

Water Tank Monitoring

TELE6530 Connected Devices

The Problem

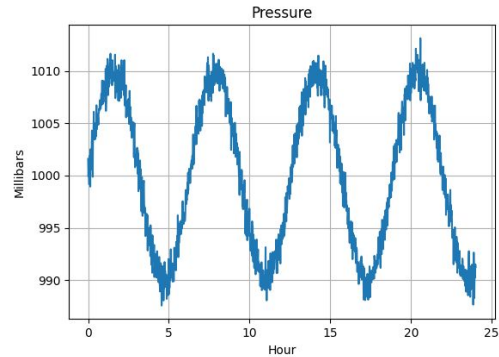
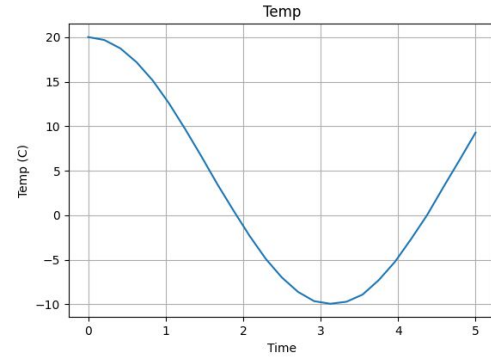
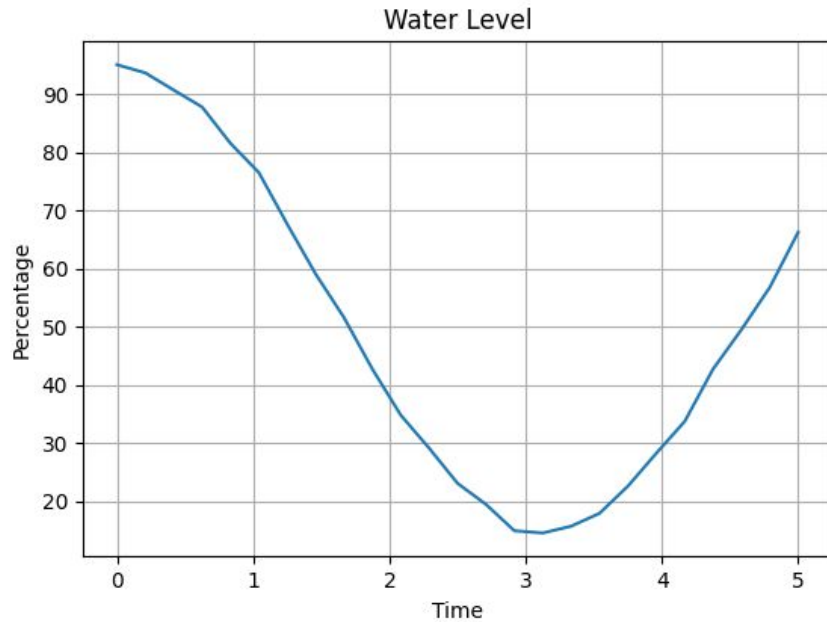
Limited Water Supply

- In India, the city's water department releases water supply on specific days of the week with limited time supply.
 - Each household has a water tank and corresponding motor that need to be manually turned on when there is supply (the supply timings and days are subject to change).
 - The only indication of that the water is filled, is the sound of water overflow from the tank.
 - If no one turns it off the motor once the tank is full, the overflowing water is wasted
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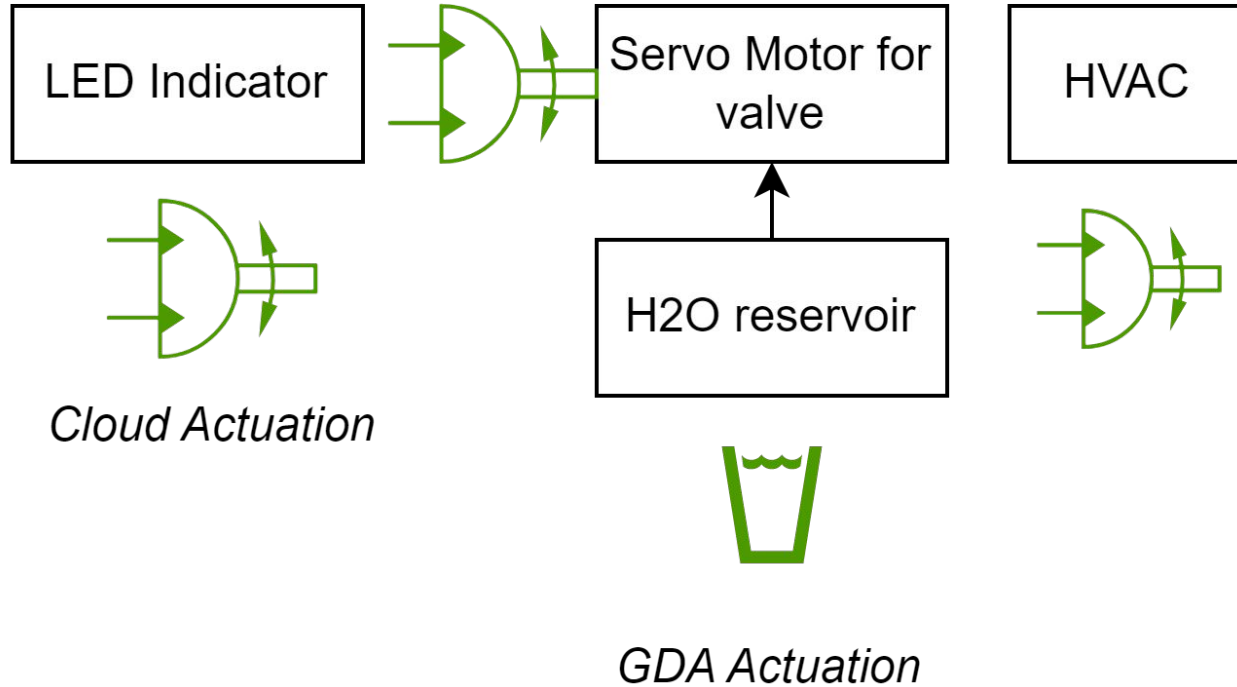
How can
we fix this?

- Using sensors and actuators we can track the physical attributes of the system
 - Using CDA we can communicate with the components
 - Using a GDA we can communicate with a network of CDAs
 - Connecting to the cloud can give us real-time updates wherever we are
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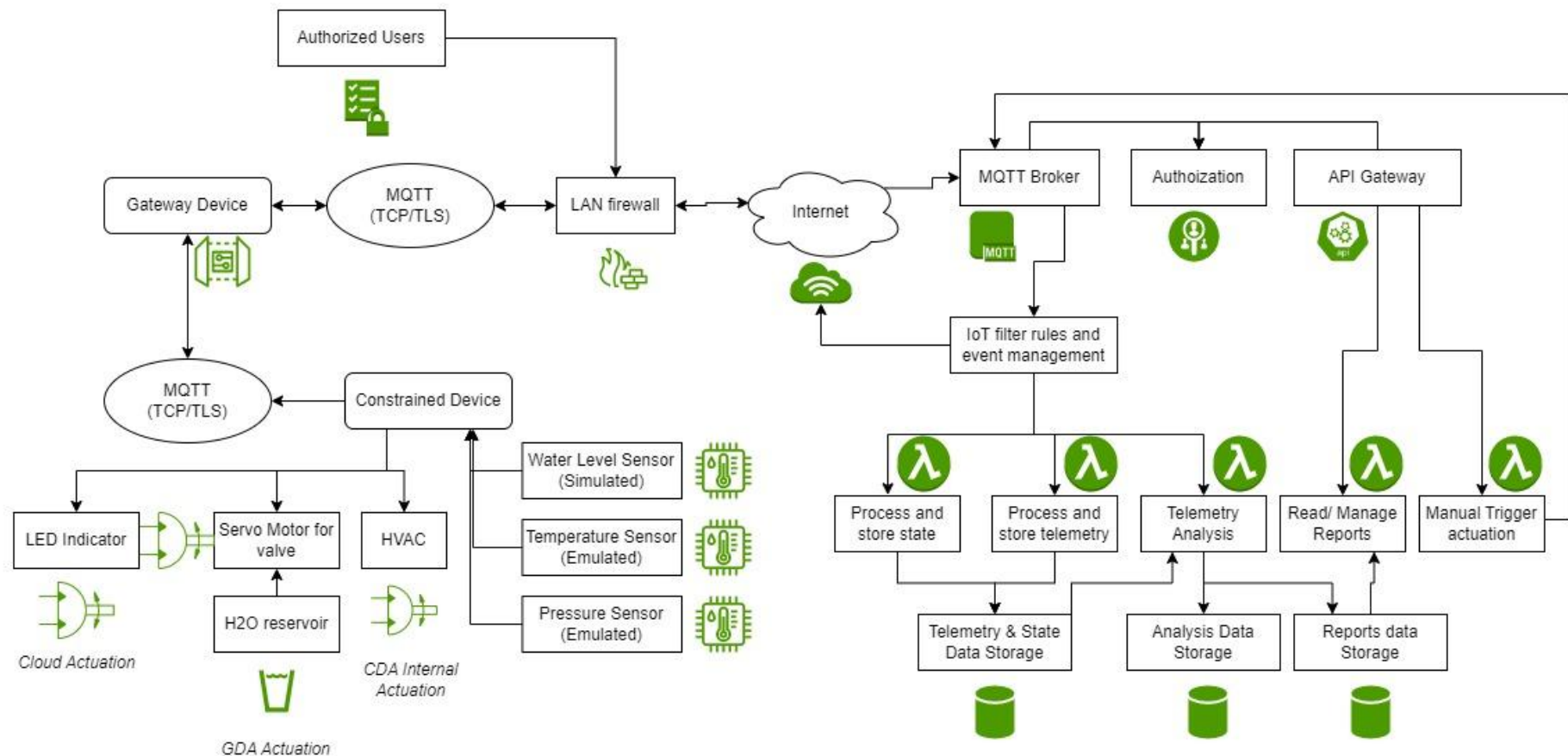
Sensors - Water Level, Temperature, Pressure



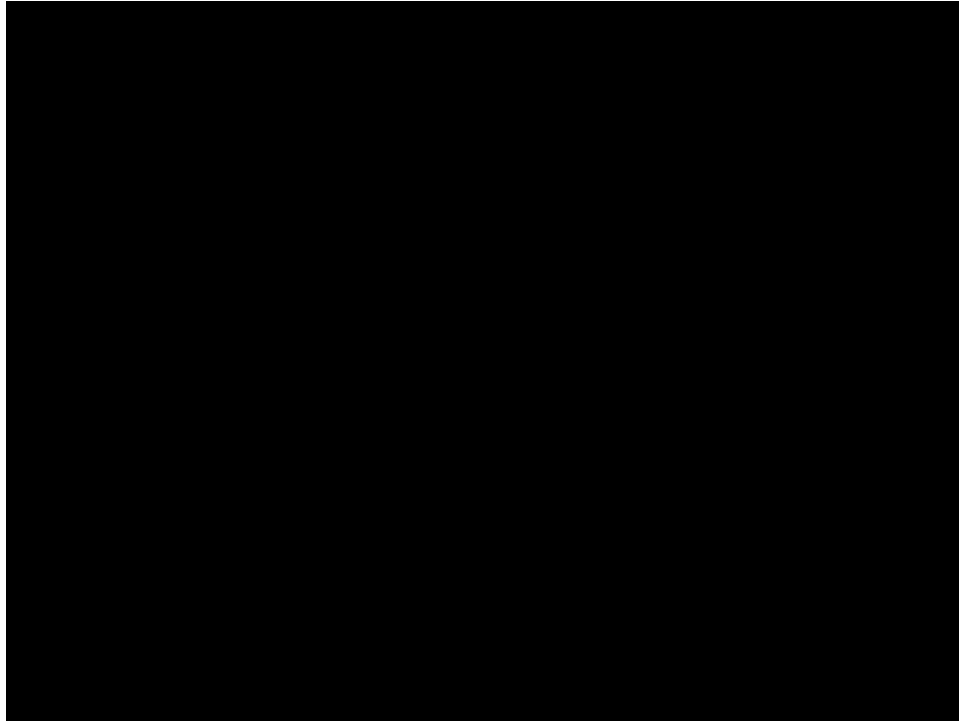
Actuations



Project Architecture



CDA Local Actuation Event



GDA Actuation Event

The screenshot displays a development environment for a Raspberry Pi project, showing a terminal window, an Eclipse IDE window, and a Sense HAT Emulator window.

Terminal Window (pragnya@pragnya-rog: ~/glt/gda-lab-modules-pkondrakunta):

```
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.app.DeviceDataManager handleUpstreamTransmission
INFO: Handling upstream transmission. JSON Data: {"value":1013.0156,"name":"PressureSensor","timeStamp":
"2022-12-16T05:54:06.774353+00:00","statusCode":0,"typeID":1012,"locationID":"constraineddevice001","l
atitude":0.0,"longitude":0.0,"elevation":0.0,"timeStampMills":1671170046775}
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.connection.MqttClientConnector$SensorMessageListener mes
sageArrived
INFO: Received SensorData response: 25.015625
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.app.DeviceDataManager handleIncomingDataAnalysis
INFO: Analyzing incoming sensor data: TempSensor
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.app.DeviceDataManager handleUpstreamTransmission
INFO: Handling upstream transmission. JSON Data: {"value":25.015625,"name":"TempSensor","timeStamp":
"2022-12-16T05:54:06.774381+00:00","statusCode":0,"typeID":1013,"locationID":"constraineddevice001","latit
ude":0.0,"longitude":0.0,"elevation":0.0,"timeStampMills":1671170046777}
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.connection.MqttClientConnector$SensorMessageListener mes
sageArrived
INFO: Received SensorData response: 60.290005
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.app.DeviceDataManager handleIncomingDataAnalysis
INFO: Analyzing incoming sensor data: WaterLevelSensor
Dec 16, 2022 12:54:06 AM programmingtheiot.gda.app.DeviceDataManager handleWaterLevelSensorAnalysis
INFO: 60.290005 Water Level data from CDA not in nominal range. Water Level Sending CLOSE valve actuat
ion event to CDA: name=ValveActuator,typeID=1003,timeStamp=2022-12-16T05:54:06.778379Z,statusCode=0,hasE
rror=false,locationID=constraineddevice001,latitude=0.0,longitude=0.0,elevation=0.0,command=0,isRespons
e=false,value=0.0
```

Eclipse IDE (eclipse-workspace - Eclipse IDE):

The IDE shows a project named "ConstrainedD..." with a console output window displaying the following log messages:

```
ConstrainedDeviceApp.py[/usr/bin/python3]
2022-12-16 00:54:06,776:root:DEBUG:Incoming system performance message received (from sys perf manager): Syste
2022-12-16 00:54:06,776:root:INFO:Publishing to topic PIOT/ConstrainedDevice/SystemPerfMsg
2022-12-16 00:54:06,776:root:INFO:MQTT message published: <paho.mqtt.client.client object at 0x7f8c670a0fa0>
2022-12-16 00:54:06,776:root:DEBUG:Published incoming data to resource (MQTT): ResourceNameEnum.CDA SENSOR MSG
2022-12-16 00:54:06,776:root:INFO:MQTT message published: <paho.mqtt.client.client object at 0x7f8c670a0fa0>
2022-12-16 00:54:06,776:root:DEBUG:Published incoming data to resource (MQTT): ResourceNameEnum.CDA SYSTEM PER
2022-12-16 00:54:06,780:root:INFO:[callback] Actuator command message received. Topic: PIOT/ConstrainedDevice/
2022-12-16 00:54:06,780:root:WARNING:JSON data contains key not mappable to object: timeStampMills
2022-12-16 00:54:06,780:root:INFO:Actuator data: name=ValveActuator,typeID=1003,timeStamp=2022-12-16T05:54:06.
2022-12-16 00:54:06,780:root:INFO:Processing Actuator command received for location ID: constraineddevice001
2022-12-16 00:54:06,780:root:DEBUG:New actuator command (0) and value (0.0) to be applied.
2022-12-16 00:54:06,780:root:INFO:Deactivating actuator...
2022-12-16 00:54:06,783:PII.PngImagePlugin:DEBUG:STREAM b'IDHR' 16 13
2022-12-16 00:54:06,783:PII.PngImagePlugin:DEBUG:STREAM b'IDAT' 41 367
```

Sense HAT Emulator:

The emulator displays a virtual Sense HAT board with the following settings:

- Screen: On
- Temperature: 25.0°C
- Pressure: 1013.0mbar
- Humidity: 45.5%
- Orientation: Yaw 0.0°, Pitch 0.0°, Roll 0.0°
- Joystick: On

Ubidots Dashboard

Water Level Sensing

Water Tank Monitoring

Temperature



5.51

Last Updated: Dec 16 2022 12:43

Water Level



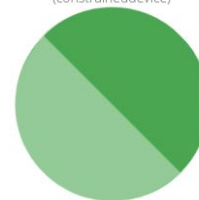
Pressure

Last value |
1,013.00

Last Updated: Dec 16 2022 12:43

LED Indicator

actuatorcmd-ledactuator
(constraineddevice)



On

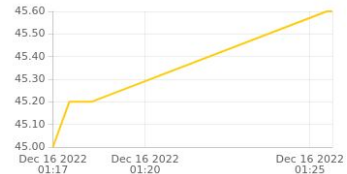
1.00

Dec 16 2022 12:30

CDA CPU Utilization



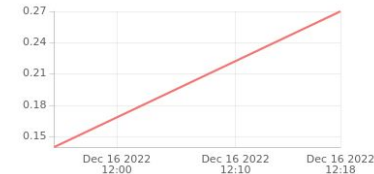
CDA Mem Utilization



GDA CPU Utilization



GDA Mem Utilization



Cloud Actuation Event

The screenshot displays a Raspberry Pi desktop environment with three main windows open:

- Ubidots Dashboard:** A web browser window showing a "Water Tank Monitoring" dashboard. It features four data widgets: "Temperature" (5.01, Last Updated: Dec 16 2022 12:55), "Water Level" (56.46), "Pressure" (1,160.25, Last Updated: Dec 16 2022 12:56), and "LED Indicator" (actuatorcmd-ledactuator (constraineddevice)).
- Terminal Window:** A terminal window showing MQTT logs. Key messages include: "INFO: Handling system performance message: SystemPerfMsg", "INFO: Message delivered. Token: org.eclipse.paho.client.mqtts3.MqttDeliveryToken", and "INFO: Publishing MQTT message. Payload: {\"value\":4.3,\"name\":\"CpuUtil\",\"timestamp\":\"2022-12-16T17:56:52.519355Z\",\"statusCode\":0,\"typeID\":9000,\"locationID\":\"const-raimeddevice001\",\"latitude\":0.0,\"longitude\":0.0,\"elevation\":0.0,\"timestampMills\":1671213412519}\"".
- Sense HAT Emulator:** A window titled "Sense HAT Emulator" showing a virtual representation of a Raspberry Pi Sense HAT. It includes sliders for "Temperature", "Pressure", "Humidity", and "Orientation" (Yaw, Pitch, Roll). The current values are 1160.3mbar, 45.1%, and 0.0° for Yaw, Pitch, and Roll respectively. A joystick control is also visible.

Outcomes

In terms of the Problem Statement:

The ability to monitor the water level using a cloud dashboard (on the web/mobile) without the need to physically access the tank

The ability to automate the turn on /off the valve using threshold triggers

(Not so necessary in India but) Regulate the temperature of the water using Cloud/GDA triggers

Not implemented but, could we?

The ability to trigger the turn on/off of the servo motor remotely on demand