**Asset integrity management system**

PIPING MODULE

**SOFTWARE DEVELOPMENT**

**ANALYSIS / DESIGN DOCUMENT**

**Document History**

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| --- | --- | --- | --- |
| **Version** | **Date** | **Who** | **Notes** |
| 1 | 03-04-2020 | Praveen Mondithoka | Prepared Basic Draft |
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| **Project Code:** | PIPING MODULE | **Project Name:** | | PIPING MODULE |
| **Client Name:** | Asset Integrity Management System | | | |
| **Sprint -** |  | **Type:** | New Development | |
| **Complexity:** | Medium | **Priority**: | High | |
| REQUIREMENT ANALYSIS **Supporting documents**    **FEATURES**   |  |  | | --- | --- | | **Limitations of Existing Tool** | **Features Targeted in New System** | | Not user friendly. | Simplified system with user friendly as top priority | | Very expensive and affordable only for very big companies. | Affordable price for mid and small companies | | Needs to navigate in many pages for completing one inspection activity. | One inspection – one screen entry.  Drill down ability from plant to individual action – by simple clicks. | | API 580 and 581 new additions have more simplified approaches. | In accordance with API 580/581 – software certification by 3rd party. | | Robust and complicated systems. | Business intelligence for better decision making with dashboard approach.  Simplified Reports. | | Most of them not taken into consideration the supporting modules like Project management, Stores incoming material inspection etc. | Supplementary modules like New equipment fabrication quality follow-up, NDT reports, Welding quality control module etc.  PRV criticality ranking and management module, IOW monitoring module, KPI module. |  * The web application shall have configurable option to configure with the handshake of master and transactional data. * The web application shall have configurable option to configure with other web application through their interfaces.   **USER FUNCTIONALITY**   1. **Login**   User logs into the application using his Employee ID and Password. If the authentication fail, he is asked to enter again. if it is successful, then the home page loads up.  Assumption: There will be 100 users and concurrent users are 50. The system should be easily operated users with education qualification of ITI.  The users are assigned with roles and role is configured with a set of menu along with actions (Edit, Add, View, Search etc.)  **User Accessibility:**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **TABLE** | **ROLES** | | | | | | | | **Inspector** | **Integrity Engineer** | **Head of Integrity** | **Maintenance** | **Operation** | **Admin** | **General** | | Piping Master | V | A/U | V | V | V | C | V | | Piping Report-Gen | A | A/U | V | V | V | C | V | | Piping Report-TML | A | A/U | V | V | V | C | V | | Piping Report-Confidence | V | U | V | V | V | C | V | | Piping Report-Observations | A | A/U | U | V | V | C | V | | Piping Report-Recommendations | A | A/U | U | V | V | C | V | | Piping Report-Reom-Status | V | U | V | U / V | U / V | C | V | | Corrosion Study Table | V | A/U | V | V | V | C | V | | Cluster Table | V | A/U | V | V | V | C | V | | POF calculation | V | A/U | V | N | N | C | N | | COF calculation | V | A/U | V | N | N | C | N | | Inspection Program | V | A/U | V | N | N | C | N | | Management Table | V | V | V | N | N | C | N | | Plant Organisation table | V | V | V | N | N | C | N | | Distribution table | V | V | V | N | N | C | N | | Dashboard configuration table | V | V | V | N | N | C | N | | Table cross reference table | V | V | V | N | N | C | N | | **Total Number of expected users** | **50** | **20** | **4** | **100** | **100** | **2** | **1000** | |  |  |  |  |  |  |  |  | | N: not even visible |  |  |  |  |  |  |  | | V: View only |  |  |  |  |  |  |  | | U: Update |  |  |  |  |  |  |  | | A: Add |  |  |  |  |  |  |  | | C; Complete access |  |  |  |  |  |  |  | | Approval Workflow for the highlighted Roles wherever approval is required. | | | | |  |  |  | | U / V: Update option for specific individual user, But will have view only option for other individual users. | | | | | | | |  1. **Home (**Dashboard**)**  * Top menu: Tabbed with different modules - *Static Equipment, Piping, Storage Tanks, Pressure Relieving devices, Home with configurable KIPs, Reports, Action Follow up, Integrity management statistics, IOWs, Project Management, Welding Quality control.*   Currently need to implement Piping module only.   * Left menu: Navigation menu with drill down options from plant to individual equipment.   Example – Parent Plant » Child Plant » Fluid » Equipment  Ammonia » Ammonia – 1 » 30 » 601.AL1001   * Right menu: Filters out and shows all the related documents (Piping reports, POF master records, COF master records, IOW records, Project records, Repair Procedure records etc.) of the equipment based on selection from left menu. When document clicked then form related to that document to be opened in the center display area as additional tab. * Middle: Shows the overall statistics at the plant level and the master data if drilled down from plant to equipment.   Drill down ability from plant to individual action – by simple clicks.  Approval process and action pending using dash-board approach.   1. **PIPING Master**   Data is supplied by the user either in excel sheet or directly from the screen is entered in PIPE\_MASTER table.  Assumption: Each plant can have maximum 50,000 Equipment (assets). Piping master upload Excel sheet contains maximum 50,000 rows.   1. **Piping Clusters and Corrosion Study**  * The process of grouping the equipment (lines) into piping clusters. * Corrosion loop numbers are updated by the user in PIPE\_MASTER tables after corrosion study based on fluid and operating conditions. * A separate record is created in the PIPE\_CLUSTER table for all unique piping clusters from pipe master table.  1. **Consequence of failure calculation**   In COF\_MASTER table calculation of COF done using data from PIPE\_MASTER and PIPE\_CLUSTER.   1. **Probability of failure calculation**   Core Calculation logic will be written by client as we don’t have knowledge on API 579 codes, this has to be included by us into the system.   1. **Assigning Inspection Strategies and Frequency**   Once the POF for each DM and COF for each line is calculated, the inspection strategies are picked from DM\_MASTER table based on the priority in the risk matrix for each DM.   1. **Inspection Reporting and Ever-greening Process**   Inspections are performed and findings along with recommendations and inspection confidence levels are reported in PIPE\_REPORT.   1. **User Management**  * Create User * Create Role * Create Menu/Action * Assign Roles * Forgot/Reset Password  1. **Logout**   Remove Session     1. **Job Scheduler**  * Email Alert * Update POF and risk ranking every year (31st Dec Night)  1. **Reports**   **Tables**   1. PIPE\_MASTER 2. PIPE\_CLUSTER 3. COF\_MASTER 4. DM\_MASTER 5. CREEP\_THERSHOLD 6. POF\_MASTER 7. POF\_IC (+ related tables) 8. POF\_SCC (+ related tables) 9. POF\_EC (+ related tables) 10. POF\_CUI (+ related tables) 11. POF\_EXSCC (+ related tables) 12. POF\_NT (+ related tables) 13. POF\_CREEP 14. POF\_HTHA 15. PIPE\_REPORT 16. TML\_HIST 17. INSP\_CONFIDENCE 18. EXTN\_CONDITION 19. RECOM\_ACTIONS 20. PLANT\_MASTER 21. USER\_ROLE\_MASTER 22. USER\_MASTER 23. MENU\_MASTER 24. REPORTS\_MASTER 25. EMAIL\_ALERTS 26. QUICK\_LINKS 27. PLANT\_DISTRIBUTION\_MASTER   **QUESTIONS**   1. **Domain**   ================================  Working Process - Piping Master, Piping Cluster, Risk ranking (COF, POF), Assigning damage mechanism, inspection strategies and frequencies, Inspection, Piping Report.  **Questions:**   * What is the prerequisite for each activity? * Provide some example/screenshots of the flow/activity? * What is the scope of the project?  1. **User Management**   ================================   * User logs into the account using his Employee ID and Password. * Role Based security. * The user is assigned with roles and role is configured with a set of menu along with actions (Edit, Add, View, Search etc.). * Approval process and action pending using dash-board approach.   **Questions:**   * For each role we would like to know   + What are the daily activities that the individual needs to achieve using the app?   + What are they looking for?   + What actions will they take based on the information that they see on the dashboard?   + How much time does it take to do these activities today?   + What are the problems that they face with the current system to achieve their goals?   + What are the critical tasks to be performed?  1. **Inventory/Master/Inspection**   ================================  **Questions:**   * We discussed how inspection is done and that manual reports are fed into the system. If there is anything additional to this, please add. * What are the different groups or sub levels within (ex: Ammonia)? Can you give us an example of some of the actions that different users will take on a daily basis considering the existing mockup?   If you can show us an example of what each type of user is looking for and how they will use the application (using existing mockup) we will be able to understand much better how the system is being used and it will help us design a system that can provide better results quicker based on the user.   1. **Technical Stack:**   ================================   * UI - Angular (Angular Material) * API - C#/Asp.net Web API core * DB - Postgresql   **Questions:**   * Should go with Open source technologies or any licensed software? * What is the estimated software cost? * For reports, do we need to use licensed crystal reports or any open source tool for reports?  1. **Database**   ===============================   * User Management: USER\_MASTER, ROLE\_MASTER, MENU\_MASTER, USER\_ROLE\_MASTER, QUICK\_LINK\_MASTER * Master: PLANT\_MASTER, PIPE\_MASTER, PIPE\_CLUSTER, COF\_MASTER, POF\_MASTER, DM\_MASTER, CREEP\_THRESHOLD, POF (IC, SCC, EC, CUI, CREEP, NT, HTHA, EXSCC) * Transaction: PIPE\_REPORT, INSP\_CONFIDENCE, EXT\_CONDITION, TML\_HISTORY, RECOM\_ACTIONS * Email Alert: PLANT\_DISTRIBUTION\_MASTER, EMAIL\_ALERT * Reports: REPORT\_MASTER   **Questions:**   * Which tables get affected in work process (Piping Master, Piping Cluster, Risk Ranking (COF, POF), Assigning DM, Inspection, Piping Report)?   **SOFTWARE COST**  **Softwares**   |  |  |  |  | | --- | --- | --- | --- | | **#** | **Tools** | **Project** | **Cost in Rs.** | | 1 | Web API Core 3.0 | Web API |  | | 2 | SQL Server 2016 | DB | 56,000 + 13,000 per user | | 3 | Postgre SQL | DB |  | | 4 | Angular 8 | UI - Angular |  | | 5 | SAP Crystal Reports, version for Visual Studio | Reports |  |   **Deployment Servers**   |  |  |  | | --- | --- | --- | | **#** | **Environment** | **Cost in Rs.** | | 1 | Production – Server with Windows server OS | 8,00,000 | | 2 | Testing – Desktop with Windows server OS | 2,00,000 | | 3 | Development – Desktop with Windows server OS | 2,00,000 |   **Development Tools**   |  |  |  |  | | --- | --- | --- | --- | | **#** | **Tools** | **Project** | **Cost in Rs.** | | 1 | Visual Studio 2019 | Web API | 70,000 / user | | 2 | SQL Server (SSMS) | DB – SQL server |  | | 3 | Postgre SQL (Pg Admin) | DB - Postgresql |  | | 4 | Visual Code | UI - Angular |  | | 5 | Bitbucket | Code Repository | 350 / user | | 6 | JIRA | Project Management | 550 / user | | 7 | IIS Express | Web server |  | | 8 | Chrome, IE | Browsers |  | | | | | |
| Mockup screen to achieve these functionalities. | | | | |
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| SOLUTION DESIGN AND IMPLEMENTATION **UI, API and Database**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **UI** | **API** | **Database** | **Job Scheduler** | **Reports** | | Angular 8  **(***Angular Material***)** | .NET C# Web API Core 3.0  [JWT authentication](https://www.toptal.com/angular/angular-6-jwt-authentication)  Entity framework – code first | Postgresql | Quartz.net | Angular |     Dependency Diagram of API Project | | | | |
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# RISK/LIMITATION

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| **Sl. No** | **Details** | **Response** |
| 1. | Skill gap – Domain | Existing application (Lloyd’s Register) screenshots |
| 2. | Job Schedular | Identify the tool |
| 3. | UI - Graphs and statistics | Identify the tool |
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# SOFTWARE TESTING

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| **Testing Scope:**  Test PIPING Module Flow as per the Test cases located in  Test Case-  Test Plan-  Acceptance criteria -  Test Results - |

# SOFTWARE DEVELOPMENT REVIEW AND APPROVAL

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| Prepared By | Praveen Mondithoka | Date: | 03-04-2020 |
| Approved By |  | Date: | - |
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