concern. Operational feasibility studies also look at how a project plan satisfies the criteria defined during the requirements analysis phase of system development.

They will be able to manage all of the project's essential cost and growth projections in a professional manner if they create a planning team. This will make the entire procedure more simpler and less difficult. There will be less wasted effort and hidden costs. As a result, employee happiness will be ensured.

### **4.3.3 Feasibility considerations for solution 3 (Appointing an HR Manager)**

Human resource management is important for the company's growth. We suggest creating one (and perhaps more) HR manager positions in order to expedite the task. Human resources managers plan, organize, and direct an organization's administrative tasks. They are in charge of recruiting, interviewing, and employing new workers, as well as consulting with senior executives on strategic planning and acting as a liaison between management and employees.

- **Economic Feasibility**

Economic feasibility is a type of cost-benefit analysis that determines whether or not a project can be completed. This phrase refers to an objective and reasonable evaluation of a project's strengths, weaknesses, opportunities, and risks, as well as the resources needed to finish the project and an estimate of its chances of success, to help in the decision-making process.

An HR team will hire next employees carefully to ensure their roles.

- **Technical Feasibility**

The technological resources of the organization are the focus of this assessment. It aids organizations in assessing if technical resources are sufficient for the project and whether the technical team is capable of translating concepts into working systems. The



proposed system's hardware, software, and other technical needs are also assessed for technical viability.

To contribute to the system, an HR manager will not require any sophisticated technical resources or expertise. A professional business development manager is likely to have the required soft skills as well as the ability to handle technical resources.

- **Behavioural Feasibility**

The proposed system's ability to satisfy the system's employees and management is examined in this behavioural feasibility evaluation. Mental pleasure is a big problem right now. Operational feasibility studies also look at how a project plan meets the criteria established during the system development requirements analysis phase.

If they form an HR team, they will be able to manage all of the future recruitments in a professional manner. This will make the operation more easier and less faulty. There will be reduced wastage of time and money, as well as hidden inefficiencies. Management and employee satisfaction will be assured as a consequence.

## 4.4 Describing and Identifying characteristics of Candidate Systems

In this part, we'll go through the different characteristics of Each system. Feature identification determines the likelihood of a project's success; perceived neutrality is an important factor in the study's credibility with potential investors and future business growth.

**Table 4.1: Character Comparison Table for Candidate System**

Characteristic	Solution 1: (Hiring a Business Developer)	Solution 2: (Forming a Planning Team)	Solution 3: (Appointing an HR Manager)
Type of cost	Salary	Salary increment	Salary
Solution effectiveness	Permanent	Depends on project	Permanent
Reaction Time	Moderate	Quick	Slow
Impact on work process	More	Huge	Less
Training requirement	Not much	Necessary	Not much

It seems the Solution 2 has the best characteristics for the attendance management project. If the system is applied, the project will see immediate consequences which will prevent a lot of loss.

## 4.5 Qualitative Evaluation Matrix for Candidate Systems

We'll go through the many qualities of each system in this section. The chance of a system's success is determined by its quality identification; perceived neutrality is a key component in the study's credibility with possible investors and future business growth.

**Table 4.2: Qualitative Evaluation Matrix**

<b>Evaluation Criteria</b>	<b>Solution 1: (Hiring a Business Developer)</b>	<b>Solution 2: (Forming a Planning Team)</b>	<b>Solution 3: (Appointing an HR Manager)</b>
Solution accuracy	Very good	Excellent	Very good
Growth potential	Very good	Excellent	Good
Response Time	Very good	Very good	Good
Impact on work environment	Very good	Excellent	Very good
Payback	Excellent	Excellent	Very good

For the company, it appears that Solution 2 has the best qualitative features. If the system is implemented, the project will experience quick results, preventing a significant instability.

## 4.6 Weigh system performance for Candidate Systems

In this part, we'll go through the accuracy percentages of each system. Accuracy identification determines a system's chances of success; perceived neutrality is a crucial component in the study's credibility with potential investors and future business growth.

**Table 4.3: Weigh system performance Matrix**

<b>Evaluation Criteria</b>	<b>Solution 1: (Hiring a Business Developer)</b>	<b>Solution 2: (Forming a Planning Team)</b>	<b>Solution 3: (Appointing an HR Manager)</b>
Solution accuracy	90%	99%	90%
Growth potential	90%	99%	80%
Response Time	90%	90%	80%

Impact on the work environment	90%	99%	99%
Payback	99%	99%	90%

According to the figures, Solution 2 is most feasible, then Solution 1 and Solution 3 respectively.

## 4.7 Best Candidate System

As we can see from the comparison tables, forming a planning team from the existing members is the most effective and efficient solution. Then comes the system of appointing a business developer and finally, hiring an HR manager. As we suggest, considering the economic and technical perspectives, all three solutions are necessary to apply. The cost might be a little high at the beginning, but the ultimate payback will be a lot higher and the company will avail economic and systematic stability in the long run.

## 4.8 Conclusion

As the comparative tables show, the most successful and efficient approach is to establish a planning team from current members. The method for choosing a business developer follows, followed by the appointment of an HR manager. All three options, as we indicate, are required to implement from an economic and technological standpoint. The initial investment may seem costly, but the long-term payoff will be far greater, and the firm will enjoy greater economic and systemic stability.

# Chapter 5

## Cost Benefit Analysis

### 5.1 Introduction

Cost-Benefit Analysis, as the name implies, entails calculating the advantages of a course of action and comparing them to the expenses associated with it. By cost, we mean the total cost needed to develop the candidate system and the cost of all the systems and subsystems under the organization.

### 5.2 Elements of cost

There are five cost elements. The cost of different elements of the company for the next six years are:

**i. Hardware Cost:**

It includes the actual cost to purchase and lease the computer and peripherals. It's difficult to determine when various users share the system. The best way to treat this cost as operating cost. The company has to invest a total amount of Tk. 13000000 in this aspect.

**ii. Personnel Cost:**

It includes the cost related to the salary of the employees, expenditure on their vacation, sick pay, and health insurance. The company has to invest a total amount of Tk. 20000000 in this aspect.

**iii. Facility Cost:**

The cost required to develop the physical site of the company is Facility cost. This are one-time cost like buying air condition, wiring, lighting, flooring, acoustics etc costs falls under this element of cost. The company has to invest a total amount of Tk. 6000000 in this aspect.

**iv. Operating Cost:**

The cost needed for day to day operation, maintenance, the amount depends on the number of shifts, the nature of applications and the caliber of the operating staff. The company has to invest a total amount of Tk. 7000000 in this aspect.

**v. Supply Cost:**

This cost is variable cost that increase with increased use of paper, ribbons, disk and the similar. The company has to invest a total amount of Tk. 4000000 in this aspect.

### **5.3 Procedures for cost benefit determination:**

Procedures of the cost benefit analysis is discussed here one by one:

#### **I. Identify the costs and benefits pertaining to a given project**

Certain costs and benefits are easily identifiable than others such as direct costs. It includes the price of hardware and raw materials. Some cost are hard to identify, these are the opportunity cost and opportunity benefit.

#### **II. Categorize the various costs and benefits for analysis**

This is the next step of identification. They are of three types such as tangible or intangible, direct or indirect and fixed or variable.

Tangible costs are easily identified and measured. The purchase of hardware, employee salaries and personnel costs are tangible cost. The total tangible cost of the company is Tk. 33000000.

Intangible costs are those which are known to exist but financial value of them cannot be accurately measured such as employee morale problem caused by a new system, the cost of breakdown of an online system during working hours.

Tangible benefits are producing error free reports, completing a job within few hours etc.

Intangible benefits occur when the satisfied customers increase in number, improved corporate image.

The cost with which a dollar figure can be directly associated in a project are direct cost which are applied directly in the operation of the company is direct cost. For example the manufacturing cost of a box containing 100 of smart ID cards is Tk. 8000 is direct cost because we can associate the ID cards with the money expended. Indirect costs aren't directly associated with a system such as if maintenance, insurance, air conditioning increases overhead it incurs an additional cost.

If we can introduce a new system that can handle 10% more transactions per day is a direct benefit.

Indirect benefits are considered as by product of another system. Direct and indirect costs and benefits are readily identified for tangible costs and benefits respectively.

Regardless of how well a system is used some costs and benefits are constant which are known as fixed costs and benefits. Employee salaries, insurance are fixed cost. Variable costs are incurred on a regular basis which are usually proportional to work volume and continue as long as the system is in operation. For example the costs of smart ID card formation vary in proportion to the amount of processing.

Fixed benefits are constant. For example, a decrease in the number of personnel by 15% resulting from the use of updated compatible computers.

Variable benefits occurs on a regular basis, for example the number of students registered for smart ID card on online secured platform saves 30 minutes of each student on average compared with the manual system. The amount of time saved varies with the number of students registered.

### III. **Select a method of evaluation:**

We have identified and broken down all financial data of Leadsas Company Ltd into various cost categories. Now it's time to select a method of evaluation. Among them net benefit analysis, present value analysis, net present analysis, payback analysis and break-even analysis are essential methods of evaluation.

#### **Net Benefit Analysis:**

By subtracting total cost from total benefit we get the net benefit. It is easy to calculate, easy to interpret and easy to present. The main drawback is that it doesn't account for the time value of money and doesn't discount future cash flow. Cash flow amounts for 6 six time periods are given in the table below:

**Table 5.1: Net Benefit Analysis.**

Cost-be nefit/ Year	2021 In Tk.	2022 In Tk.	2023 In Tk.	2024 In Tk.	2025 In Tk.	2026 In Tk.	Total In Tk.
Costs	2500000	5000000	7500000	10000000	10000000	15000000	50000000
Benefit	500000	2500000	12000000	18000000	24000000	28000000	85000000
Net Benefits	-200000 0	-250000 0	+ 4500000	+ 8000000	+ 14000000	+ 13000000	+ 35000000

The time value of money is expressed in the form of interest on the funds invested to realize the future value. Assuming compounded interest the formula is:

$$F = P(1+i)^n$$

Where,

F = Future value of an investment,

P = Present value of an investment,

I = Interest rate per compounding period,

n = number of years.

So in case of the company, if Tk. 50000000 is invested for 6 years at 10% interest would have a value at maturity of:

$$\begin{aligned} F &= \text{Tk. } 50000000 (1 + .10)^6 \\ &= \text{Tk. } 88578050 \end{aligned}$$

### **Present Value Analysis:**

The amount that we are willing to invest today is determined by the value of the benefits at the end of a given period is called present value of the benefit.

A critical factor to be considered in computing the present value is a discount rate equivalent to the forgone amount that the money could earn if it were invested in a different project.

Present value,

$$P = F / (1+i)^n$$

So, the present value of Tk. 120000000 invested at 10% interest at the end of 7 years is:

$$\begin{aligned} P &= \text{Tk. } 85000000 / (1 + 0.10)^6 \\ &= \text{Tk. } 47980284 \end{aligned}$$

**Table 5.2: Present value analysis using 10% interest rate (discounted)**

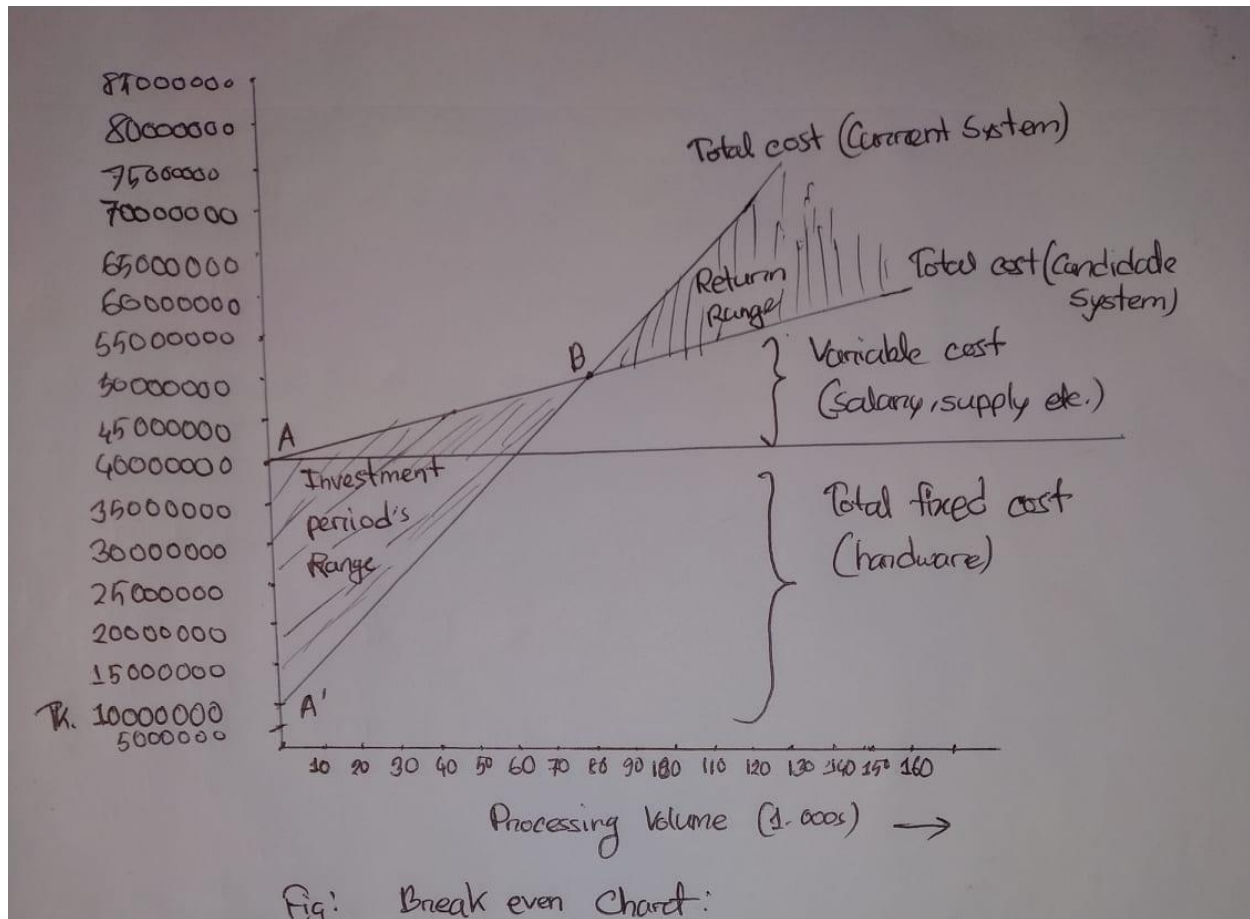
Year	Estimated Future value, F	Discount Rate = $1/(1+0.10)^6$	Present Value = F * Discount Rate	Cumulative Present Value of Benefits
2021	12000000	0.909	10909090	10909090
2022	12000000	0.826	9917355	20826446
2023	12000000	0.751	9015777	29842223
2024	12000000	0.683	8196161	38038385
2025	12000000	0.621	7451055	45489441
2026	12000000	0.564	6773687	52263128
2027	12000000	0.513	6157897	52263128

**Break Even Analysis:**

The point where the cost of the candidate system and that of the current one are equal is Break-even point. Initially the costs of the developed candidate system exceed than that of the current system, which is investment period. When both costs are equal it is break even. Beyond that point, the candidate system provides greater benefit than the old one, which is a return period.

Break-even point is the point at which the costs of the candidate system and the existing system are equal. The expenses of the created candidate system initially surpass those of the present system, indicating an investment phase. It is break even when both expenses are equal. Beyond that, the proposed system outperforms the previous one, which is based on a return period.





**Fig 5.1:**The above diagram shows the investment range in the are ABA', the breakeven point B and the return range.

#### IV. Interpret the results of the analysis:

So the result shows a good amount of profit and future and present amount of investments.

#### V. Take action:

The company should take necessary actions according to the produced cost benefit analysis as soon as possible.

## 5.4 Conclusion

As the name indicates, cost-benefit analysis involves evaluating the benefits of a course of action and comparing them to the costs associated with it. By cost, we mean the overall cost of developing the candidate system as well as the cost of all the organization's systems and subsystems.

# Chapter 6

## System Design

### 6.1 Introduction

We have identified the shortcomings, analyzed feasibility and estimated cost of the proposed solutions in the previous chapters. Now we are focusing on creating a new candidate system that solves the existing issues of the current system. We have thoroughly designed each modules of the candidate system and relationship among the systems through structure chart with identifying critical modules throughout characteristics analysis of the modules, identified major development activities and lastly discussed about processing controls and personnel allocation in this chapter.

#### 6.1.1 Significance of new system design

System design is a method for creating a new system that provides a "how to" approach. This crucial phase is made up of various steps. The focus is on converting performance specifications into design specifications.

The stages of design development are logical and physical. The current physical system is reviewed, input and output specifications are prepared, edit, security, and control specifications are created, the implementation plan is detailed, and a logical design walkthrough is prepared. The physical design depicts the physical system in detail, plans system implementation, creates a test and implementation strategy, and specifies any new hardware or software.

#### 6.1.2 Reviewing the Shortcomings of the Current System

We have thoroughly investigated our current system of the project of Leadsas ltd. and found sirius loop hole in the system that causes most of the issues. To overcome those, building a

new proposed system is a must. To discuss further, we just want to remind the the focused problems we aim to solve in the new design are stated below.

1. No detailed Memorandum of Understanding (MoU) signed with the clients during the agreement of the order.
2. No specific team for business development and analysis.
3. Faulty data collection process.

### **6.1.3 Objective of the Proposed System**

Our main focus designing the new candidate system is to eliminate the shortcomings of the current system. We have analysed the feasibility of the proposed system in the previous system and come to the conclusion that our candidate system addresses the potential solutions to overcome the issues. The primary objectives of the proposed candidate system are:

1. To improve the current system in such a way that is sustainable, less error prone and easily evolvable to the current system.
2. To improve the product quality as a whole, emphasis on data collection and curation method.
3. To build a solid action plan, extensive business development plan and managing the human resources effectively is ensured.

### **6.1.4 Overview of the Key solutions of the Proposed System**

We will consider two main portions of changes in the current system. The dataflow of the system is revised thoroughly and a detailed methodological description of the proposed system will be described in the discussion of the data flow diagram. Furthermore, we have proposed three key points to consider to eliminate the shortcomings in the previous chapter and they are:

1. Introducing Business Development Team or Personnel
2. Introducing Human Resource Manager
3. Proper action plan for the project

### **6.1.5 Alternatives to the Proposed System**

We consider no alternative solutions are required as we have thoroughly investigated the problems of the current system, brainstorming on the issues, reviewed the proposed solutions

from the current literature and unified all the problem's solutions into one proposed candidate system. We will continue to audit our proposed system in the future and based on the future events and forthcoming issues, we will consider redesigning the system accordingly.

## 6.2 Data Flow Diagram of the Proposed System

A data-flow diagram is a way of representing a flow of data through a process or a system. The Data Flow Diagram also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops. Here is a Data Flow Diagram of the Automatic Attendance System project of Leadsas:

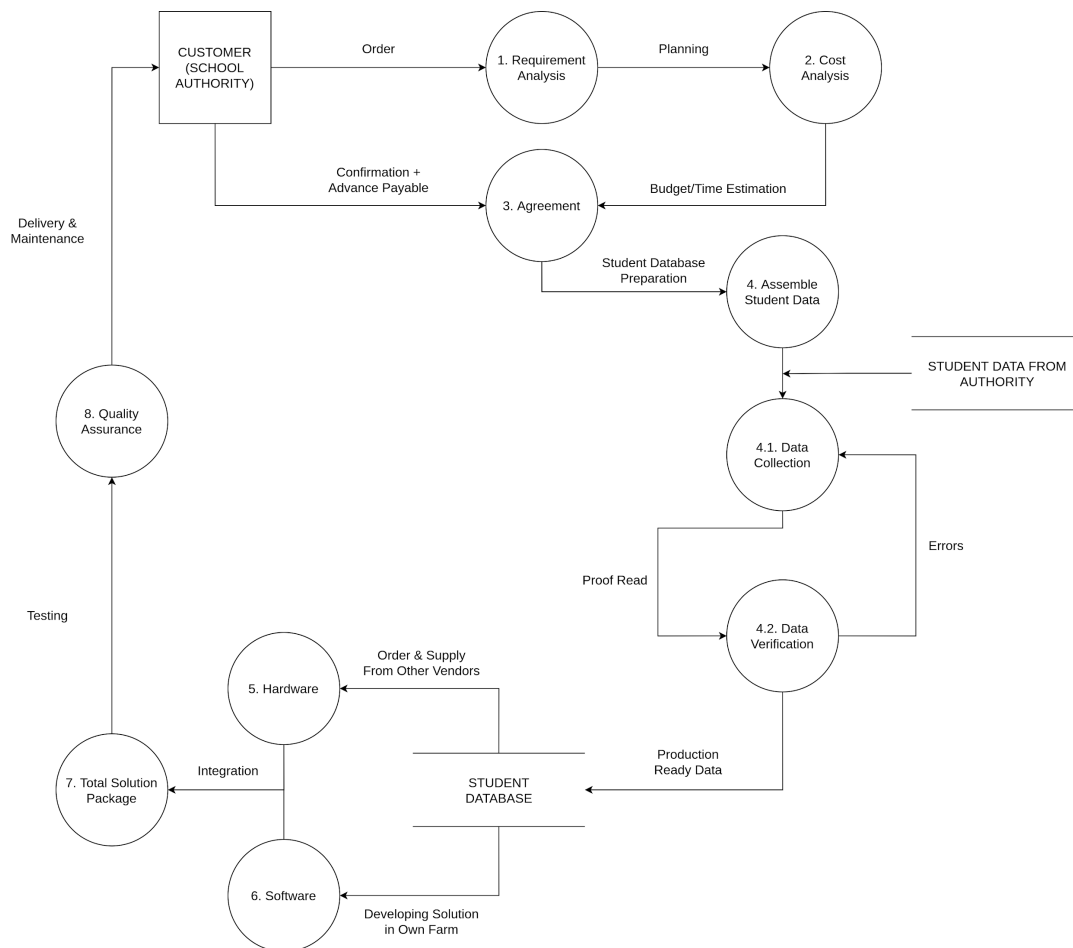


Fig 6.1: Data Flow Diagram of Proposed System

### 6.2.1 Description of Data Flow Diagram

The scenario about the whole process of the project can be assumed from this Data Flow Diagram figure. Requirement and cost analysis, data collection and verification, software and hardware development are some of the key points of this process. We have interviewed Sadik Al Sarker, the Managing Director of the company, to know details about their journey and troublesome issues they faced. It was great to have them on board and they have discussed freely about their shortcomings and difficulties they faced over those projects.

Our main concerning project is ‘Digital ID Card and Automatic Attendance System’. According to the collected information the data flow diagram is described below.

### 6.2.2 Introduction to the Basic Components of the Data Flow Diagram

There are mainly three main components in a Data Flow Diagram

- **Source and Destination:** The customers are the source and destination in our design. They will order according to their requirement and the company will hand over the project to them when its completed.
- **Data Flow:** An arrow from one place to another determines the data flow as output from a source or process or data store to another process or a destination as input.
- **Data Store:** An open rectangle representing data store means data at rest or temporary repository of data. It acts as data storage for input in a project.

### 6.2.3 Elaboration of the Components of the Data Flow Diagram

Here we elaborately discussed the components of the Data Flow Diagram.

#### 1. Requirement Analysis

After receiving the order, there is a phase of requirement analysis. In this phase, the required technical resources and data is estimated. When a customer orders according to their requirement at first the company goes through this process. In this process the communication team takes order from the source

which works as input to this process and the managing director starts planning according to the requirements which works as output shown by data flow.

## **2. Cost Analysis**

This is the phase where the required cost and budget of the project is estimated. According to the planning the documentation team analyzes the cost and time estimation for every raw materials needed. In this process planning from the requirement process works as input to this process and budget and time estimation works as output shown by data flow.

## **3. Agreement**

In this section, agreement with the client happens. After analyzing the estimated time and budget the communication team forwards it to the customer for advance payment. If the customer is satisfied with the budget and estimated time then they confirm their order. With the approval of the customer the data entry team starts to collect student information according to their plan.

In this process budget and time estimation from the cost analysis process and confirmation with advance payment from source works as input to this process and student database preparation works as output shown by data flow.

## **4. Assembling Student Data**

This process is divided into two sub problems, data of the students for the ID card and attendance software are collected and verified in this part. The two sub parts are:

**4.1. Data Collection:** The data entry team collects data from school authority under the supervision of the administrative director. Here ‘STUDENT DATA FROM AUTHORITY’ acts as a data store for collecting data about students and Proof reading of the collected data acts as output to the next sub process.

**4.2. Data Verification:** After proof reading the collected data is verified through individual students. If there is any error found then data is corrected and proofreading is done once more. After the data is ready it acts as output from the process and as input to the DATA STORE Student Database.

## **5. Hardware**

According to the prepared database raw materials needed for the project is ordered from other vendors.

## **6. Software**

A website is created for the users from prepared database under the surveillance of ICT director. Then combining the raw materials and website the events team prepare the solution package for their customers.

## **7. Total Solution Package**

The package is tested after preparing by the events team for any modification and the quality of the package is ensured under the supervision of managing director.

## **8. Quality Assurance and Maintenance**

When the package is ready it is delivered to the customer finally by the communication team under the supervision of operation director. Testing from the total solution package process works as input to this process and delivery and maintenance works as output shown by data flow.

## **6.3 Structure Chart**

In software engineering and organizational theory, a structure chart depicts the breakdown of a system to its most manageable levels. They are used to organize program modules into a tree in structured programming. Each module is represented by a box containing the name of the module.

We have designed structure chart shown in Fig 6.2. Here, we have divided the total system into 14 modules and each of the transactions among the modules are stated.

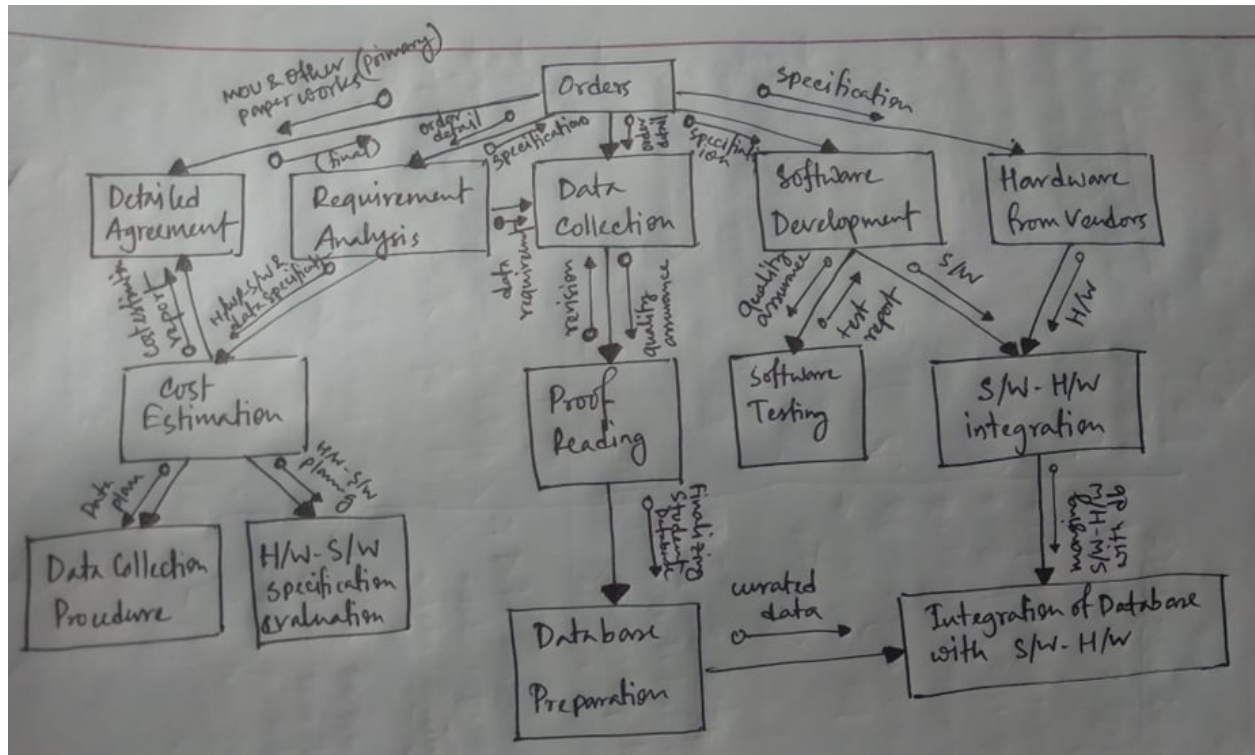


Fig 6.2 Structure Chart

The coupling is the degree of interdependence between the modules in the structural chart. Two tightly connected modules are extremely reliant on one another. Loosely connected modules, on the other hand, are not dependent on each other. Within uncoupled modules, there is no interdependence at all.

Low coupling is an indicator of a good design. The amount of relationships between the modules is used to determine coupling. That is, when the number of calls between modules grows or the amount of shared data grows, the coupling grows. As a result, a design with a high coupling factor will have more faults.

So, we have designed our proposed system in such a manner that we ensure low coupling among the modules. Though there are still some modules with relatively high coupling. 'Order' is the central module which derives all the other modules and one of the major component for dataflow. Another high coupled modules are 'Data Collection' and 'Software Development'. In the proposed system, we tried to solve all the data related shortcomings from the current system,



that's why we have integrated some of the data management modules in the system which results some high coupled modules. Nevertheless, all the other components of the Structure Chart is low coupled.

The degree to which the pieces of a module belong together is referred to as cohesion. As a result, cohesiveness assesses the strength of relationships between functional components inside a module. Functionality, for example, is closely linked in highly cohesive systems. In system design, cohesion is a form of ordinal measurement that can be classified as "strongly cohesive design" or "poor cohesive design." All of the modules in our proposed system is strongly cohesive which makes our system design strongly cohesive design.

1. **Order:** It is the central module of the entire chart where all the communication and agreement with the customer and to the other internal modules. It serves all the requirement specification after the proper agreement. Though it is a highly coupled module, it is designed to be highly cohesive.
2. **Detailed Agreement:** It is a critical module which is associated with order and cost estimation module. It is a moderately coupled module which is essential for ensuring both of the parties, customer and the company is at the same pace.
3. **Requirement Analysis:** In any system design, requirement analysis is a must. It is designed to be highly cohesive and loosely cohesive, associated with the order and cost estimation only.
4. **Cost Estimation:** Cost estimation ensures the stability of the agreement as per user requirement and providers demand. It is a highly coupled module as it is associated with four modules.
5. **Data Collection Procedure:** In our proposed system, data collection procedure preparation is among the solutions where we emphasized the most. It is a well designed strongly cohesive module with loosely coupled with cost estimation only.
6. **Hardware-Software Specification Evaluation:** It is done due to cost estimation process. It is a strongly cohesive and loosely coupled module.
7. **Data Collection, Proof Reading, Database Preparation:** All the data related modules are the most critical modules in the system. Therefore, they are designed to be strongly

cohesive. Though, the data collection module is highly coupled the other modules are kept loosely coupled.

8. **Software Development & Testing:** Software development and testing modules are strongly cohesive and loosely coupled.
9. **Hardware from Vendors:** The project owner collects their hardwares from the independent vendors as per requirement. So it is strongly cohesive by nature and kept as loosely coupled in the structure chart.
10. **Software-Hardware Integration:** Integrating software with hardware is a on the flow task to be done before connecting with the database. It is designed as strongly cohesive and loosely coupled, connecting with three modules only.
11. **Integration of Database with Software-Hardware:** It is the last module of the structure chart. Depending on only two modules made the module to be loosely coupled and strongly cohesive.

## 6.4 Major Development Activities

During structured design, a number of development activities are carried out. Database design, implementation planning, system testing, system interface specification, and user documentation are among them.

1. **Database design:** This activity is concerned with the physical database design. It's crucial to figure out how the access paths will be implemented. A logical path leads to a physical path. Pointers, chains, and other mechanisms may be used to implement it.
2. **Program design:** Prior to conversion, a choice is made on the programming language to be utilized, as well as the flowcharting, coding, and debugging procedure. The programming languages that can be used on the system are limited by the operating system. Following the completion of the system design, the implementation plans and test cases are necessary. As a result, precise timetables for system testing and user training must be established.

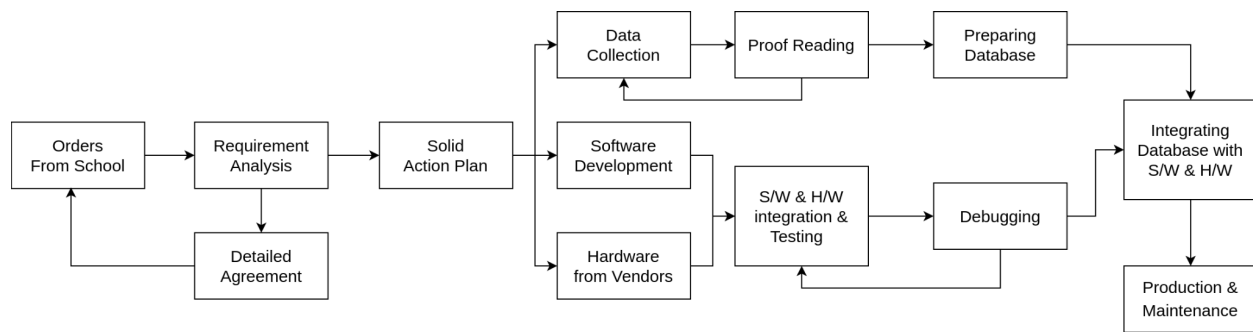


Fig 6.3 Major Development Activities of the proposed system

3. **System and Program Test Preparation:** There are separate test requirements for each aspect of the system. After all of the programming and testing has been finished, the system is tested. Acceptance testing is a type of test that aims to persuade the user that the candidate system will fulfill the stated requirements. It takes place in front of users, audit representatives, or the entire team.
4. **System interface specification:** This phase outlines how information should enter and exit the system for the user. The designer provides the user with a number of possibilities.

As per our need we divided all the major development activities in Fig. 6.3. The description of the modules are stated in the description of the data flow diagram and the structure chart.

Another crucial component of system design in user documentation. User documentation in the form of a user or operator's manual must be written before the system is ready for implementation. The manual explains how to access, update, and retrieve data, as well as how to display and print results in various formats.

## 6.5 Personnel Allocation

In the planning phase, an organized approach is helpful. A finished structural chart depicts the work that must be completed. In all the critical modules, we assigned our best possible personnel. Poor cohesive and highly coupled modules are assigned to the best team. After the modules have been assigned, each team's roles are assigned, and the designer oversees the entire project. It's critical to assign modules. The user interface is represented by the bottom

modules, which are crucial. As a result, such a module should be assigned to a team with specific expertise.

In the proposed system, we consider order management, project planning and data preparation to be the most critical task as they are highly coupled modules. Though they are strongly cohesive in design, we but to ensure the best of the quality of the end product, we recommend to assign the best of the people in those tasks. In figure 6.4 we have allocated the teams on each of the modules.

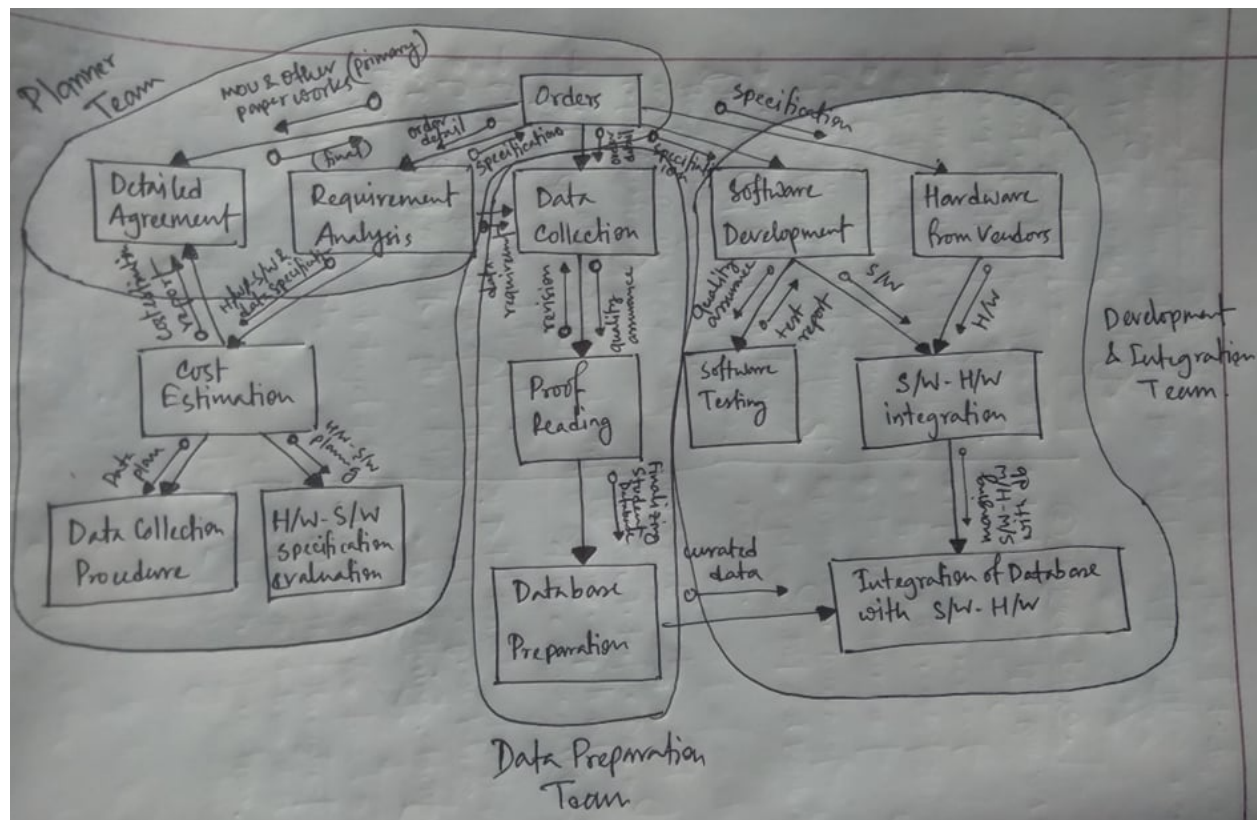


Fig 6.4 Personnel Allocation

## 6.6 Conclusion

A through analysis and implementation guideline of the newly proposed system is described in the chapter with a dataflow diagram, structure chart and major development activity chart. In the upcoming chapter we will devise the database preparation of the project in a detail manner.

# Chapter 7

## Database Design

### 7.1 Introduction

We have proposed the new system in the previous chapter. Based on the data flow diagram, structure chart and major development activities, we have designed the database in this chapter. We mainly revised the system in the procedural and planning section. In the flow of the data we ensure the quality of the data with high priority.

We consider that the database design of the current system is well structured and normalized. So we are stating the current schema of the database for our proposed system as well.

### 7.2 Database Tables

Primarily we have got two tables from the company. They are stated below.

1. **Student's Information Table:** Student ID, Student's Name, Guardian's name, Roll number, Class, Section, Session, Date of birth, Current Address, Permanent Address, Admission date
2. **Attendance Table:** Date, Class, Section, Session, Student's name, Roll, present field

### 7.3 Normalizing the Database

Normalization is a technique for organizing data in a database. A database must be normalized in order to reduce redundancy (duplicate data) and ensure that only related data is stored in each table. It also prevents any problems caused by database changes like insertions, deletions, and updates.

We can see from the fields of the tables in the section 7.2, there are huge data redundancy and incompatibility over the database. The tables in the database is in 1NF (First Normal Form) as they fulfill the following criteria:

1. Each table cell should contain a single value.
2. Each record needs to be unique.

To apply 2NF (Second Normal Form) in the database, we need to ensure to criteria:

1. Database is already at First Normal Form
2. Single Column Primary Key that does not functionally dependant on any subset of candidate key relation.

We consider the roll to be the primary key of the general information table and academic information table and foreign key in the revised attendance table. It is renamed as ‘Student ID’. Therefore, we devised the following tables.

Student ID	Student's Name	Guardian's name	Date of birth	Current Address	Permanent Address	Admission date

Table 7.1: General Information Table

Student ID	Session	Section	Remark from previous session

Table 7.2: Academic Information Table

Date	Class	Student ID	Present field

Table 7.3: Attendance Table

We will recommend to use Table 7.1 and Table 7.2 for ID card generation process and Table 7.3 for attendance system. Here, the date along with class field will be act as primary key.

## 7.4 Conclusion

Properly maintaining a database is a key factor for quality ensurance of any project. We devised the whole system in the previous chapters and designed the database to be compatible with the new system. Furthermore, we have normalized the existing database to ensure less data redundancy and compatibility.