

## **This project presents a Simio-based simulation model for a Flood & Weather Monitoring System.**

The model represents three monitoring points along a drainage canal—Upstream, Center, and Downstream—and simulates hourly weather-driven changes in water levels. The system automatically evaluates flood risk, triggers alerts when unsafe conditions occur, and provides visual and statistical performance measures.

### **Data Foundation & Table Setup:**

- Creating a structure csv file to hold the external weather data (Hour Int, Rain\_Up, Rain\_Center, Rain\_Down, Height\_Up, Height\_Center, Height\_Down “Real”).
- Creating a structure table with the same columns name using add table and property.
- Import the csv file inside the table using the Create binding options.
- Setting Base Time Units for Hours.

### **Create the Hourly Weather Objectives:**

- Creating Entity named HourlyUpdate using standard library panel for representing one hour of weather data.
- Creating a Source named HourlySource using standard library panel giving it Entity Type: HourlyUpdate, Interarrival Time: 1 Hour and Max Arrivals: WeatherTable.AvailableRowCount for creating one entity per hour.
- Creating 3 Servers named UpstreamStation, CenterStation, DownstreamStation representing Upstream, Center, Downstream using standard library panel for processing the entity.
- Creating Sink using standard library panel for ending the system.
- Connecting all using connectors.

### **Create State Variables:**

- Defining global states to store and update the current water height during the run using Definitions then state.
- Creating Real States named WaterUp, WaterCenter, WaterDown to store current height.
- Creating Integer States named AlertUp, AlertCenter, AlertDown to store 0 or 1 status.
- Creating Counter States named HourIndex Initial Value = 1 to track the Hour Index.

### **Update Water Height at Each Station:**

- For every server we Add-On Process → Entered to create a new Process using Assign steps → Tally → Decide → Assign.
- For UpstreamStation in Assignment1 Variable name is WaterUp, Variable value WeatherTable[HourIndex].Height\_Up and Assignment2 for Alert Calculation Variable name is AlertUp, Variable value Math.If(WaterUp > 80, 1, 0) → Tally Step recorded the water levels into Tally Statistics for reporting → Decide Step checked if AlertUp == 1 If true → Assign Step incremented the AlertCountUp counter.
- For CenterStation in Assignment1 Variable name is WaterCenter, Variable value WeatherTable[HourIndex].Height\_Center and Assignment2 for Alert Calculation Variable name is AlertCenter, Variable value Math.If(WaterCenter > 80, 1, 0) → Tally Step recorded the water levels into Tally Statistics for reporting → Decide Step checked if AlertCenter == 1 If true → Assign Step incremented the AlertCountCenter counter.
- For DownstreamStation in Assignment1 Variable name is WaterDown, Variable value WeatherTable[HourIndex].Height\_Down and Assignment2 for Alert Calculation Variable name is AlertDown, Variable value Math.If(WaterDown > 80, 1, 0) → Tally Step recorded the water levels into Tally Statistics for reporting → Decide Step checked if AlertDown == 1 If true → Assign Step incremented the AlertCountDown counter.

### **Change Station Color Based on Alert:**

- Red is Alert and Green is safe.
- For each Server using Animation → Status label set the expression to If(AlertUp == 1, Red, Green) / If(AlertCenter == 1, Red, Green) / If(AlertDown == 1, Red, Green)

### **KPIs Performance Measures for Number of Alerts Triggered:**

- Creating 3 counters named AlertCountUp, AlertCountDown, AlertCountCenter using Integer states.
- For every server entered Assign Step incremented the AlertCountUp counter as AlertCountUp, AlertCountUp +1 / AlertCountCenter, AlertCountCenter +1 / AlertCountDown, AlertCountDown +1

### **KPIs Performance Measures for Highest Water Level:**

- Creating Tally Statistics named MaxWaterUp, MaxWaterCenter, MaxWaterDown
- Record values whenever water is updated.

### **KPIs Performance Measures for Time in Alert State:**

- Creating State Statistics named AlertUp, AlertCenter, AlertDown

### **Time Plot – Water Height:**

- Plot WaterUp, WaterCenter, WaterDown
- X-axis: Time

### **Histogram – Rainfall:**

- Histogram using Rain\_Up, Rain\_Center, Rain\_Down

### **PieChart- Average Water Level:**

- Categories: Upstream, Center, Downstream
- Values: Average water height

### **Alert Trend Line:**

- Plot AlertUp + AlertCenter + AlertDown over time

### **Final Results:**

- Peak Water Levels: The system successfully recorded flood peaks of 82, 85, and 90.
- System Reliability: 25 entities were created, and 24 successfully processed through the 24-hour simulation window.
- Risk Metrics: The report identified that while all three stations hit dangerous water levels, the logic correctly identified active alert states for the system, contributing to the "Total Time in Alert" KPI.