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| High-Level Design Specifications |
| Cylinders & Orders Management System (COMS) Project |
| This document establishes the high-level design of the system. It defines the proposed software architecture, the transition from analysis to design, and the database design for the development of the COMS project. |

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**Cylinders & Orders Management System (COMS)  
 Project**

**High-level Design Specifications**

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# INTRODUCTION.

Hoang Kim Joint Stock Company is one of the leading providers of printing cylinders in Vietnam. They are currently using the latest technologies from Germany and Japan, and their client bases include various Vietnamese corporations as well as across Southeast Asia.

The company would like to have an integrated IT system that can:

* Manage the main manufacturing process, i.e. sales orders and cylinders.
* Benchmark employees’ performance to calculate bonuses.
* Give management reporting tools for daily operations.
* Be easy to maintain and to add new features in the future.

## Purpose

The purpose of this document is to provide system specifications for the COMS project. It defines the proposed software architecture, the transition from analysis to design, and the database design for the development of the COMS project.

## Audience

The intended reader of this High-level Design Specs is the project team to:

* provide an overview of the design of the system to be implemented;
* transform the various analysis use case scenarios to the chosen platform and technology;
* reference the database design to perform the correct data operations

## Organisation

The overview of the requirements of the project is summarised in Section 2 and section 3. The transition from analysis to design is described in Section 4. Section 5 describes the database design and Section 6 gives details of the system’s menu items.

## References

To fully understand the background to this project, the reader should also be familiar with the COMS User Requirement Specs (reference GG/COMS/TS.1).

# OVERVIEW OF REQUIREMENTS



## System Interface

Currently, the system does not need to interface with any other system.

## System Functions

The following system functions are to be implemented in this system.

1. Managing of print sales order data, including list of cylinders belonging to the sales order.
2. Managing of cylinder data.
3. Managing of employee data, including management of roles.
4. Managing manufacturing work flow, including progress log for each cylinder & function to draw flow charts.
5. Generating cylinder statistics reports (by status, current step, etc.) & employee statistics reports (by marks, time range, errors, etc.).
6. Managing of employee performances and bonus calculation.

# SYSTEM OVERVIEW.

COMS performs the primary functions of manufacturing, as specified in the following subsections



## Sales Order, Cylinder and Employee Info Management

1. Allow sales staff to create sales order.
2. Allow authorized sales staff to add / update / remove / delete cylinders from a sales order.
3. Allow sales order and cylinder data to be viewed by authorized users.
4. Allow mechanical department manager to print cylinder data.
5. Allow all department managers to manage subordinates’ roles. Some roles require approval from directors.
6. There will be an indicator at cylinder type setup to set as Replace / Normal / Backup to allow how many cylinders are for Replace / Normal and Backup purpose.
7. There will be an indicator at cylinder making technology setup to set as Electro-mechanical engraving / Laser engraving.

## Cylinder Manufacturing Process Management

* 1. Allow workers to scan to update cylinder status immediately after completing a step, link the worker id to that step for that cylinder, and note the amount of time required, for performance grading. The update in status will be logged and can be accessible at anytime.
  2. Each cylinder will have a priority level. Under a step, higher-priority cylinders must be processed first.
  3. Allow operation managers to update the schedule for a step.
  4. Allow workers to send a faulty cylinder to the previous step, and log the error from a list of error code or by text. The error will be linked to the step where it occurred.
  5. These error descriptions can be viewed and changed.
  6. Allow operation managers to send a faulty cylinder to a step not according to the work flow.
  7. Allow operation managers to stop processing a cylinder or stop processing a sales order. Also allow them to resume processing that cylinder or sales order. This role can only be granted by IT staff and requires approval from a director.
  8. Allow mechanical dept. manager to print cylinder progress form (for scanning barcode).
  9. Allow managers to view all cylinders currently under one step.
  10. Allow managers to export schedules into excel.
  11. Allow all staff to view cylinder’s progress log and sales order’s progress log.
  12. Allow department managers to change the work flow(list of steps) in their own departments. Using GUI to make changes to steps in workflow steps.

## Employee Performance Management

1. Calculate and store the mark a worker achieves after he performed a step, based on a specified formula.
2. Allow accounting staffs to print out workers’ list of marks achieved during a period. They can also print out the list of step for reference.
3. Allow accounting staffs to modify performance formulas, based on 4 specified constants and other parameters such as cylinder size, number count, or colour count in the sales order.
4. Allow one step to have more than one formulas. Based on cylinder characteristics such as size, hollowness, the system will pick the suitable formula in real time.
5. Allow managers to view a worker performance (e.g. number of cylinders he worked on) during a period.
6. Allow managers to view list of errors occurred under a step during a period, filterable by each worker.

# TRANSITION FROM ANALYSIS TO DESIGN



## Introduction

We decided to implement the system in .NET platform, running in Internet Information Services (IIS) server application and uses Microsoft SQL Server database. The choice of technology and platform was made due to the IT staff on customer site is more familiar with .NET. Therefore we will be able to roll out and hand over the system more easily and reduce learning curve. Also there is a lean towards .NET development in Vietnam IT industry, so it would help in case the customer would like to enhance the system and decides to hire more staff. Furthermore the existing Windows Server 2003 environment would require less setup to host a .NET application.

## Web Client GUI

Since most functions do not require a complicated UI, and the number of client workstation is large, we decided to go for a web application. It would reduce maintenance cost in terms of client-side installation and future updates. There would also be a control of direct access to the database, increasing security and system stability. On the other hand, we will need to cater to connection issues during transactions, and web browser compatibility.

## Thick Client GUI

However, there are a few functions that require a complex GUI, namely the management of work flows and production steps. For this we will implement a thick client written in .NET. The thick client will use web services to talk to the server side. In doing this, in the future the web services can be reused, or other parts of the system can be exposed by web services successfully as well if there is a need.

## Class Diagram

The sample analysis diagram and translated design diagram are presented as below. The analysis boundary class has become .ASPX classes for web clients / .CS for thick client which calls the controller objects through the .WCS web service class. The controller and entity classes have become .CS classes.

### Sample Analysis Class Diagram



Figure: Sample Analysis Class Diagram

### Translated Design Class Diagram



Figure: Translated Design Class Diagram

### Entity Structure

The entity structure is described as in the diagram below.



Figure: Entity Structure Diagram

### Controller Structure

We will have a main controller called MainController for all boundary objects to call. The main controller will then call the appropriate controllers. The other controllers will retrieve the data from the entity objects. The main controller will then process the data and forward to the appropriate boundary object for display / further interaction.



Figure: Controller Structure Diagram

# DATABASE DESIGN



The database design for the system is described as follow.

Figure: COMS Database Schema

## ACCESS\_RIGHT

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| rightId | int | Primary Key |
| name | int |  |

## CYLINDER

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| cylinderId | int | Primary Key |
| orderDetailId | int | Foreign Key |
| barcode | varchar |  |
| priority | varchar |  |
| status | varchar |  |
| currentStepId | int | Foreign Key |
| updateDate | datetime |  |
| updateUser | varchar |  |
| length | int |  |
| diameter | int |  |
| area | int |  |

## CYLINDER\_LOG

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| logId | int | Primary Key |
| cylinderId | int | Foreign Key |
| startTime | datetime |  |
| endTime | datetime |  |
| mark | int |  |
| formulaUsed | varchar | Foreign Key |
| remarks | varchar |  |
| employeeId | int | Foreign Key |
| errorId | int | Foreign Key |
| stepId | int | Foreign Key |

## DEPARTMENT

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| departmentId | int | Primary Key |
| name | varchar |  |

## EMP\_ROLE\_RLTS

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| employeeId | int | Primary Key |
| roleId | int | Primary Key |

## EMPLOYEE

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| employeeId | int | Primary Key |
| departmentId | int | Foreign Key |
| surname | varchar |  |
| givenName | varchar |  |
| staffCode | varchar |  |
| barcode | varchar |  |
| position | varchar |  |
| userName | varchar |  |
| password | varchar |  |
| updateDate | datetime |  |
| updateUser | varchar |  |

## ERROR

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| errorId | int | Primary Key |
| name | varchar |  |

## FORMULA

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| formulaId | int | Primary Key |
| stepId | int | Foreign Key |
| formula | varchar |  |
| coef1 | int |  |
| coef2 | int |  |
| coef3 | int |  |
| coef4 | int |  |
| updateDate | timestamp |  |
| updateUser | int |  |

## ORDER

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| orderId | itn | Primary Key |
| productName | varchar |  |
| price | double |  |
| receivedDate | datetime |  |
| deadline | datetime |  |
| remarks | varchar |  |
| orderType | varchar |  |
| barcode | varchar |  |
| updateDate | datetime |  |
| updateUser | varchar |  |

## ORDER\_DETAIL

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| orderDetailId | int | Primary Key |
| orderId | int | Foreign Key |
| cylinderCode | varchar |  |
| cylinderType | varchar |  |
| quantity | int |  |
| colorCount | int |  |

## ROLE

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| roleId | int | Primary Key |
| name | int |  |

## ROLE\_RIGHT\_RLTS

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| roleId | int | Primary Key |
| rightId | int | Primary Key |

## STEP

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| stepId | int | Primary Key |
| workflowId | int | Foreign Key |
| name | varchar |  |
| type | varchar |  |

## STEP\_RLTS

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| fromStepId | int | Primary Key |
| toStepId | int | Primary Key |

## WORKFLOW

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| workflowId | int | Primary Key |
| startDeptId | int | Foreign Key |
| endDeptId | int | Foreign Key |
| name | varchar |  |

# SYSTEM ARCHITECTURE

## Software Architecture

The software architecture is described as below.

* Web clients uses web browser to connect to .NET web server.
* .NET thick client connects to web service component of .NET server.
* .NET server has 3 layers:
  1. Presentation layer: .ASPX pages to display web content and .SVC classes to expose web services.
  2. Controller layer: .CS classes to hold the business logic
  3. Data access layer: .CS classes using Entity Framework to access the database.
* .NET server has direct connection to MS SQL Database server.



Figure: Software Architecture Layout

## Physical Architecture

The physical architecture is described as below.

* All components are connected through LAN network. Internet connection is not required.
* Web clients and thick clients are running Windows XP.
* Web clients have Internet Explorer 7.0 installed.
* Thick clients have .NET framework 4.0 installed.
* .NET Server has Windows Server 2003.
* Only .NET server has access to MS SQL Database server.



Figure: Physical Architecture Layout

## Web Client

The home page of the web client contains these 2 menu items:

* Cylinder Status Update Page
* Login Page

### Cylinder Status Update Page

Here the user can update the cylinder status without the need to login with the following input:

|  |  |  |
| --- | --- | --- |
| **Input** | **Type** | **Description** |
| Cylinder Code | Text Input | Scan barcode or enter by keyboard |
| Step | Drop-down List | Select from list |
| Employee Code | Text Input | Scan barcode or enter by keyboard |

### Login Page

Here the user can log in to the system with the following input:

|  |  |  |
| --- | --- | --- |
| **Input** | **Type** | **Description** |
| Username | Text Input | Enter by keyboard |
| Password | Password Input | Enter by keyboard |

After logging in, user will be able to access the main page with the following menu items (subject to user’s assigned roles and access rights)

* Sales Order Menu
* Cylinder Menu
* Employee Menu
* Queue Menu
* Role Menu
* User Account Menu
* Formula Menu
* Error Menu
* Log Out Menu

### Sales Order Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Sales Order | Create | Create new sales order and add cylinders to it |
| Manage Sales Order | Search, Update, Delete | Search, Update, Delete |
| View Order Progress | View | View the status of all cylinder belonging to sales order |
| Start/Stop Production Process | Start, Stop | Start the production of the cylinders under the sales order |

### Cylinder Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Print Cylinder Info | Search, Print | View cylinder info and print out |
| Update Cylinder Priority | Search, Update |  |
| View Cylinder Progress Log | View | View all the work performed on the cylinder |
| Send Cylinder To Step | Update | Move cylinder to another step |

### Employee Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Employee | Create | Create new employee |
| Manage Employee | Search, Update, Delete, Manage –Employee-Role | Search, Update, Delete |
| Print Worker’s Mark Report | View | View the status of all cylinder belonging to sales order |

### Queue Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| View Queue | View, Export to Excel | View the list of cylinder currently under a workflow |

### Role Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Role | Create | Create new role and assign access rights to role |
| Manage Role | Search, Update, Delete | Search, Update, Delete |
| Approve Role Change | Approve | Approve role-change requested by another user |
| Create Access Rights | Create | Create new access right |
| Manage Access Rights | Search, Update, Delete | Search, Update, Delete |

### User Account Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create User Account | Create | Create new user account |
| Manage User Account | Search, Update, Delete |  |

### Formula Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Employee | Create | Create new employee |
| Manage Employee | Search, Update, Delete, Manage –Employee-Role |  |
| Print Worker’s Mark Report | View | View the status of all cylinder belonging to sales order |

### Error Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Error | Create | Create new error and assign to a workflow |
| Manage Error | Search, Update, Delete | Search, Update, Delete |

### Log Out Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Log Out | Log Out |  |

## Thick Client

The home page of the thick client contains these menu items:

* Login Page

### Login Page

Here the user can log in to the system with the following input:

|  |  |  |
| --- | --- | --- |
| **Input** | **Type** | **Description** |
| Username | Text Input | Enter by keyboard |
| Password | Password Input | Enter by keyboard |

After logging in, user will be able to access the main page with the following menu items (subject to user’s assigned roles and access rights)

* Workflow Menu
* Step Menu
* Performance Formula Menu

### Workflow Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Workflow | Create | Create new workflow and add steps to it |
| Manage Workflow | Search, Update, Delete | Search, Update, Delete |

### Step Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create Step | Create | Create new step and link to other steps |
| Manage Step | Search, Update, Delete | Search, Update, Delete |
| Print Step List | View |  |

### Performance Formula Menu

Here the user can perform the following functions:

|  |  |  |
| --- | --- | --- |
| **Page** | **Action** | **Description** |
| Create formula | Create | Create new formula and assign to a step |
| Manage formula | Search, Update, Delete | Search, Update, Delete |