

Input-Output Design

Mr. GD Makkar
HOD, Dept. of CA & IT
SGRRITS
Dehradun

Input-Output Design

- Input/output design is the first task in the system design phase of the SDLC.
- Output design focuses on user needs for screen and printed forms of output while input design provide user interaction with the computer.
- The outputs can be in the form of operational documents, reports, and graphs.
- The input records have to be validated, edited, organized and accepted by the system before being processed to produce the output.

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Output Design

Output presents information to the system users through information system.

Types of output

1. External output:

- External output is for the users outside of the organization.
- They are usually reports on business transactions.
- Examples of external outputs are invoices, account statement, purchase orders, Internet based information delivery, email etc.
- Most external outputs are created as preprinted forms that are designed by forms manufacturers for use on computer printers.

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2. Internal outputs

- Internal outputs are for the internal users within an organization.
- Internal outputs support day-to-day business operations and produce various kinds of reports for management interest and fulfill decision support requirements.
- Management information systems typically produce three types of reports:
 - Detailed,
 - Summary, and
 - Exception.

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- **Detailed Reports:** These reports present information with little or no filtering or restrictions.
- **Summary Reports:** Summary Reports categorize information for managers who do not want to go through details. The data for summary reports is typically categorized and summarized to indicate trends and potential problems. Graphics (charts and graphs) may be used to make the detail report more summarize
- **Exception Reports:** In exception reports, data is filtered before it is presented to the manager as information. Exception reports only report exceptions to some condition.

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3. **Operational output:** Operational outputs are used purely with in the computer department. For example, program listings, usages statistics etc.
4. **Interactive outputs:** Interactive outputs are those by which user communicates with the computer directly often called dialogues.
5. **Turnaround output:** Turnaround output are those outputs that reenter the system as an input.
6. **Graphic output:** Graphic output use pictorial chart to convey the information to the users that cannot be expressed in the tabular output. Line chart, bar chart, and pie chart etc. can be use to represent output in graphic format.
7. **Multimedia:** multimedia output is used when information is to present in the format other than traditional screen outputs, numbers, and codes. This includes graphics, audio, video and animations. Multimedia format makes the output more interactive and user friendly.

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Principles of Output Design

Computer outputs should be simple to read and interpret.
These enhance readability and understandability.

- Every report or output screen should have a title.
- Reports and screens should include section headings to segment large amounts of information.
- Information in columns should have column headings.
- Legends should also be used to formally define all fields on a report. You never know whose hands a report might end up in!
- Computer jargon and error messages should be omitted from all outputs.

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Output Design Process

- Outputs present information to system users.
- Management and users make important decisions based on system outputs.
- The outputs are produced from data that is either retrieved from databases or, more often, input by users.
- System analysts should follow the following steps while designing the output:
 - Identify system outputs
 - Select Output Medium and Format
 - Prototype The Output for System Users

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➤ Identify System Outputs

- Output requirements are usually define during requirement analysis.
- The outputs can be easily identified by examining the physical DFDs for dataflow that are connecting to external entities.
- Depending on the system development methodology being used, each dataflow may also be described as logical data flow in a data dictionary.
- The data structure for a dataflow specifies the attributes or fields to be included in the output.
- The designer may also interview users to brainstorm to identify outputs of the system.

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➤ Select Output Medium and Format

The next step in the output design is to select output medium and data format. The best medium and format for the design and implementation is based on:

- The type and purpose of the output.
- The operational, technical and economic feasibility.

Once the type of reports and outputs has been identified and understand, several design issues need to be addressed. The issues are:

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- Is the output for internal or external use?
- What implementation method would best serve the output?
- What medium would best serve the output?
- What would be the best format for the report? Tabular? Zoned? Graphic? Etc.
- How frequently is the output generated? Hourly? Daily? Monthly? On demand?
- How many pages or sheets of output will be generated for a single copy of a report?
- Does the output require multiple copies?
- For printed outputs, have distribution controls been finalized?
- For attributes contained on the output, what format should be followed?

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Prototype the Output for System Users

- The format or layout of an output directly affects the system user's ability to read and interpret it.
- The best way to layout outputs is to sketch a sample of the report or document via prototyping.
- When prototyping outputs, it is important to involve the user to obtain feedback.
- System analysts must use his/her experience to demonstrate how the user may obtain appropriate help or instructions, drill-down to obtain additional information, navigate through pages, request different formats that are available, size the outputs, and perform test customization capabilities.

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Report Design

- Computer system use reporting and query applications to retrieve the data that are available in the database and present it in a way that provides useful information, drives decision-making and support business activities.
- A report presents data as organized and meaningful way, which can be used and distributed.

Type of Reports

There are three types of reports:

1. Detailed reports
2. Summary reports
3. Exception reports

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Detailed Reports: These reports present information in detail without filtering or making any restrictions on it. Detailed reports may be historical in nature. For example, detail listing of customer accounts, products in inventory.

Summary Reports: These reports categorize information for managers who do not want to go through in detail. The data in summary reports are categorized and summarized to indicate trends and potential problems. Charts and graphs can be included in the summary report to make it more summarize and to increase readability. For example, report that summarize the months and years total sales by product types and category.

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Exception Reports: These reports filter data before they are presented to the manager as information i.e., it displays only those records that meet a specific condition or conditions. For example, total sale made in the year 2008.

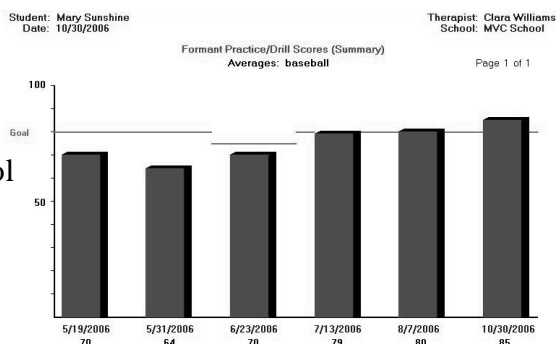
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Importance of Reports

The following are various advantages of reports:

- Data can be organize and present in groups.
- Running total, group total, grand total, and percentage of total can be calculated.
- Sub-reports and graphs can include within the body of report.
- Data can be present in attractive format with pictures, special fonts and lines.

Report using Graphic tool



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Criteria for Report Design

Reports are the best way to convey the information to the users. The information present in the report should be accurate. Several criteria that should be considered in order to produce good report are given below:

1. Relevance
2. Accuracy
3. Clarity
4. Timeliness
5. Cost

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Relevance

Only the information that is relevant to the purpose of the report should be present in the report. All the relevant information should be included and the irrelevant information should be excluded.

Accuracy

The information that appears on the report should be accurately recorded, transmitted, and transformed into summary data. The main purpose of the report is to help management in decision-making. If the information is inaccurate then the main purpose of the report will not be accomplished.

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Clarity

The information that is present on the report should be clear and understandable. The information present should be balance on the report, the display should not be too crowded and not too spread out. Sufficient margins and spacing throughout the output will enhance readability. Desired information should be easy to locate. Comparison ratios, percentages, graphs can be used to make reports readable and understandable.

Timeliness

Reports must be prepared and ready for use in time. Reports usually provide information, which is used to make decisions. Hence, the information should reach to the users on time.

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Cost

There are two types of costs are associated with reports. The *first cost is the preparation of reports*, which consist of analysis, design, computation and distribution. *Second cost is the reading the report and locating valuable information in it*. Often the cost of reading is overlooked during the calculation of costs. The reading cost can be significantly reduced if the appropriate information is presented clearly on the report. The total cost should be less than the expected benefits.

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Input Design

- Collection of input data is the most expensive part of the system.
- Input design describe how users interact with computer system, and consist of all hardware, software, screens, menu, functions, output, and features that effect two-way communications between users and the computer.
- The communication between the users and the computer are more prone to error.
- If the data going into the system is incorrect, then the processing and output will magnify these errors.

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Principles of Input Design

- The quality of system input determines the quality of system output.
- Input design features can ensure the readability of the system and produce more accurate data.
- The following general principles should be followed for input design:
 1. **Capture only variable data:** Variable data are those data items that change for each transaction handled or decision made. For example, the over time (OT) hours of each employee varies therefore it should be entered. On the other hand, the rate of OT does not vary from employee to employee, so it need not be entered. The rate can be stored in the system and retrieved automatically when the OT has to be calculated.

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- 2. Do not capture data that can be calculated:** It is unnecessary to store the calculated item, as it will increase the volume of database. Only the inputs required for the calculations are captured and stored. For example, in the calculation of OT, only the inputs required i.e. OT hours and rate are captured not the calculation total payment of OT.
- 3. Include the instructions for completing the form:** The instruction for completing the form should be provided to the user on the same time when they are filling the form so that if they are making some mistake, they can correct it. It should not be provided as a separate file as users don't like to read the instruction separately.

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- 4. Minimize user efforts:** The data entry operator has to enter huge amount of data and this process takes long time. Forms should be designed that a user needs to select the required data instead entering data. It will not only save the time but also increase the efficiency of users and it is less prone to error.
- 5. Data should be entering in proper sequence:** Data to be entered should be in proper sequence so that it can be read like book, top to bottom and left to right. It should indicate the proper flow of the data on the form.

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6. Check should be applied on data: Checks should be applied on data to verify that data entered by the users is valid or invalid. Checks are used to check the errors in the design. The following techniques are widely used to validate data:

- **Existence checks** determine whether all required fields on the input have actually been entered. Required fields should be clearly identifies as on such the input screen.
- **Data type checks** ensure that correct type of data is input. For example, alphabetic data should not be allowed in a numeric field.

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- **Domain checks** determine whether the input data for each field falls within the range of values define for that field. For example, an upper limit range may be applied to OT hours to ensure that OT hour per week for an employee should not exceed more than the upper range specified.
- **Combination checks** determine whether known relationships between two fields are valid.
- **Self-checking** digits determines data-entry on primary keys. A check digit is a number that is used a primary key. The check digit verifies correct data has been entered and is non-redundant.

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- **Format check** compares data entered against the known formatting requirements for that data. For example, some fields may require leading zeros while others don't. Roll numbers of student may be preceded with their course name to identify that a student belongs to which department i.e. CA0801 identifies that student is from course MCA and he is enrolled in year 2008 and his roll number is 01.

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Input Design Process

System analysts should follow the following steps while designing the input screen:

- Identify system inputs
- Select appropriate GUI controls
- Design, validate and test inputs
- Design the source document

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- **Identify system inputs**

Input requirement is usually define during requirement analysis. These inputs can easily be identified by examining the physical DFDs for dataflow that are connecting to external entities.

Depending on the system development methodology being used, each dataflow may also be described as logical data flow in a data dictionary. The data structure for a dataflow specifies the attributes or fields to be included in the input. The designer may also have to interview users and to brainstorm to identify inputs of the system.

- **Select appropriate GUI controls**

Once the input requirements have been identified, controls that will be displayed on input screen will be selected for each attribute. To choose the correct control for attributes, we must begin by examining the possible values for each attribute.

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- **Design, validate and test inputs**

This step involves developing prototype screen for users to review and test. Prototype consists of simulation of a computer screen, form or report. Prototype demonstrates how the user may obtain appropriate help or instructions.

User's feedback is collected to enhance screen design to make it better and easy to fill. Prototype does not display all details to a user unless they are requested.

- **Design the source document**

Source document is used to capture the data from user. A well-designed source document is divided into zones. Some zones are used for identifications; these include company name, form name, logos etc. other zones contain data that identifies occurrence of the form such as form sequence number and date. The largest portion of the document is used to record transaction data. Data that occur once and data that repeats should be logically separated.

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GUI Controls for Inputs

- Most applications being developed today include a Graphical User Interface (GUI).
- GUI designs provide a user-friendlier interface.
- Every GUI application is consist of form on where all controls are place that is used to get inputs from the user.
- Input controls ensure that input data is correct, complete and secure.

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Form Design

A form in computer is like a form on paper that is used to fill out information with pen or pencil. Computerized forms allow entering data into database, displaying it for review and also printing it for distribution. Computerized form is more versatile and powerful than paper form as it can also use computer database.

Select your country:	<input type="text" value="United States of America"/>	
First name:	<input type="text"/>	<input type="radio"/> Your first name will be used to personalize your CNN Member experience
Enter your e-mail address:	<input type="text"/>	<input type="radio"/> Your e-mail address will be used as a unique identifier
Choose a password:	<input type="text"/>	<input type="radio"/> Six-character minimum; no spaces
Re-type your password:	<input type="text"/>	
Password hint:	<input type="text"/>	<input type="radio"/> Six-character minimum; no spaces
ZIP/Postal Code:	<input type="text"/>	<input type="radio"/> Your zip code is needed to provide you with local information and offers

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User Interface Controls

The designer can include many controls such as menu bar, toolbar, status bar, dialog boxes, list boxes, combo boxes, option buttons, check boxes, command buttons, text boxes, calendar control, scroll bar, among others on the input form.

- **Text Box:** Text box is the most common control used for input data. A text box is consist of a rectangular shaped box and accompanied by a caption that describes what kind of data will be input in a text box. Single or multiple lines of data can be entered in a text box.
- **Command Button:** Basically, buttons are not input control. They do not contribute to the input of actual data. But input form design is incomplete without them. Command buttons servers several purposes. It initiates an action. It allows user to commit all of the data to be processed, storing, retrieving data from database.

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- **List Box:** A list box allows the user to select a data item from a list of possible choices. The list box is rectangular and contains one or more rows of possible data values. If the list is bigger than the size of list box, a scroll bar is automatically added to the list box. User can only select item(s) in the list box but cannot enter data.
- **Combo Box:** Combo box is a rectangular box with a small button connected to its side. The small button contains the image of a downward pointing arrow and bar. When user clicks on downward pointing arrow, a hidden list is opened containing list of data item and user can select data item. Unlike list box, user can also enter data in the combo box if the required item is not available in the list.

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•**Radio Button:** Radio button or option button provide the user with an easy way to select a particular value from a value set. A radio button consists a small circle and an associated textual description that correspondence to the value choice. A user can select only one option at a time, and selected option show a black dot.

•**Check Box:** Check box is consists of square box followed by a textual by a textual description. Check box is used to select one or more choices from a group. Selected options are represented by a checkmark or an X. unlike radio button, user can select as many as check boxes.

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The screenshot displays a 'Connect to Database' dialog box. At the top, there are radio buttons for 'SQL Server', 'Oracle', 'OleDb', and 'Odbc'. Below this is a 'Generate My New Classes' section with two list boxes: 'Available Tables' and 'Selected Tables'. The 'Selected Tables' list contains 'Articles' and 'Clients'. To the right, there are text boxes for 'Project' (gpmi), 'Path' (C:\gpmi), and 'Class Name' (Articles), along with a 'Browse' button. Below these are checkboxes for 'Data Access Layer', 'Aspx templates', and 'Standard Functions', and buttons for 'Preview DAL' and 'Generate'. At the bottom, there are text boxes for 'User Id' (jolliver) and 'Serial No' (0), a 'Valid' button, and an 'Exit' button. Arrows from labels at the top and bottom point to these specific UI elements.

User Interface Controls

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Importance of Form

The following are various advantages of form:

- A form provide an easy way to view data
- Using forms, data can be entered easily. This saves time and prevents typographical errors.
- Form present data in an attractive format with special fonts and other graphical effects such as color and shading.
- Forms offer the most convenient layout for entering, changing and viewing records present in the database.
- An entry field in a form can present a list of valid values from which users can pick to fill out the field easily.

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Criteria for Form Design

- A good designed form requires complete fact-finding, careful design and thorough testing.
- Good form design is not possible without good system design.
- The form designer has to make a number of decisions for each form and these must be done by agreement with the users.
- Following criteria must be considered while designing a form:
 - Organization
 - Consistency
 - Completeness
 - Flexible entry
 - Economy

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- **Organization**

The different controls on a form must be arranged in proper order with visual separation between the controls. Information on a form should be properly balanced by sequencing the controls. The data that is frequently used should always be placed in the beginning of the form. If there are groups of logically related data, they should be placed together, for example, name, address, phone number. Grouping of data will help the user to understand which section of the form they are completing.

- **Consistency**

Form designed should not only be internally consistent but also be consistent with other forms in the organization. Consistent form is easy for the user to understand and fill. Consistent forms reduce errors and data capture costs.

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- **Completeness**

The form should gather all the necessary data at the source so that there is no need to write down data from other forms. This reduces the major source of errors.

- **Flexible Entry**

Filling of the form should be easy. It should provide help to the user while filling the form. What kind of data is to be entered in a control? What will be the format of the data entered? Form should be designed in such a way that it helps the user to fill it.

- **Economy**

The total cost of design, printing, data entry etc. must be minimized. Usually handling costs are much more than the cost of designing and printing. Spending more resources on design and printing often reduces the cost of data capture.

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Difference between Forms and Reports

- Forms can be used for both input and output. Reports, on the other hand, are used for output only.
- Typically, forms contain data only one record such as data about one student, one customer etc. a report, on other hand, contains data about multiple records from a database such as all customers detail.
- Although forms can also be printed, but reports give more control over how data are displayed and show greater flexibility in presenting summary information.

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