HOW IDEAS BECOME SYSTEMS

Making Technology Work the Way You Need

FIRST EDITION

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HOW IDEAS BECOME SYSTEMS MAKING TECHNOLOGY WORK THE WAY YOU NEED

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PREFACE

This book, "How Ideas Become Systems: Making Technology Work the Way You Need", was created to serve as a practical and accessible guide for students, educators, and anyone interested in understanding the fundamentals of system analysis and design. It brings together concepts, real-world examples, and hands-on exercises to help readers move from abstract ideas to workable solutions. The content is organized to ensure clarity, with illustrations, diagrams, and relatable scenarios that make complex topics easier to grasp.

The journey of developing this book was inspired by the need for resources that not only explain theory but also demonstrate how it applies in real projects. Whether you are a beginner stepping into the world of technology or a practitioner looking to refine your skills, this book aims to guide you in transforming requirements into effective systems. I hope it inspires you to create solutions that are both functional and impactful.

Norzahirah Binti Zainuddin

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MESSAGE FROM THE DIRECTOR

I would like to express my heartfelt appreciation to the entire editorial team for their dedication, creativity, and commitment in making this publication a success. Your hard work, attention to detail, and teamwork have brought our ideas to life beautifully. Each member's effort, from planning to final editing, has contributed greatly to producing a high-quality outcome that we can all be proud of. Thank you for your patience, passion, and professionalism throughout this journey. Your contributions are truly valued, and I am deeply grateful for your unwavering support. Together, we have achieved something remarkable.

Rozali Bin Ibrahim

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OVERVIEW

SYSTEM ANALYSIS AND DESIGN

System Analysis & Design (SAD) is a vital area of study that equips students with the knowledge and techniques to analyse existing systems, identify problems, and design effective solutions. It bridges the gap between theory and practice by teaching students how to transform ideas into functional, efficient, and user-friendly systems through structured planning, analysis, and design processes. An important part of SAD is the Preliminary Analysis, which involves initial activities such as identifying system goals, understanding user needs, assessing the project's feasibility, and defining the scope of work. These activities help ensure that projects get off to the right start, with clear objectives and realistic expectations. This topic also enhances problem-solving skills by breaking down complex challenges into manageable components, strengthens communication skills for engaging with both technical and non-technical stakeholders, and prepares students for industry roles such as system analyst, business analyst, project manager, and software developer. In today's technology-driven world, where organisations depend on accurate, reliable, and secure systems, mastering SAD helps students contribute to creating solutions. This reduces errors, lowers costs, improves efficiency, and meets user needs — ultimately playing a key role in project success and achieving organisational goals.

SYSTEM ANALYSIS

Figuring out a problem and defining what a new or improved system needs to do to solve it. This is a crucial early step in any project

Main Activities:

Problem Identification and Scope
to clearly identify what the problem is that the system will solve

Fact-Finding (Requirement Gathering)
gather information to understand the problem fully

Requirements Analysis and Modelling
taking all the raw information and turning it into a clear list of system requirements

Feasibility Study
to determine whether a proposed project is worth doing

PRELIMINARY ANALYSIS ACTIVITIES

Understanding System Requirements

Before any coding or design work, we must know exactly what the system needs. Think of it like building a house — you can't start without knowing the number of rooms, layout, and safety features.

Input

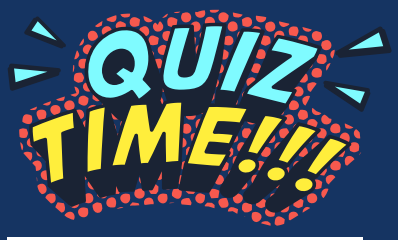
What information the system receives from users or devices.

Output

The results produced by the system.

Process

How the system transforms input into output.



INPUT

EXAMPLE

A student registration form takes student's name, ID and course selection

ACTIVITY

List 5 inputs for an online food ordering app.

OUTPUT

EXAMPLE

A payment receipt showing order details and total amount.

ACTIVITY

Design a sample output for a mobile banking transaction

PROCESS

EXAMPLE

Payment verification → transaction approval → receipt generation.

ACTIVITY

Describe the process for booking a cinema ticket online.

REQUIREMENT DETERMINATION

Involves understanding and defining what a new or improved system needs to do. It's the first and most critical step in the system development life cycle (SDLC). The main goal is to figure out the user's needs and how the system should function to meet those needs.

Purpose of Requirement Determination

The main purpose is to avoid building the wrong system. Without a clear understanding of what's needed, a project can fail, go over budget, or produce a system that users won't accept. By thoroughly determining requirements, analysts ensure that the final system is useful, effective, and meets the business's goals. It serves as a foundation for all subsequent project activities, such as design, development, and testing.

TECHNIQUES FOR FACT-FINDING

How to gather the information. Analysts use several methods to collect data from users and stakeholders.

INTERVIEW

What is?

Direct conversation with users or stakeholders.

SCAN ME

An interview in System Analysis & Design is a direct conversation between the system analyst and the stakeholders, such as users, managers, or technical staff, to gather information about the current system, problems faced, and expectations for the new system.

It is one of the most effective ways to understand user needs because it allows for two-way communication — the analyst can ask follow-up questions, clarify uncertainties, and observe reactions. Interviews can be structured with prepared questions, unstructured for open discussion, or a mix of both.

This method is especially useful for obtaining detailed, firsthand insights that may not be captured in documents or surveys, helping the analyst design a system that truly matches user requirements.

NOTES

INTERVIEW

EXAMPLE

Asking a cashier what problems they face using the POS system.

ACTIVITY

Write 5 interview questions for an online shop owner.

QUESTIONNAIRE

What is?

A set of questions for many people at once.

SCAN ME

A questionnaire is a set of written questions designed to collect information from users, stakeholders, or other relevant groups about a system. In System Analysis & Design, it is used to gather data on user needs, current system performance, and suggestions for improvement.

Questionnaires can be distributed in paper form or online, making it possible to reach a large number of respondents in a short time. They may include closed-ended questions for quick, quantifiable results, or open-ended questions to capture opinions and ideas in more detail. This method is especially useful when the analyst needs input from many people or when face-to-face interviews are not practical.

A well-designed questionnaire helps ensure that important requirements are identified early in the system development process, supporting better design decisions.

NOTES

QUESTIONNAIRE

EXAMPLE

Google Form survey to students about online class experience.

ACTIVITY

Create 3 multiple-choice questions about mobile app features.

OBSERVATION

What is?

Watching how the current system operates.

Observation is a fact-finding technique where the system analyst watches how tasks are actually carried out in the workplace to understand current processes, workflows, and user interactions with the system.

In System Analysis & Design, observation helps the analyst see real-world practices, uncover problems that users might not mention in interviews or questionnaires, and verify whether documented procedures match what happens in reality.

It can be direct (watching users perform tasks in real time) or indirect (reviewing recorded activities, such as CCTV footage or system logs). Observation is especially valuable for identifying inefficiencies, bottlenecks, or workarounds that are not officially recorded.

By witnessing the actual environment, the analyst gains a clearer and more accurate picture of user needs, which leads to more practical and effective system designs.

SCAN ME

NOTES

OBSERVATION

EXAMPLE

Sitting in a bank to see how tellers process deposits.

ACTIVITY

Observe a library system and note 5 things about how books are borrowed.

RESEARCH

What is?

Studying documents, manuals, competitor websites.

SCAN ME

Research is a fact-finding method where the system analyst gathers information from existing sources such as books, journals, reports, websites, and industry documentation to understand a problem or explore possible solutions. In System Analysis & Design, research helps the analyst learn about best practices, new technologies, competitor systems, market trends, and relevant regulations before designing a system.

This method is especially useful when the analyst needs background knowledge, benchmark data, or technical details that cannot be obtained directly from users. Research can be primary (collecting new data through experiments, surveys, or fieldwork) or secondary (using information already published by others).

By conducting thorough research, the analyst ensures the system design is informed, up-to-date, and aligned with industry standards.

NOTES

RESEARCH

EXAMPLE

Checking e-commerce sites for their product filtering system.

ACTIVITY

Find 3 competitor websites for a business you want to create and list their best features.

CHOOSING THE RIGHT FACT-FINDING METHOD

Choosing the right Fact-Finding Method

Here are four scenarios showing how to choose the right method.

Need detailed personal feedback → use **interviews**

Need quick, mass responses → use **questionnaires**

Need to see real-life operations → use **observation**

Need background info → use **research**

ACTIVITY

Scenario A: A system analyst wants to understand why staff members often skip a particular step in the current workflow and hear their personal opinions on how to improve it.

- **Answer**

Scenario B: An analyst needs to know how satisfied 200 customers are with the current online ordering system, and the results must be collected within a week.

- **Answer**

ACTIVITY

Scenario C: The analyst suspects that the real way employees use the POS system is different from the documented procedure and wants to confirm it.

- **Answer**

Scenario D: Before designing a new student information system, the analyst wants to find out what features are used in similar systems at other colleges.

- **Answer**

Answer:
Scenario a: interview
Scenario b: questionnaire
Scenario c: observation
Scenario d: research

ANALYSING THE GATHERED INFORMATION

ANALYSING THE GATHERED INFORMATION

WHY?

After collecting data through interviews, questionnaires, observations, or research, the raw information can be messy, lengthy, and hard to interpret. Analysis is the process of turning that raw input into clear, structured, and meaningful insights that can guide system design decisions.

NOTES

ANALYSING THE GATHERED INFORMATION

Once the facts are gathered, next step is to organize and analyse them. This activity is about taking all the raw information and turning it into a clear list of system requirements. These requirements are usually broken down into two types:

Functional Requirements:

What the system must do.

define the specific actions, behaviours, or functions a system must perform

Non-Functional Requirements:

How the system should be.

define the quality attributes or constraints of a system

ANALYSING THE GATHERED INFORMATION

Functional Requirements
(What the system must do)

example

- **User Authentication**
- **Search Functionality**
- **Data Processing**

Non-Functional Requirements
(How the system should be)

example

- **Performance**
- **Security**
- **Usability**
- **Reliability**
- **Scalability**

EXAMPLE

Survey shows 85% of users want mobile payment options.

ACTIVITY

Collect and summarise 10 responses from friends about their favorite online learning tool.

Step-by-step: Create, distribute and analyse a Google Form

Source: https://www.youtube.com/watch?v=tLjbn_KAec0

AI Tools in Each SAD Stage

INTERVIEWS

- Otter.ai / Fireflies.ai
- ChatGPT suggests four wp questions, summarizes key points, or identify

QUESTIONNAIRES

- Google Forms with AI analysis (Sheets + Gemini/ChatGPT)
- Typeform with AI

OBSERVATION

- Computer Vision AI (e.g. Amazon Rekognition, Microsoft Azure Vision)
- AI Video Summarizers

RESEARCH

- Perplexity AI/ChatGPT Advanced Search
- Scholar AI Locates and summarizes academic papers

APPRECIATION

Our team would like to express our deepest appreciation to the Director of Kolej Komuniti Selandar for the constant support, encouragement, and guidance that made the completion of this eBook, "How Ideas Become Systems", possible. Our heartfelt thanks go to our parents for their endless prayers and unwavering belief in us. To our spouses, thank you for your patience, understanding, and motivation throughout this journey. Finally, we are truly grateful to our friends and colleagues who contributed, in big or small ways, to the creation of this eBook. Your ideas, feedback, and moral support have been invaluable in bringing this project to life.

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Norzahirah Binti Zainuddin has 16 years of teaching experience at Kolej Komuniti and Politeknik. She holds a Bachelor's Degree in Computer Science (Software Development) and has extensive expertise in delivering courses on web development, software engineering, and cybersecurity. Her passion for education is matched by her commitment to guiding students in mastering both theoretical concepts and practical skills, preparing them to excel in the rapidly evolving field of technology.

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With two decades of experience, Hamidah binti Mohamed Shah is a senior lecturer in the field of Information Technology at Kolej Komuniti. Her expertise lies in several core programming languages courses, including C, C++, Java, and Python. Holds a Bachelor's degree in Information Technology and Diploma Education in Information Technology and Communication, which underscores the commitment to effective teaching methodologies

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Currently teaching in Kolej Komuniti Selandar Melaka, Muhammad Afif bin Razali has years of experience teaching in various institutions; including Politeknik Sandakan Sabah, SMK Simpang Bekoh Melaka, and others. Holding a Bachelor's Degree (Hons) Teaching English as a Second Language from Universiti Kebangsaan Malaysia (UKM), he aspires to empower Malaysian TVET students with potent language skills to ace their career world.

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