6.4 Table of Formulation

Element	Description	Detector
Initial State	No information about crop health status. Sensors inactive, no collected data.	
Goal State	Accurately identify and classify crop diseases in real-time. Provide insights through UI.	
States	**State 1:** Data Collection Sensors are active, collecting raw image data from crops. **State 2:** Data Preprocessing Raw image data is preprocessed to enhance its quality. **State 3:** Neural Network Analysis Convolutional Neural Networks (CNNs) analyze preprocessed data to extract features. **State 4:** Database Integration Integrate a comprehensive disease database for training. **State 5:** Training Neural Network Train the neural network with learned features and the disease database. **State 6:** Identifying Diseases The trained model identifies and classifies diseases in real- time.	Sensors Active Sensors Preprocessing Collect Data Neural Network Preprocess Data Disease Database Analyze With Neural Network Neural Network Integrate Database Trained Model Train Neural Model

	State 7: Real-time Monitoring Continuously monitor and analyze crop health in real-time. **State 8:** User Interaction Users interact with the system through a user interface to receive insights.	Real time Analysis Identify Disease User Interface Real Time Monitoring
Actions	**Action 1:** Activate Sensors **Transition:** State 1 → State 2 **Description:** Activate sensors to start the data collection process. **Action 2:** Collect Data **Transition:** State 2 → State 3 **Description:** Sensors collect raw image data from crops.	Sensors Active Sensors Sensors Collect Data

	Action 3: Preprocess Data **Transition:** State 3 → State 4 **Description:** Preprocess raw image data to enhance quality. **Action 4:** Analyze with Neural Network **Transition:** State 4 → State 5 **Description:** CNNs analyze preprocessed data to extract features.	Preprocessing Preprocess Data Neural Network Analyze With Neural Network

	Action 5: Integrate Database **Transition:** State 5 → State 6 **Description:** Integrate a comprehensive disease database for training.	Disease Database Integrate Database
	Action 6: Train Neural Network **Transition:** State 6 → State 7 **Description:** Train the neural network with learned features and the disease database.	Neural Network Train Neural Model
	Action 7: Identify Diseases Transition: State 7 → State 8 **Description:** The trained model identifies and classifies diseases in real-time.	Train model Identify Disease
	Action 8: Real-time Monitoring Transition: State 8 **Description:** Continuously monitor and analyze crop health in real-time.	Real time analysis Real Time Monitoring
	Action 9: User Interaction Transition: State 8 **Description:** Users interact with the system through a user interface to receive insights.	User Interface User Interaction
Constraints	• System must operate in real-time • Accuracy in diseases identification is crucial	