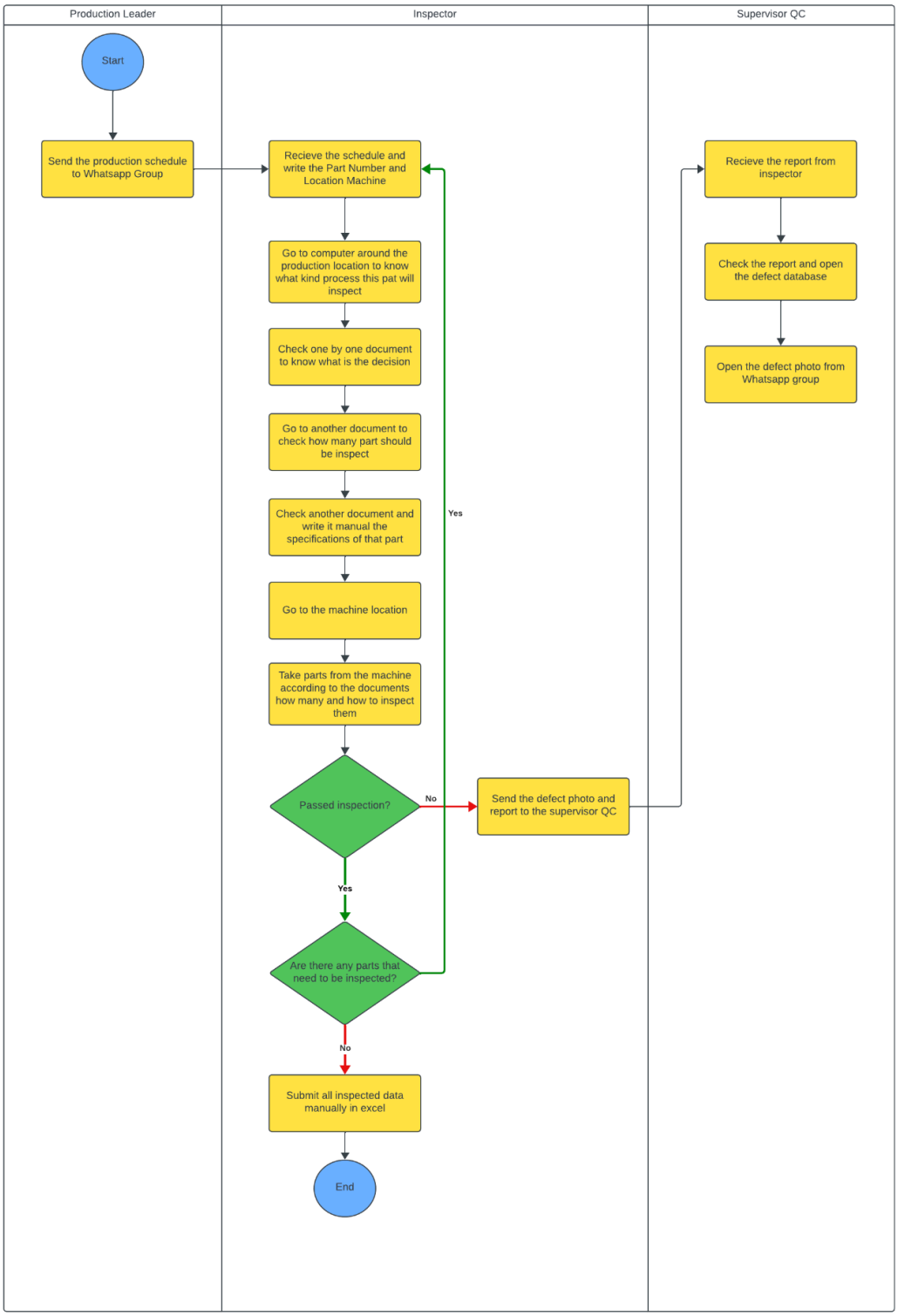
F-200

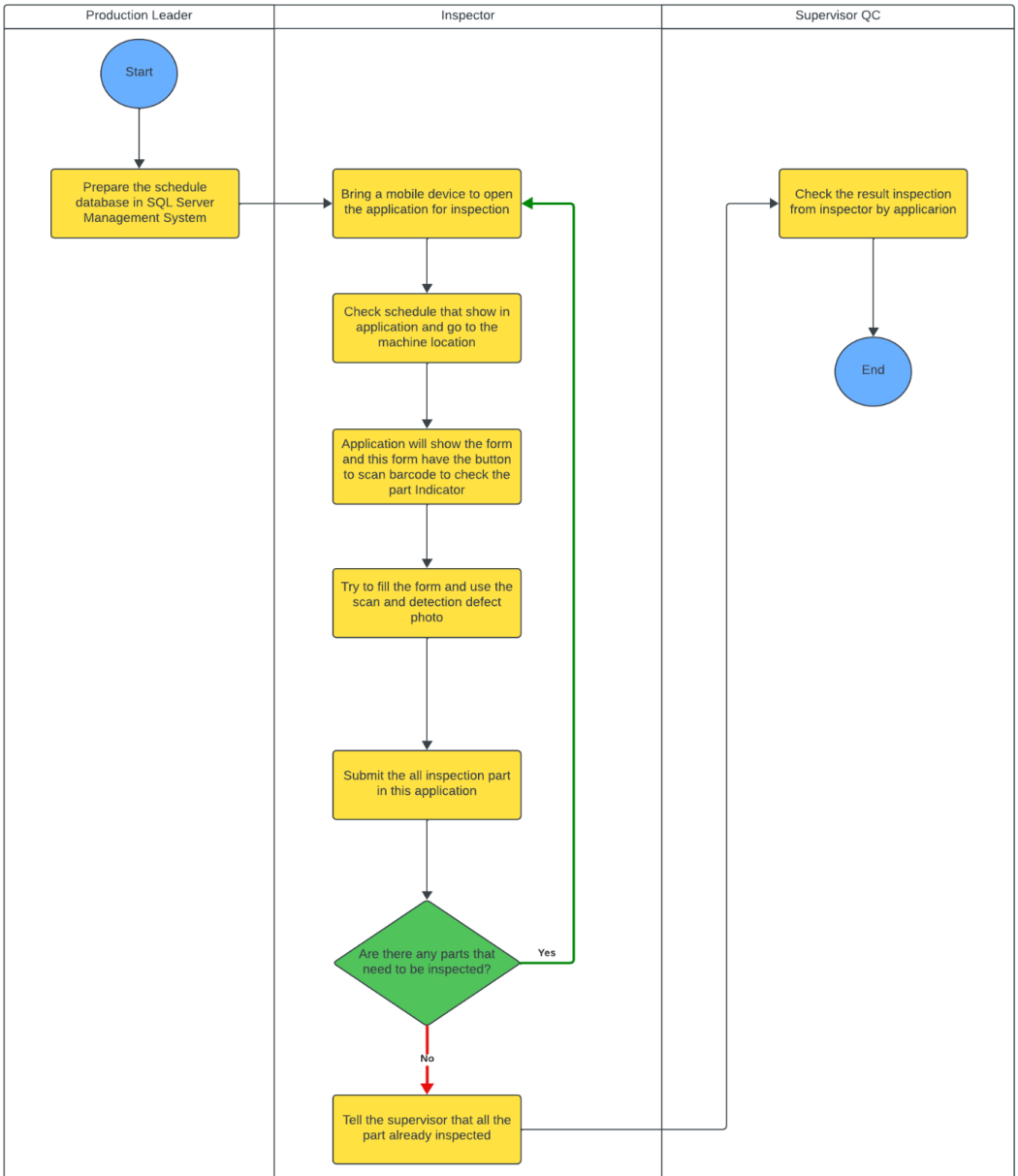
SPECIFICATION

2.1 Existing Business Process



The existing process within the inspection industry involves manual and fragmented procedures. Inspectors typically receive the daily production schedule via group messaging apps, containing details on parts to be inspected and their respective production machines. Inspectors must navigate separate systems or documents to access inspection guidelines, often requiring them to move away from production areas to computers for reference. Upon inspecting parts, inspectors manually fill out extensive paper-based forms and subsequently input this data into Excel databases. This method poses a risk of human error and inefficiency in decision-making due to the time-consuming, manual nature of these tasks. Furthermore, the identification and reporting of defects often involve a separate

1. Proposed Business Process



In the proposed digitalized process, inspectors gain access to a centralized platform offering a comprehensive daily schedule that directly presents part details, their respective machines, and prior inspection records. With an automatic link to inspection guidelines, inspectors seamlessly access this information within the application interface, eliminating the need to navigate external systems. The application's automatic form-fill feature streamlines the inspection reporting process by populating forms with relevant data from the schedule, reducing human error and time spent on manual data entry. Additionally, defects are reported instantly through the application, enabling inspectors to photograph and submit defect reports directly within the platform. This integrated approach minimizes delays, fosters quick decision-making, and ensures a more secure and efficient handling of inspection data, significantly reducing the risk of errors and enhancing overall productivity within the inspection workflow.

2.2 Global Description of The Product

2.2.1 Main Functionality

- **The Inspector can detect product defects using a camera**

  The main function of the project is the Automatic Product Defect Detection by Camera. In manufacturing, inspectors often struggle to examine every tiny detail of products for defects, especially during long shifts lasting more than 6 hours. Using technology to detect product defects will assist inspectors in identifying issues more effectively. This functionality uses a camera to automatically detect any issues, making the process of inspecting products easier. Inspectors can quickly scan the items rather than having to look at each one closely. The application will display any defects in a clear and visible way on the

screen. Human errors are prevented and issues are resolved more quickly in this way.

- **The Inspector can detect parts along with the autofill suggestion quickly**

  This functionality uses a camera to automatically scan parts and directly provides key details, feedback and suggestions such as inspection duration, material composition, and part type for the inspection purpose. It estimates and displays real-time inspection times, aiding in efficient workflow planning. The system goes beyond identification, offering insights into the materials used in each part, enhancing decision-making for quality control.

- **The Inspector can quickly making decision of inspection schedule**

  By automating the processes of production scheduling and inspection decision-making. It allows for easy access to the production schedule and provides detailed information about every part, including machine locations and previous inspection records. It offers a pivotal feature allowing direct input of inspection decisions within the application, drastically reducing human error during inspections. This innovative solution not only streamlines the previously manual scheduling tasks but also empowers inspectors to make accurate decisions promptly.

1. User Characteristics

Explain the type and the characteristics of the user.

Users	Responsibility	Access rights	Education Levels	Skill Levels	Experience	Type of Training

Inspector	Responsible for inspecting products, identifying defects, and ensuring compliance with quality standards.	No Acess right needed	Typically, a bachelor or equivalent, with additional training in quality control processes and procedures.	Proficient in understanding inspection guidelines, using the application for defect identification, and conducting quality assessments.	Proficient in understanding inspection guidelines, using the application for defect identification, and conducting quality assessments.	Basic training during onboarding to familiarize inspectors with the application, navigation, and basic inspection procedures.

2. Constraints

The constraints of our product from the user's point of view

1. Skill Level Variation:

   Constraint: Users with different skill levels may find it challenging to navigate the application if it does not cater to varying levels of expertise in quality control processes. This constraint could affect the overall usability and efficiency of the product.

2. Compatibility Issues:

   Constraint: Users might face frustration if the application is not compatible with their preferred devices or operating systems. This constraint could limit their flexibility and convenience in using the product.

3. Product Development Environment

a. **Hardware :**

The development of this system will need a hardware to run the system well, The company should have several hardware, there will be need:

Hardware	Function
Laptop	Develop Quality Control Mobile Application

b. **Software :**

The development of this system will need a software to run the system well, The company should have several software to develop the system, there will be need:

Software	Function
Chrome	Used to open the web-based application created to run the defect detection system.
Microsoft Power Apps	A mobile application that supports the QC Inspection Process. Power Apps is useful for creating logic coding, designing UI/UX, and providing a bridge for users to access the system.
Microsoft SharePoint	Serves as a cloud database for storing various data, such as a list of part

	numbers.
Microsoft On-premises gateway	Acts as a bridge to enable Power Apps and SSMS (SQL Server Management Studio) to run and interconnect seamlessly.
Microsoft Power Automate	Filters several defect image submissions made by inspectors through the system.
Microsoft SQL Server (SSMS)	Used for data history and as the main database for inspection results filled by inspectors through Power Apps.
Visual Studio Code	Useful for creating coding flows for various modules that require a web-based approach.

c. **Connection:**

The development of this system will need a connection internet to run the system well, The company should use internet connection to develop the system, there will be need:

Connection	Function
4G Internet Connection	Internet network, which is really needed to develop of the system
Wi-Fi Connection	Another internet connection to develop the system.

4. Product Operational Environment

a. **Hardware:**

To run the system, the company should have several pieces of hardware to use it well. Here's the hardware needed:

Hardware	Function
Laptop	Display Quality Control Mobile Application
Tab/Mobile Phone	Display Quality Control Mobile Application

b. **Software:**

To run the system, the company should have software as a container to access the system to use it well. Here's the software needed:

Software	Function
Chrome	Used to open the web-based application created to run the defect detection system.
Microsoft Power Apps	A mobile application that supports the QC Inspection Process. Power Apps is useful to run the Mobile Application of Daily Inspection Quality Control

c. **Connection:**

To run the system, the company should have an internet connection to use the system well. Here's the internet connection needed:

Connection	Function
4G Internet Connection	Internet network, which is really needed to run of the system
Wi-Fi Connection	Internet network, which is really needed to run of the system

2.3 Requirement Analysis

2.3.1 External Interface

Interface between the product and the user :

Hardware Interface :

- Processor: 1.60 GHz or faster with two or more cores. For unattended mode, four or more cores are needed.
- Storage: 2 GB
- RAM: 4 GB
- GPU acceleration

Software Interface :

- Operating System: Windows 10 or later, macOS 10.13 or later
- Developing Tools: Microsoft Visual Studio Code
- Application: Microsoft SharePoint, Microsoft On-premises gateway, Microsoft Power Automate, Microsoft Power Apps
- Data Base: Microsoft SQL Server (SSMS)

Connection Interface :

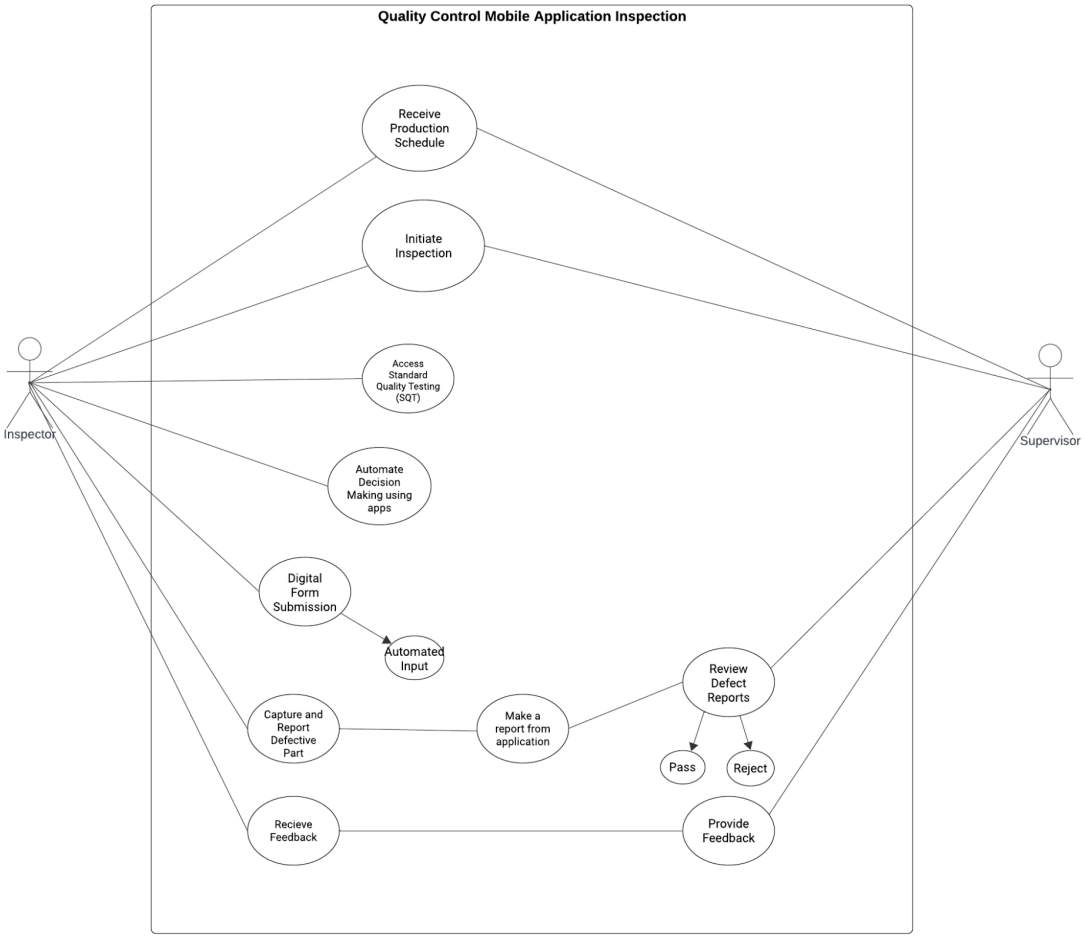
- The product requires a stable internet connection for seamless integration with SharePoint, On-premises gateway, Power Automate, and Power Apps. This

ensures real-time collaboration, data access, workflow automation, and application development.

- For on-premises configurations, a secure local network connection is necessary to establish communication between the product and the associated hardware and software components.

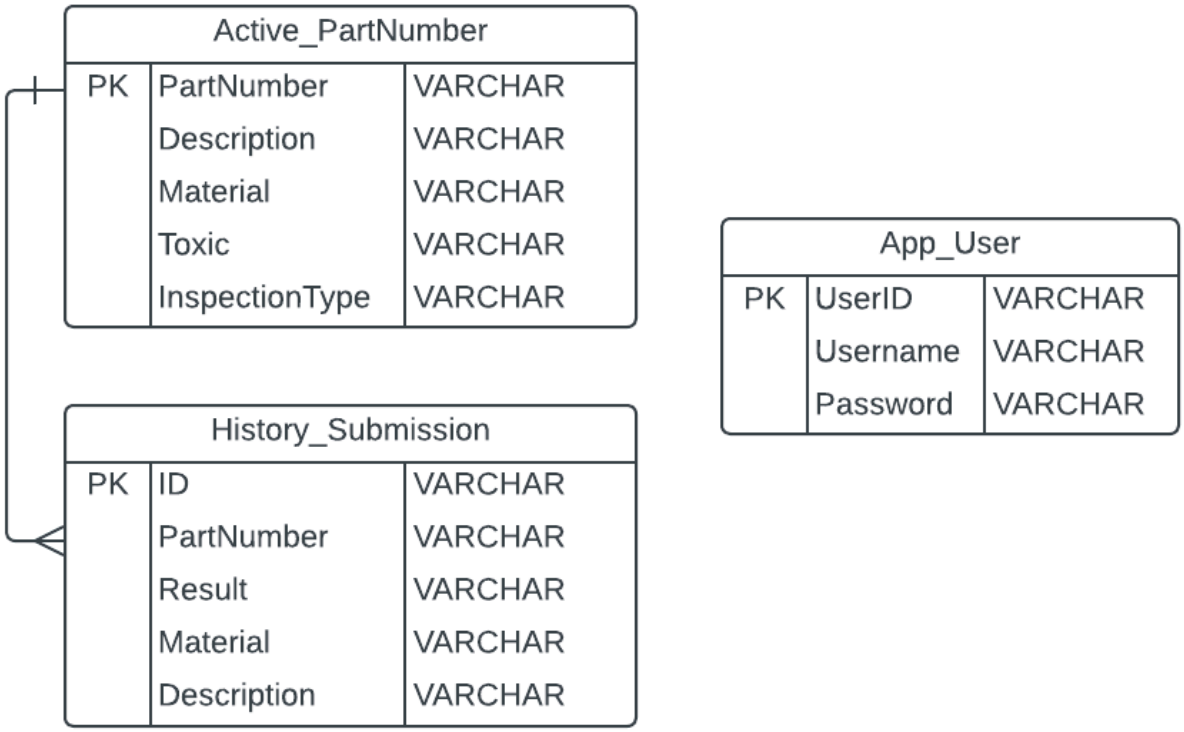
1. Functional Description

    1) **Use Case Diagram**


Quality Control Mobile Application Inspection
Receive Production Schedule
Initiate Inspection
Access Standard Quality Testing (SQT)
Automate Decision Making using apps
Digital Form Submission
Automated Input
Capture and Report Defective Part
Make a report from application
Review Defect Reports
Pass
Reject
Recieve Feedback
Provide Feedback
Inspector
Supervisor

2. Data Requirement from user's perspective

   a. **ERD (Entity Relationship Diagram)**



   b. **Data Dictionary.**

      1. **App_User**

Field Name	Data Type	Required	Field Size	Description	Example
UserID (PK)	VARCHAR	YES	50	User ID used to log in the Application	98765
Username	VARCHAR	YES	100	Username of the user that used to log in to the website	DhevinD

Password	VARCHAR	YES	50	Password of the user that used to log in to the website	Admin1

2. **Active_PartNumber**

Field Name	Data Type	Required	Field Size	Description	Example
PartNumber(PK)	VARCHAR	YES	50	PartNumber is the Number of some part and it is unique	11011-9018
Description	VARCHAR	YES	255	Description of the part that useful to know what toy this part will user	Red Train with snowball inside
Material	VARCHAR	YES	50	Material of this part that used to inform the user to fill the form	PVC
Toxic	VARCHAR	YES	50	Toxic is some column to define this part toxic or no, the value of this column only “Y” or “N”	Y
InspectionType	VARCHAR	YES	50	InspectionType is to define what kind of	Water

				inspection this part will inspect	

3. **History_Submission**

Field Name	Data Type	Required	Field Size	Description	Example
ID(PK)	Int	YES	50	ID used to know how many data that already submitted, this column is auto increment	1
PartNumber	VARCHAR	YES	100	PartNumber is the Number of some part	11011-9018
Result	VARCHAR	YES	50	Result in this case is to know this inspection PASS/FAIL	PASS
Material	VARCHAR	YES	50	Material of this part that used to inform the user to fill the form	PVC
Description	VARCHAR	YES	255	Description of the part that useful to know what toy this part will user	Red Train with snowball inside

3. Functional Requirement from user's perspective

1. The system can automated and showed production scheduling

The system should automate the scheduling of production activities based on predefined parameters such as machine availability, production priorities, and resource allocation.

2. **The system provide the part scanner to get the detailed information of the part**

The system should include a part-detail scanner functionality that allows inspectors to automatically scan parts and retrieve detailed information such as part number, description, material composition, and inspection history.

3. **The system implementing the intelligent decision support**

The system should provide intelligent decision support capabilities to assist inspectors in making informed decisions during quality inspections. This may include recommending appropriate actions based on inspection results and historical data.

4. **The system can showed the real-time part identification**

The system should be capable of real-time part identification using automated scanning technology, providing key details such as part number/code, and name.

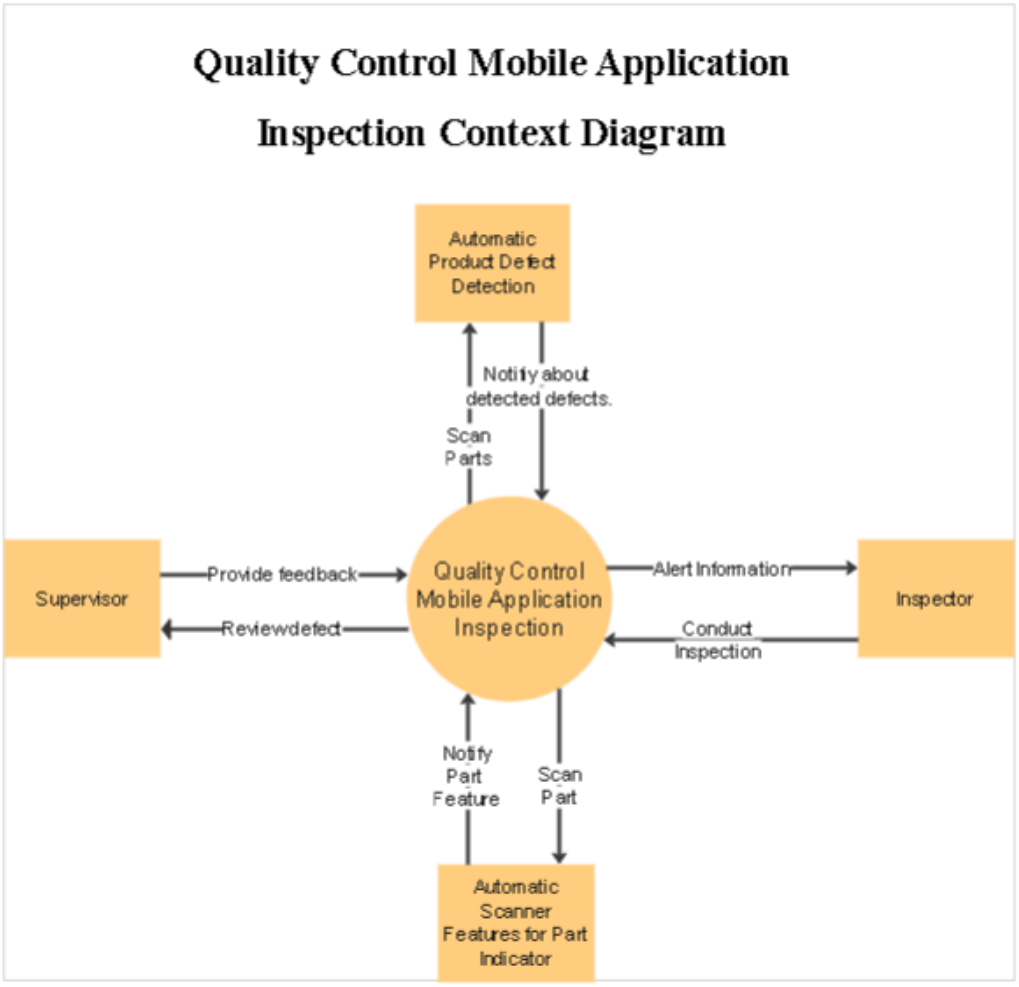
5. **The system can use automated defect detection**

The system should automatically detect defects in products during the inspection process using image processing algorithms and machine learning techniques, improving the accuracy and efficiency of defect identification.

6. **The system give the integrated Quality Assurance guidelines**

The system should integrate standard quality testing (SQT) tutorials and guidelines directly within the application interface, allowing inspectors easy access to relevant information during inspections.

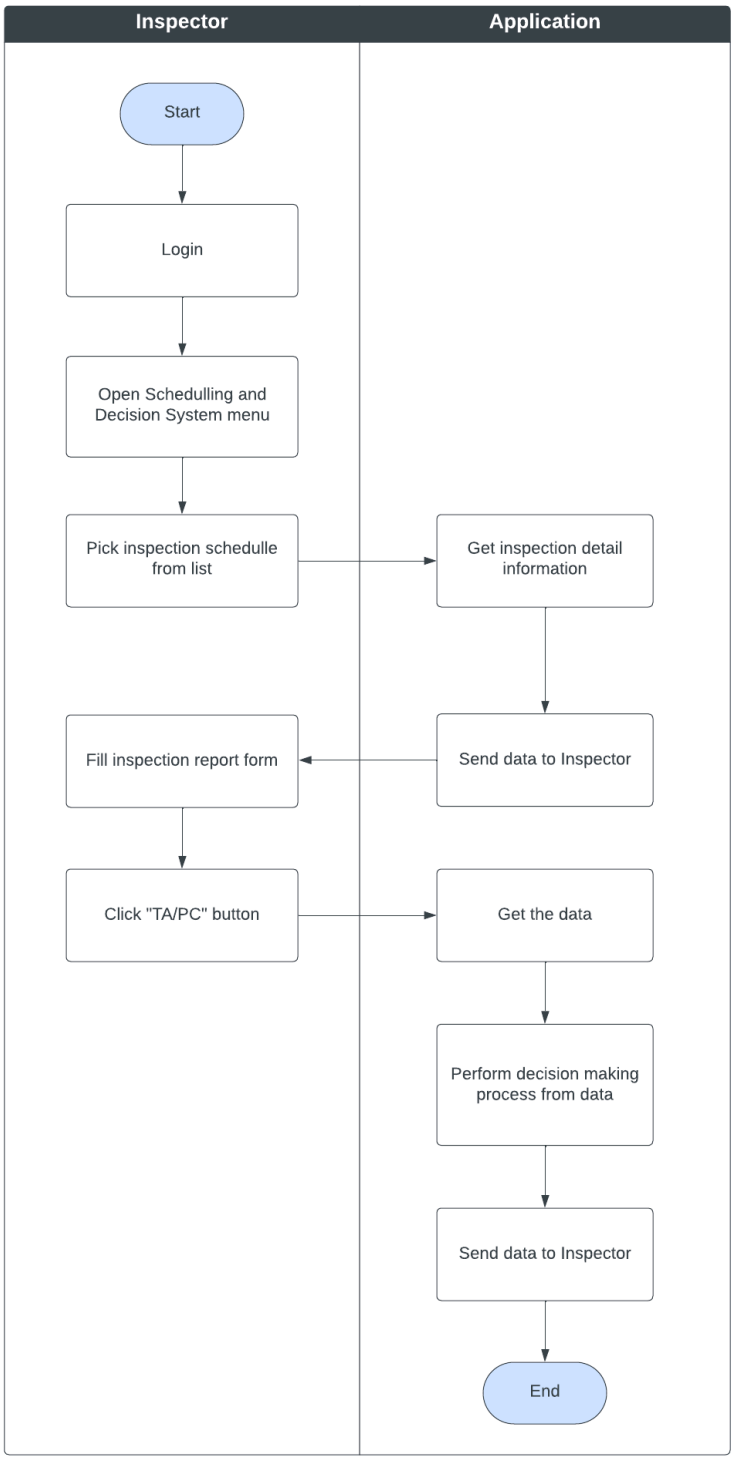
a. **Context Diagram**



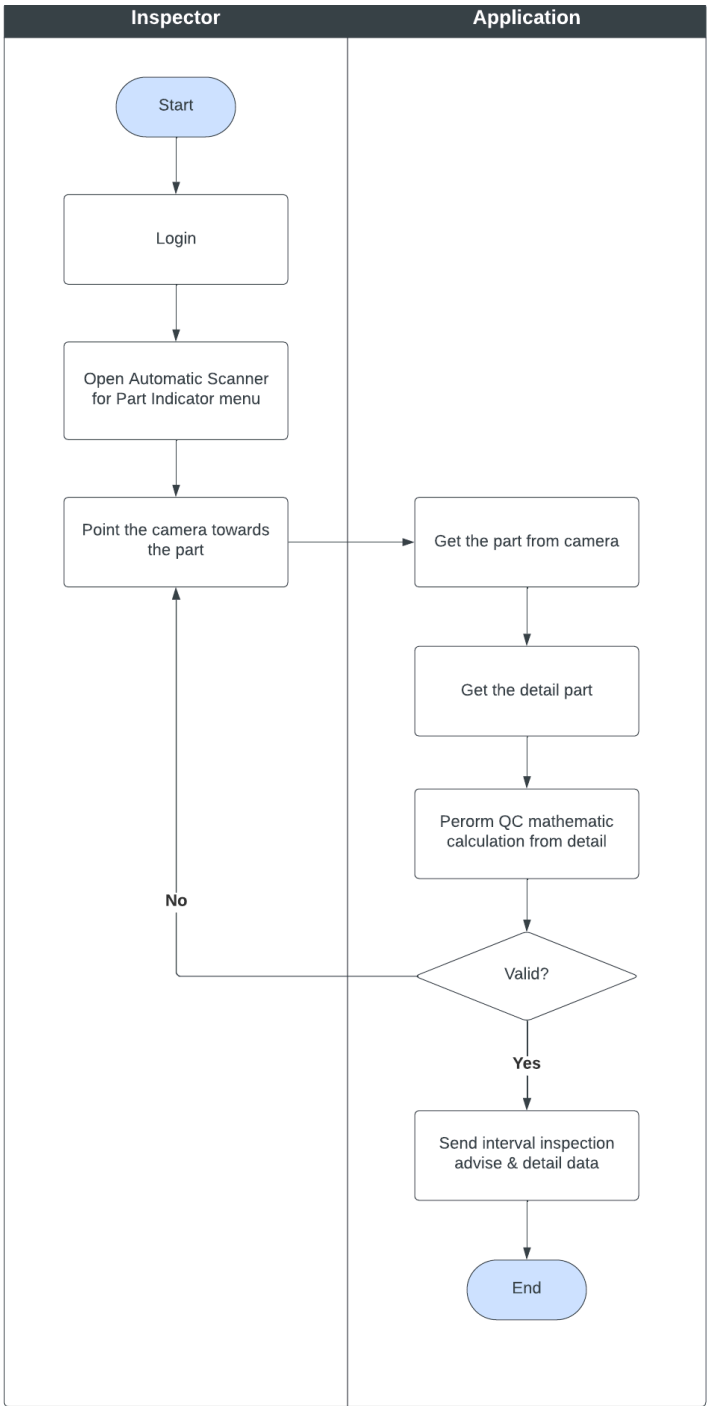
b. **Activity Diagram and Data Flow Diagram**

- **Activity Diagram**

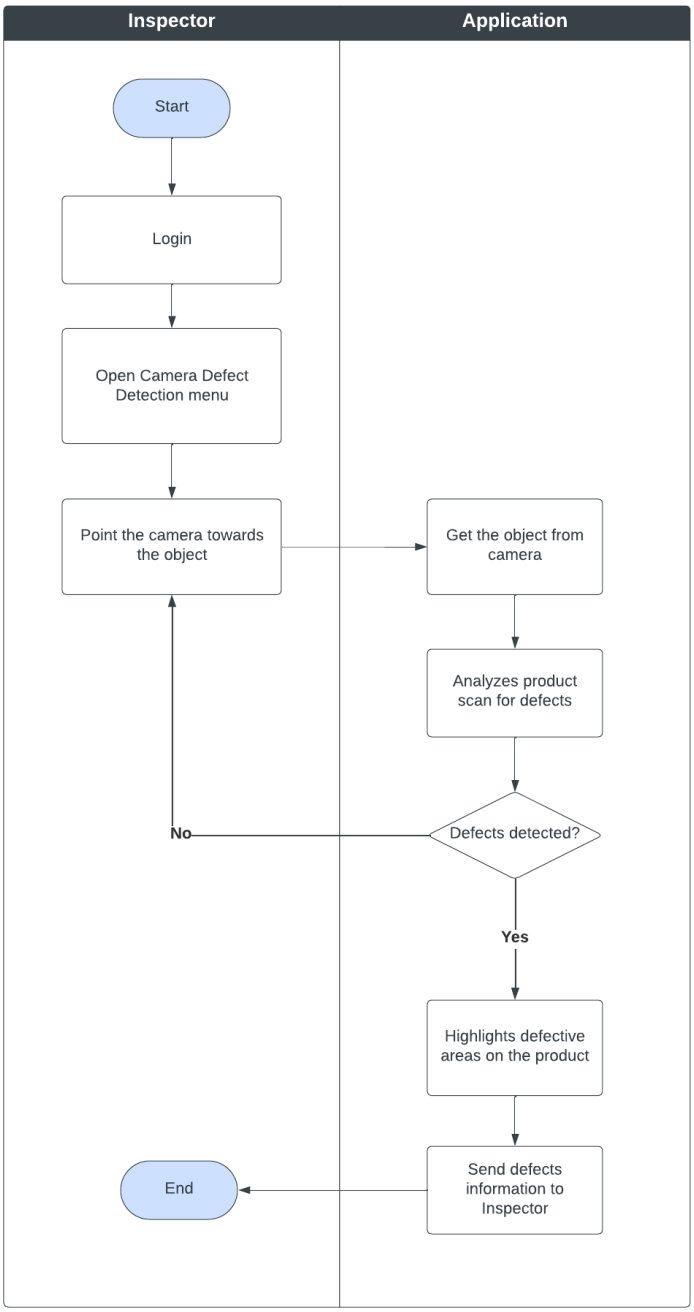
1. **Scheduling and Decision System**


Inspector
Application
Start
Login
Open Schedulling and Decision System menu
Pick inspection schedulle from list
Get inspection detail information
Send data to Inspector
Fill inspection report form
Click "TA/PC" button
Get the data
Perform decision making process from data
Send data to Inspector
End

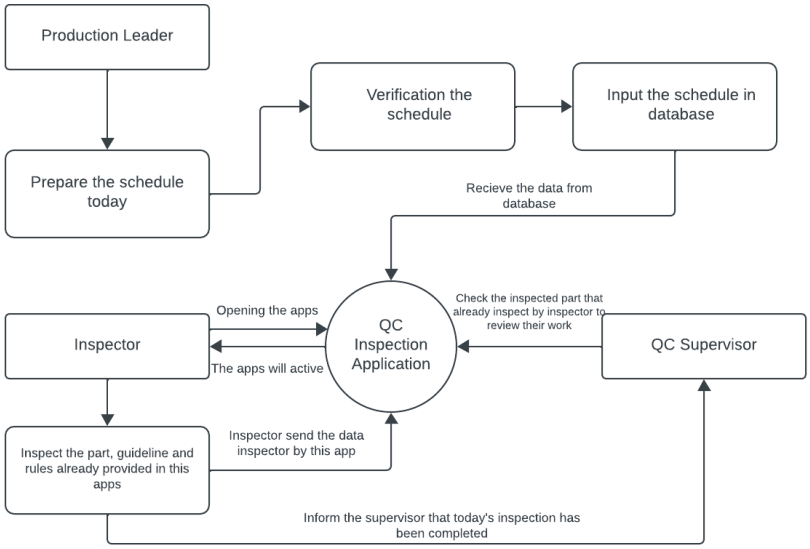
2. The Automatic Scanner Features for Part Indicator



3. **Automatic Product Defect Detection by Camera**



- **Data Flow Diagram**



c. **The Detail of Process Inside The Activity Diagram and Data flow diagram**

- **Activity Diagram**

1. **Scheduling and Decision System**

a. Inspector login to the application

b. Inspector open Scheduling and Decision System menu

c. Inspector pick inspection schedule they want to check

d. Application process the request by get inspection information detail

e. Application send data back to the Inspector

f. Inspector fill the inspection report form in the app

g. Inspector click the button “TA/PC” to automate decision

h. Application process the request by receive the data

i. Application perform decision making process based on received data

j. Application send the decision result data back to Inspector

2. **The Automatic Scanner Features for Part Indicator**

   a. Inspector login to the application

   b. Inspector open Automatic Scanner for Part Indicator menu

   c. Once camera opens, the Inspector points the camera towards the part

   d. Application get the part from camera

   e. Application get the detail of captured part

   f. Application perform QC mathematic calculation from detail

   g. Application check whether the data is valid or not

   h. If no, then application will get new part from camera

   i. If valid, the application will send interval inspection advice along with the detail data of the part to the Inspector

3. **Automatic Product Defect Detection by Camera**

   a. Inspector login to the application

   b. Inspector open Camera Defect Detection menu

   c. Once camera opens, the Inspector points the camera towards the object

   d. Application get the object from the camera

   e. Application start to analyze the product by scanning for any defects

   f. Application check whether the product has defects or no

   g. If no, then the application will get new object from camera

   h. If yes, the application will highlights the defects areas on the product

   i. Application send the defects detail information to the Inspector

- **Data Flow Diagram**

  The QC Production Leader will prepare today's schedule of product’s inspection, they will verify the schedule before inputting to the system. After everything is clear, they will start to input the schedule to the database.

The QC Inspector will inspect the part, they will also have access to the guidelines and rules. Inspector can submit the detailed data of the inspection report and inform the supervisor about their activities. Both tasks will be facilitated by the QC application.

The QC Supervisor will have an overview of the inspected part report that was already inspected by the QC Inspector in the field.

The QC Inspector will inspect the part, they will also have access to the guidelines and rules. Inspector can submit the detailed data of the inspection report. Both tasks will be facilitated by the QC application.

4. Non-Functional Requirement

Parameter	Requirement
Performance	The system ensures a swift response time of under 2 seconds for user interactions.
Reliability	The system will guarantee minimizing the failure rate in operation
Compatibility:	The system is compatible with major web browsers (Chrome, Firefox, Safari, and Edge)
Response time	Provides a maximum response time of approximately 5 seconds
Safety	All data on the system is guaranteed to be safe

2.4 Specification Testing

List of specification testing from <u>user perspective</u>.

1. **Database-Integrated Scheduling and Decision System Testing**

Objective: To validate the functionality and efficiency of the system's scheduling and decision-making features integrated with the database.

Testing Scope: This testing aims to verify the effectiveness and accuracy of the automated production scheduling and inspection decision-making processes, emphasizing the integration with the database. The specific testing scenarios include:

Database Integration Testing

Scenario: Verify seamless integration with the database to access production schedules, part details, machine locations, and past inspection records.

Decision Input Testing

Scenario: Test the system's feature allowing direct input of inspection decisions (TA/PC) within the application, ensuring reduced human error during inspections.

Workflow Efficiency Testing

Scenario: Assess the system's efficiency in automating scheduling tasks and enabling prompt and accurate decision-making by inspectors.

2. **Automated Scanner Features for Part Indicator Testing**

Objective: To ensure the functionality and precision of the automated scanner features for part inspection.

Testing Scope: This testing aims to validate the efficiency and accuracy of the automated scanner features for inspecting parts. The specific testing scenarios include:

Part Scanning and Identification Testing

Scenario: Evaluate the system's capability to automatically scan parts, providing detailed inspection data such as material composition, inspection duration, and part type.

Real-time Inspection Duration Display Testing

Scenario: Verify the system's ability to estimate and display real-time inspection times, aiding in efficient workflow planning for inspectors.

Materials Insight and Categorization Testing

Scenario: Assess how effectively the system identifies materials used in parts, enhancing decision-making for quality control, and categorizes parts for inventory management.

3. **Automatic Product Defect Detection by Camera Testing**

Objective: To validate the accuracy and efficiency of the automated defect detection using the application's camera.

Testing Scope: This testing aims to verify the system's capability to detect defects in products using the camera integration. The specific testing scenarios include:

Defect Detection Accuracy Testing

Scenario: Evaluate the system's accuracy in identifying defective areas when scanning products with the camera, ensuring precise defect recognition.

Defect Highlighting and Recognition Testing

Scenario: Verify the system's ability to highlight problematic areas accurately, aiding inspectors in recognizing and marking defects efficiently.

Quality Control Enhancement Testing

Scenario: Assess how effectively the system boosts defect detection accuracy, expediting the assessment of product quality, and ensuring meticulous quality control. For each item in the specification, the test method is clear and the amount to be measured.