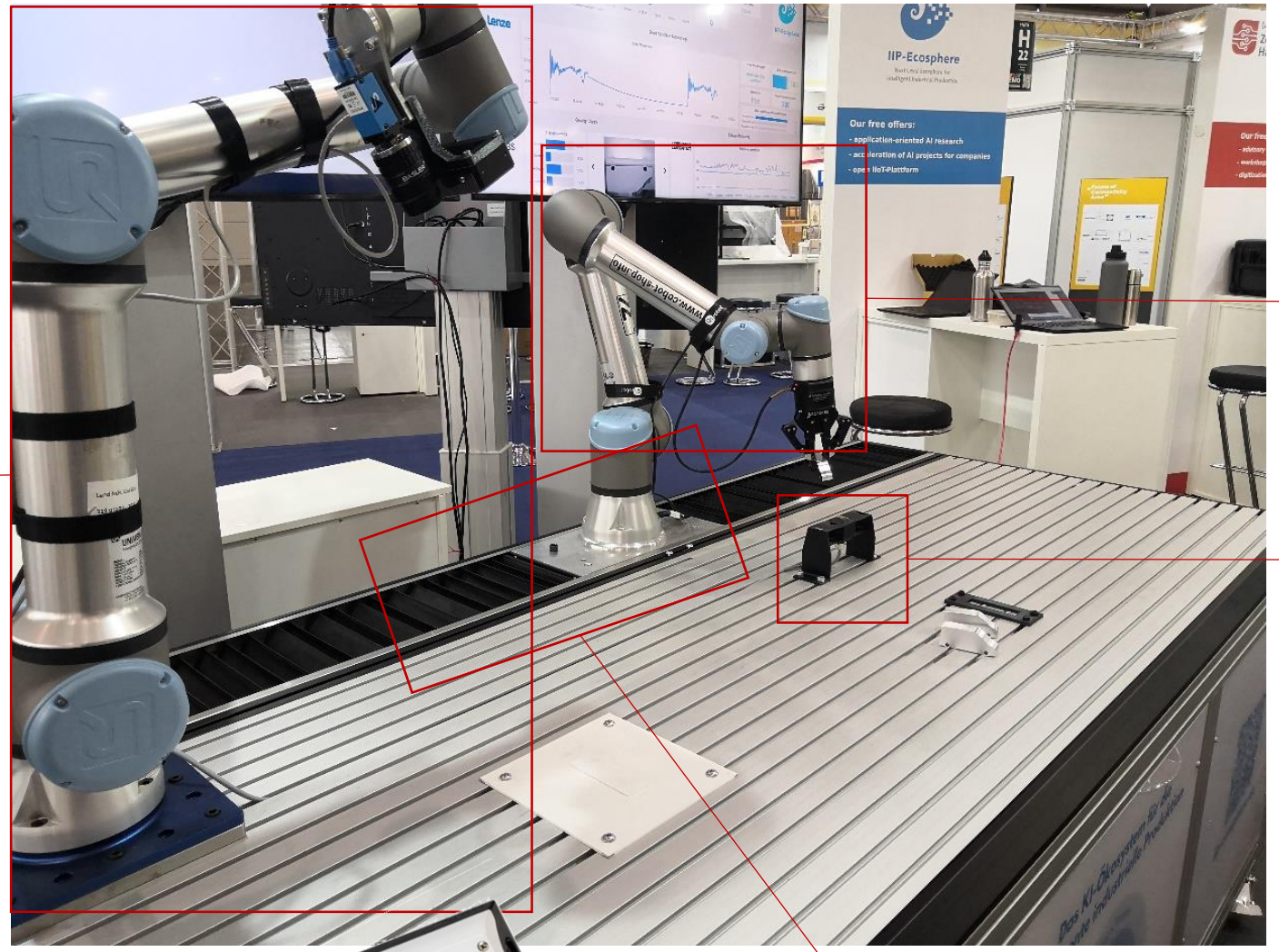
EMO‘23/HM‘23 demonstrator setup



Cobot 1 (visual quality inspection)

Cobot 1 (gripping)

MIP magnetic sensor

Control buttons

Lenze linear drive (condition monitoring on forward path)

Cobot Control
AI Application

2 Schalter

Elektr.

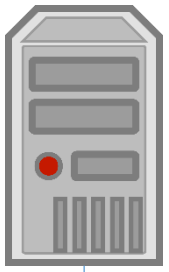
PLCnext AXC f3152

IP: 192.168.2.10
Port X2
4840: OPC UA server

Container:
*: AAS VAB server

Lenovo Server

Platform core



IP: 192.168.2.1
9001: Platform AAS server
9902: Platform AAS registry
9003: Platform VAB server
8883: Central AMQP Broker
9989: MDZH AAS server/registry
9090: Prometheus server
9091: Prometheus alert mgr
*: Exporter
*: APP AAS VAB server
4000: BaSyx UI
4200: Mgt UI
4201: Tablet UI
5001: Local Docker Registry
Container:
*: AAS VAB server

LAN

U2x **Cam**

IP: -> Beckhoff

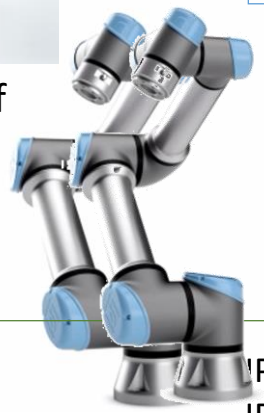
LAN

LAN

Managed Switches

IP: 192.168.2.30 (li)
IP: 192.168.2.31 (re)

LAN/Profinet



QR Code Reading
Photo Taking
Reaction to AI Result

IP: 192.168.2.21
IP: 192.168.2.23

2x UR5 Cobots

Proxmox: 192.168.2.11 (Eth1)
GPU-VM: 192.168.2.13
Bitmotec: 192.168.2.12
1883: MQTT -> Grafana

IP: 192.168.2.80
4840: OPC UA

IP: 192.168.2.40

IP: 192.168.2.81
MQTT: 1883

IP: 192.168.2.82
MODBUS TCP

Hardware connections at AXC F 3152

oktoflow

HM'23

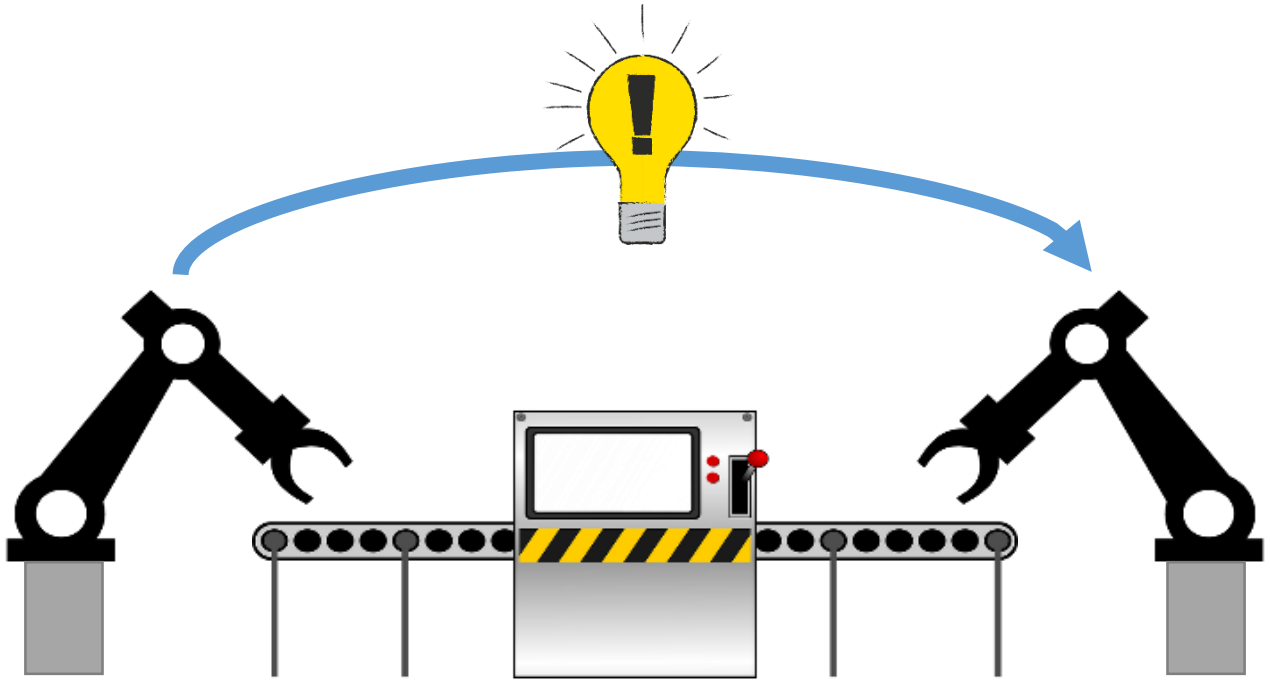
Pin	PLC Global	After Trigger	Meaning
dio-1/IN01	HW_IN_1	HW_Button1	Start Cobot 1
dio-1/IN02	HW_IN_2	HW_Button2	Start Cobot 2
dio-1/IN03	HW_IN_3	HW_Button0	Quit

EMO'23

Pin	PLC Global	After Trigger	Meaning
dio-1/IN01	HW_IN_1	HW_Button1	Start Cobot 1
dio-1/IN02	HW_IN_2	HW_Button2	(Start Cobot 2)
dio-1/IN03	HW_IN_3	HW_Button0	Drive to start

oktoflow

Federated Learning Path



PlcNextOpcConn

PlcNext → Decider
HW_Btn0: Boolean
HW_Btn1: Boolean
HW_Btn2: Boolean
PC_ReadyForRequest: Boolean
PC_RobotBusyOperating: Boolean
PC_RobotBusyOperatingAddInfo: short

Path 2

Decider -> AppAAS
io: Boolean
ioReason: Integer
error: String []
img1Error: String[]
img2Error: String[]
img3Error: String[]
errorConfidence: Double []
imageUri: String[]
robotId: Integer
aiId: String

Grafana

AAS

Beckhoff → Decider
bPicCounter: Short
bPicScene: Short
bPicTrigger: Short

Decider → Beckhoff
bPicCounter: Short
bPicScene: Short
bPicTrigger: Short

Decider-> PlcNext
PC_StartOperation: Boolean
PC_Command01: Int16
PC_Quit: Boolean
status: String [red, green, off]

PlcBeckhoffOpcConn

ActionDecider
errorThreshold: Double

AppAAS (2x)

Decider → CamSource
command: String
stringParam: String

CamSource

FL-Client

AppAAS → AI
command=SEND_FEEDBACK_TO_AI
param=<feedback>

AI → Decider
error: String [Shatter, Scratch ,Geometry, Car missing, Normal]
errorConfidence: Double []
imageUri: String base64
robotId: Integer
aiId: String

AppAas → MdzhAasConn
command=QUERY_CAR_AA
param=<productId>

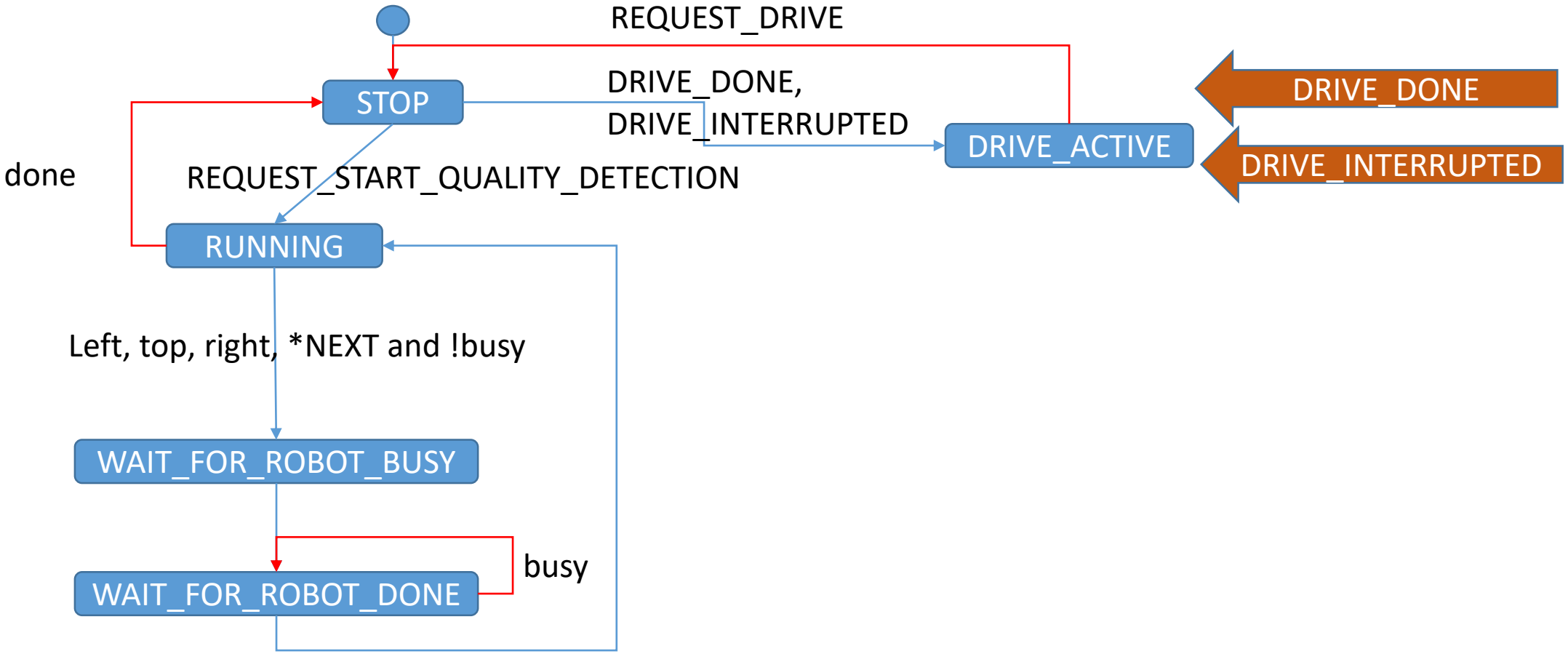
MdzhAasConn

CamSource → AI
image: String base64
imageUri: String
side: String
robotId: Integer

Static AI

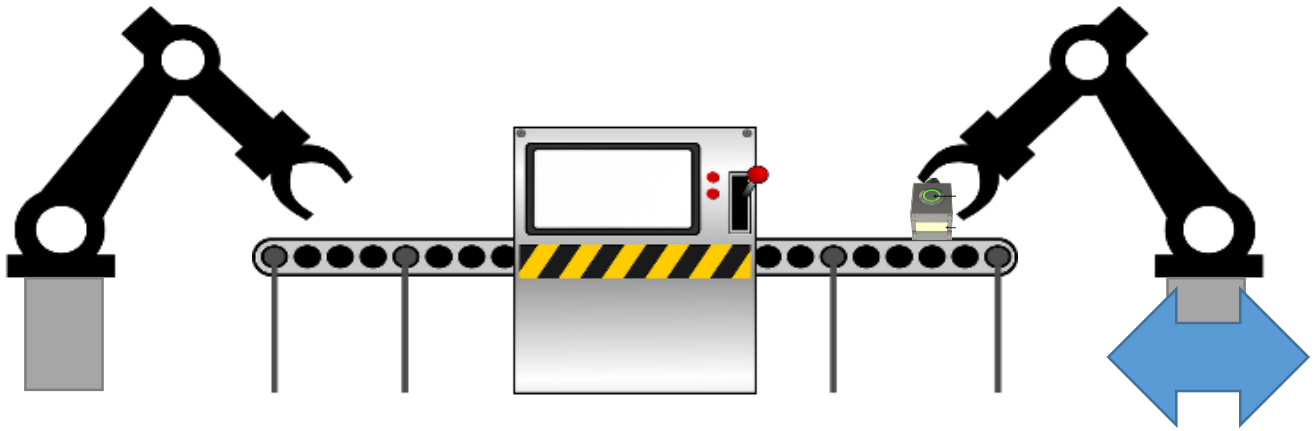
AppAAS → AI
command=SEND_MODEL_CHANGE_TO_AI
param=<modelId>

Forward Flow
Backward Flow
Param
commented out


REQUEST_DRIVE
STOP
DRIVE_DONE,
DRIVE_INTERRUPTED
DRIVE_ACTIVE
DRIVE_DONE
DRIVE_INTERRUPTED
done
REQUEST_START_QUALITY_DETECTION
RUNNING
Left, top, right, *NEXT and !busy
WAIT_FOR_ROBOT_BUSY
busy
WAIT_FOR_ROBOT_DONE

oktoflow

Drive Path



driveMqttEnergyConn
(MQTT v3)

PLCNext -> Aggregator
channel: String
value: String
timestamp: IEC61131_3DateTime

PlcNextOpcConn

Path 1

Decider -> StateController
command: String
stringParam: String

driveChannelToTimeSeriesAggregator
(values to channels to time series)

DriveAppAas -> Aggregator, OpcConn
iFriction_set: int
iTension_set: int
~~iFriction_actual: Integer (ro)~~
~~iTension_actual: Integer (ro)~~
bExecute: Boolean
rPosition: Double
rVelocity: Double

driveAppAas

AAS

Aggregator -> AI
Channels: PhoenixChannel[]
channel: String
values[]: String
timestamp: IEC61131_3DateTime
samplerate: Double

MdzhAasConn

MiPAiService

MiPMqttConn
(Mqtt v3)

Grafana

driveBeckhoffOpcUaConn

Opc -> DriveAppAas
Done : Boolean
Busy : Boolean
Active : Boolean
CommandAborted : Boolean
Error : Boolean
ErrorID : UInt32
iFriction_actual: Integer (ro)
iTension_actual: Integer (ro)

Drive data.hub

Lenze -> AI
channelcount: Integer
channels: LenzeChannel[]
channelNo: Integer
timestamp: String
timebase: Double
samplerate: Double
connection: String
name: String
unit: String
data: **String**

DriveLenzePythonAi

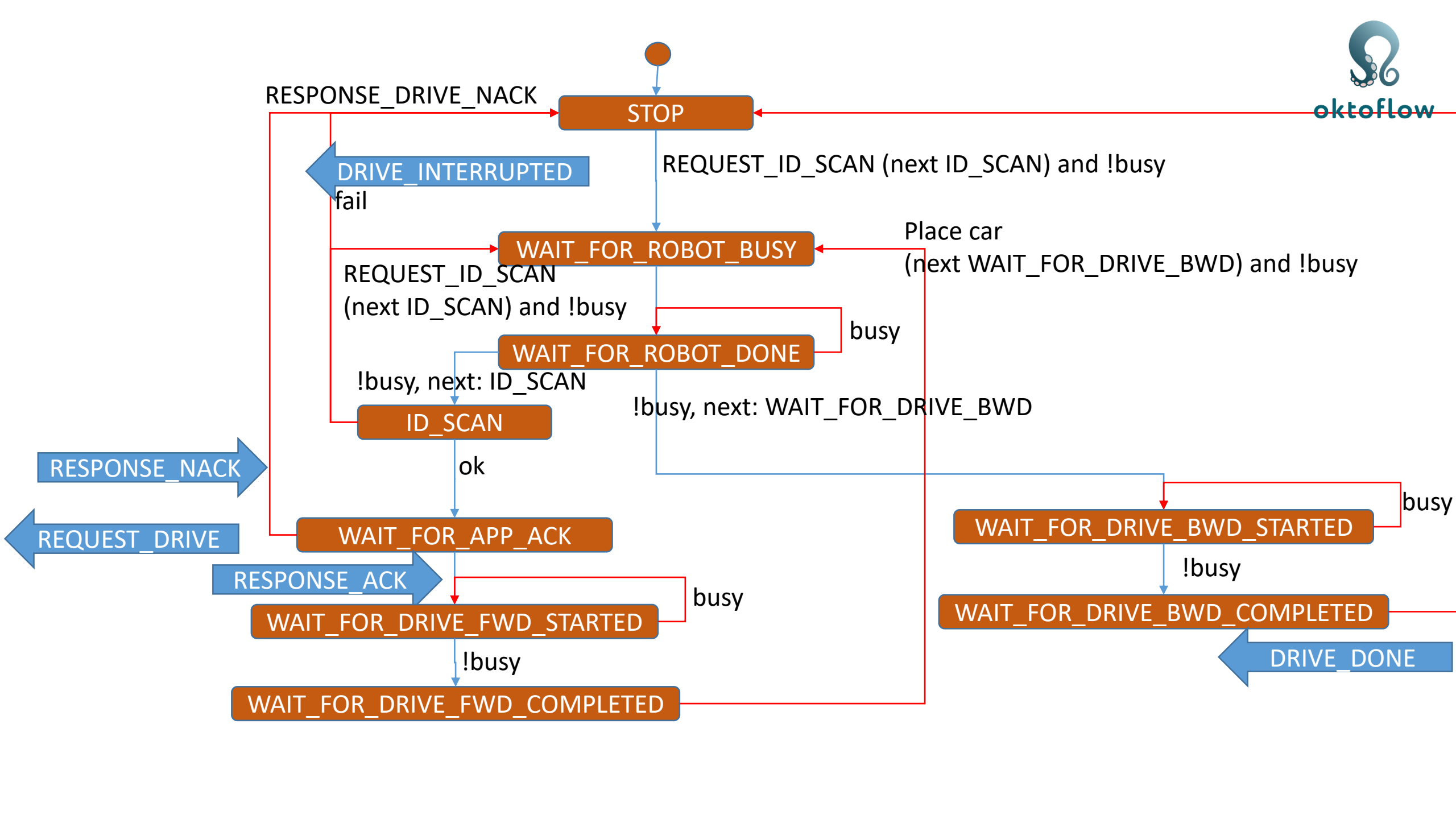
DriveIsmllPythonAi

DriveRapidMinerAi

AI -> Grafana
io: Boolean
String[Tension_is_good, Tension_to_low, Tension_to_high]: error
double[]: errorConfidence
aiId: String
energy: Aggregator -> AI
drive: Lenze -> AI

driveLenzeMqttConn
(Mqtt v3)

Forward Flow
Backward Flow
Param
Commented out


RESPONSE_DRIVE_NACK
STOP
oktoflow
DRIVE_INTERRUPTED
fail
REQUEST_ID_SCAN (next ID_SCAN) and !busy
WAIT_FOR_ROBOT_BUSY
Place car
(next WAIT_FOR_DRIVE_BWD) and !busy
REQUEST_ID_SCAN
(next ID_SCAN) and !busy
WAIT_FOR_ROBOT_DONE
busy
!busy, next: ID_SCAN
!busy, next: WAIT_FOR_DRIVE_BWD
ID_SCAN
RESPONSE_NACK
ok
REQUEST_DRIVE
WAIT_FOR_APP_ACK
WAIT_FOR_DRIVE_BWD_STARTED
busy
RESPONSE_ACK
!busy
WAIT_FOR_DRIVE_FWD_STARTED
busy
WAIT_FOR_DRIVE_BWD_COMPLETED
!busy
DRIVE_DONE
WAIT_FOR_DRIVE_FWD_COMPLETED

Cobot movements

(x) case in UR cobot-program
→ PLC auto-advance
→ PLC explicit next