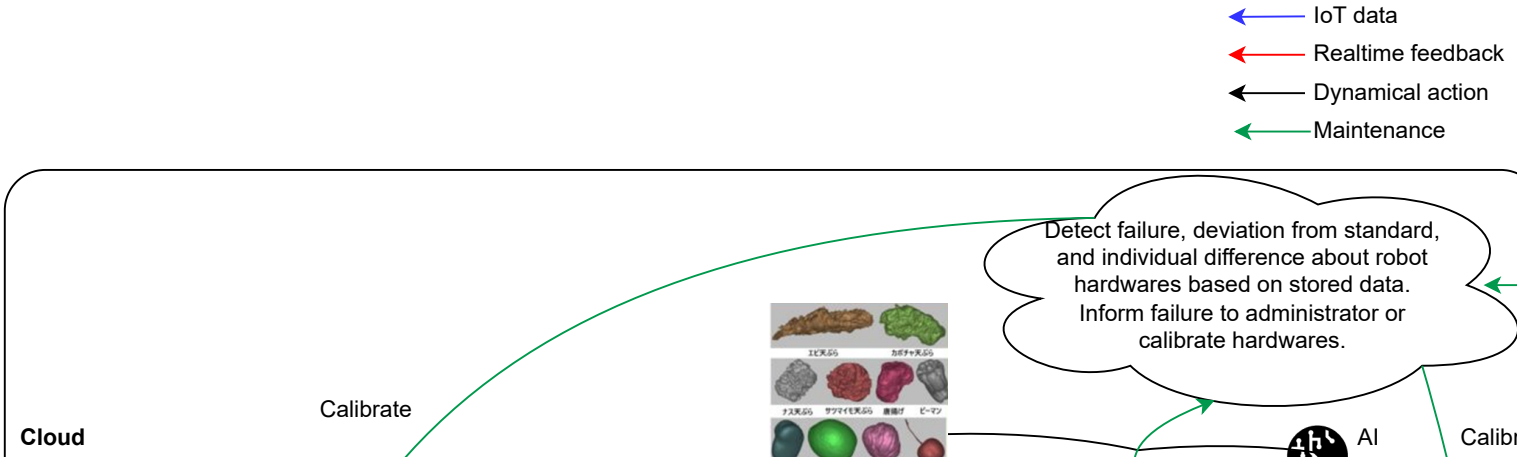
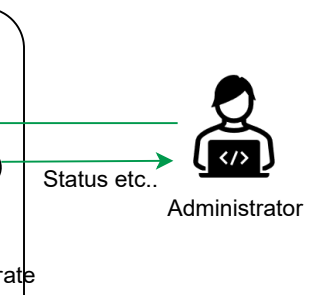
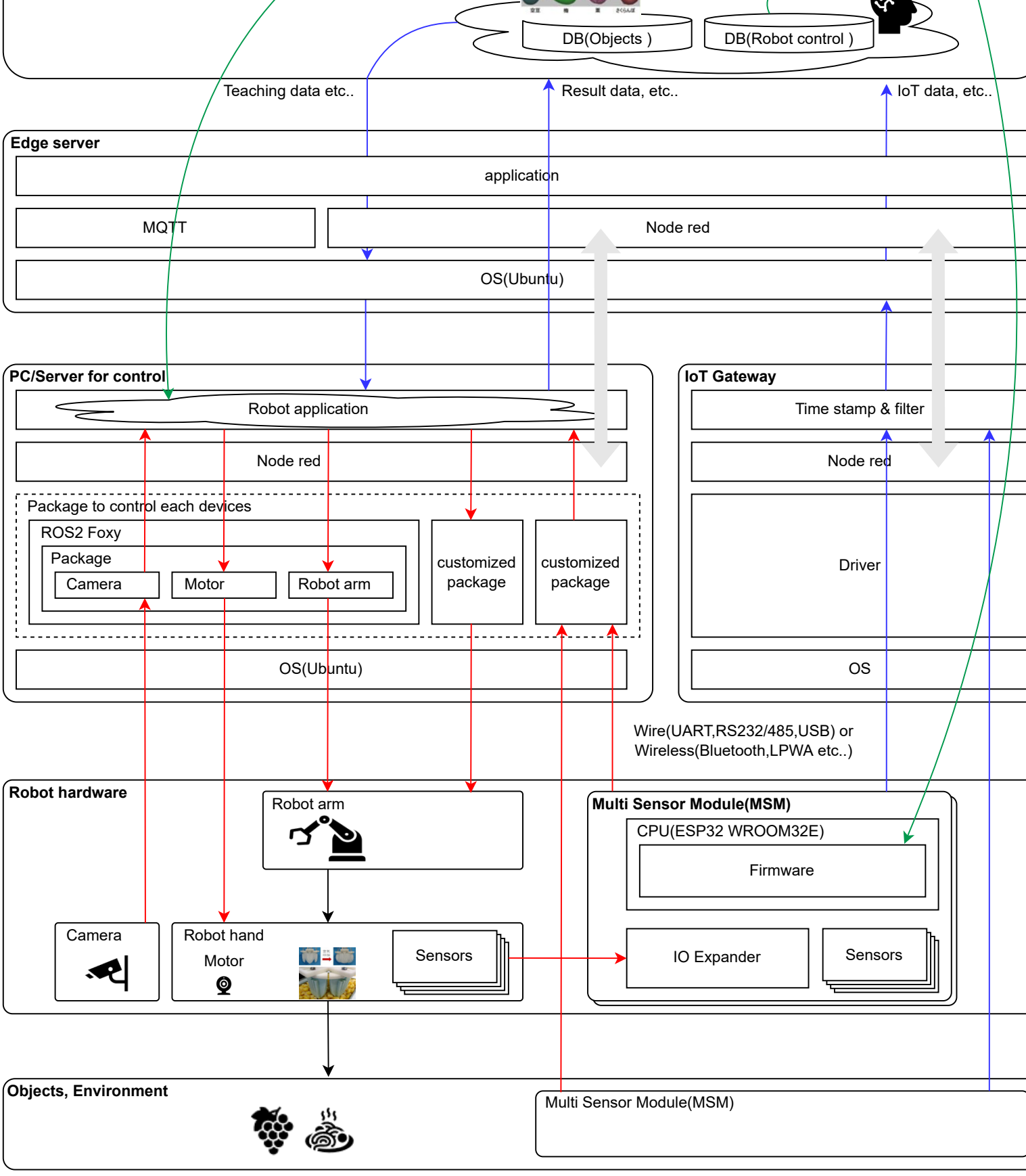
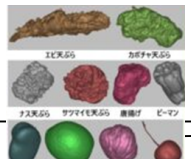

IoT data
Realtime feedback
Dynamical action
Maintenance
Detect failure, deviation from standard, and individual difference about robot hardwares based on stored data. Inform failure to administrator or calibrate hardwares.
Calibrate
Cloud
AI
Calibr


Status etc..
Administrator
rate


DB(Objects)
DB(Robot control)
Teaching data etc..
Result data, etc..
IoT data, etc..
Edge server
application
MQTT
Node red
OS(Ubuntu)
PC/Server for control
Robot application
Node red
Package to control each devices
ROS2 Foxy
Package
Camera
Motor
Robot arm
customized package
customized package
OS(Ubuntu)
IoT Gateway
Time stamp & filter
Node red
Driver
OS
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
Robot hardware
Robot arm
Camera
Robot hand
Motor
Sensors
Multi Sensor Module(MSM)
CPU(ESP32 WROOM32E)
Firmware
IO Expander
Sensors
Objects, Environment
Multi Sensor Module(MSM)

Component in release6



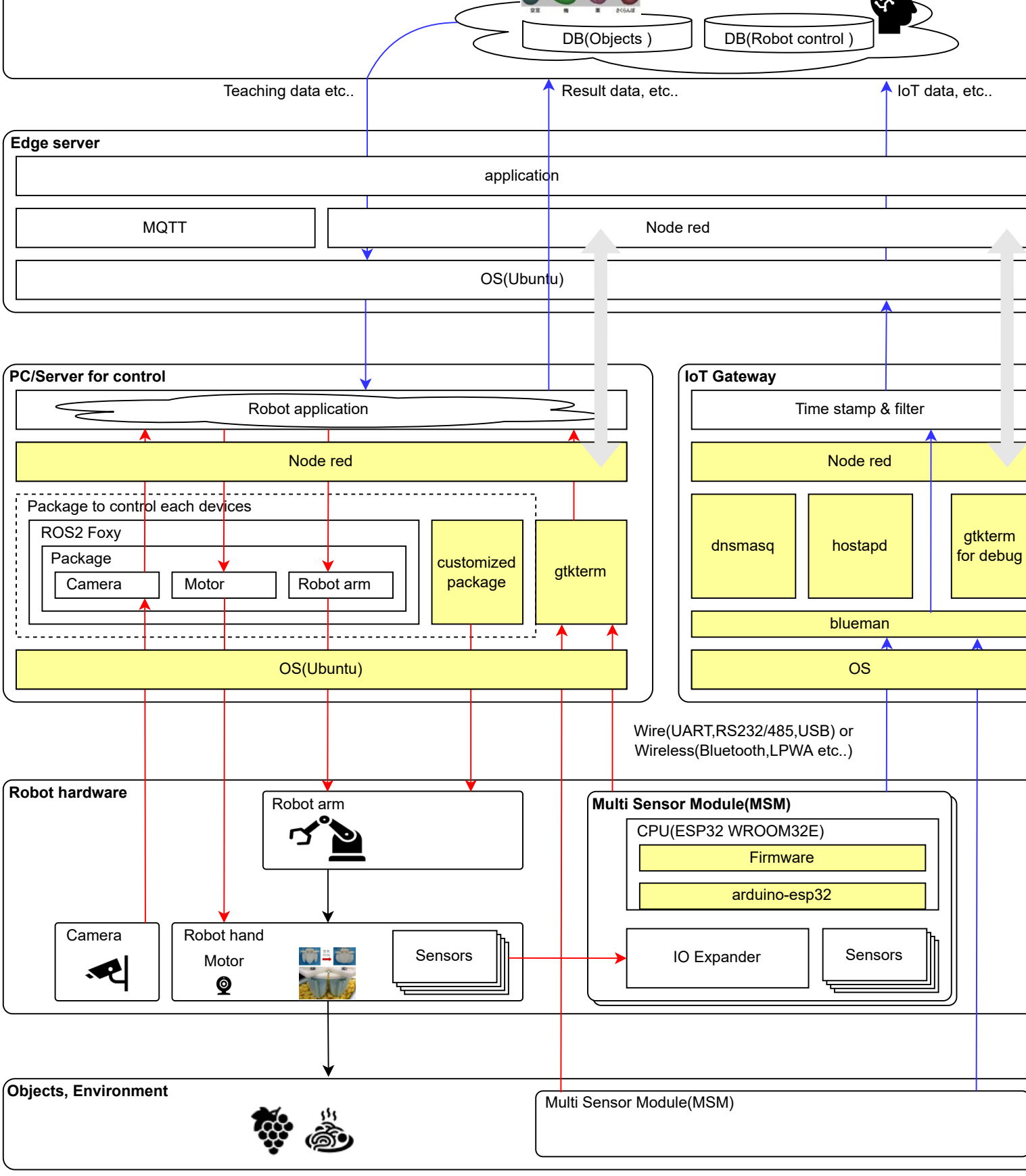
IoT data

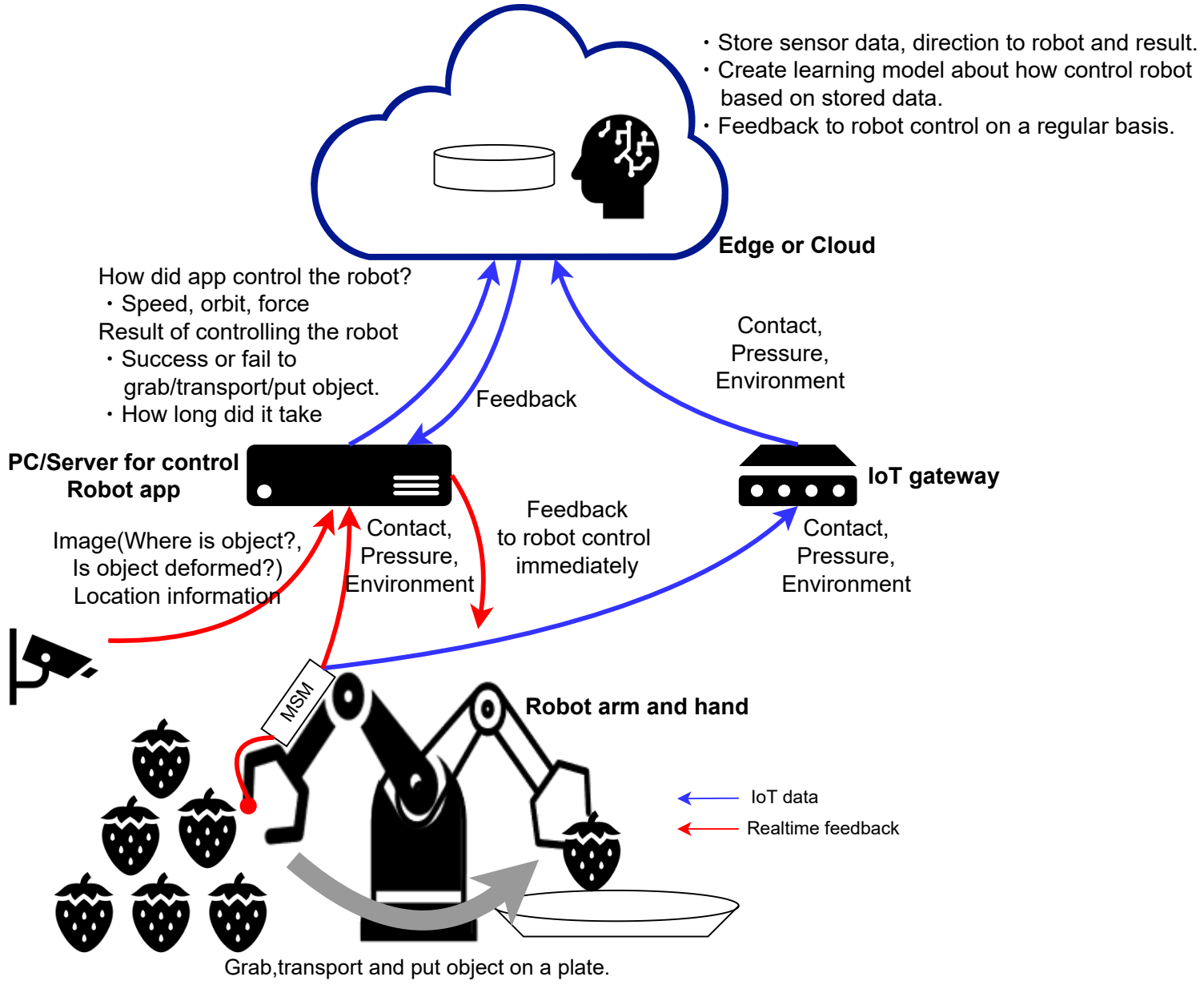
Realtime feedback

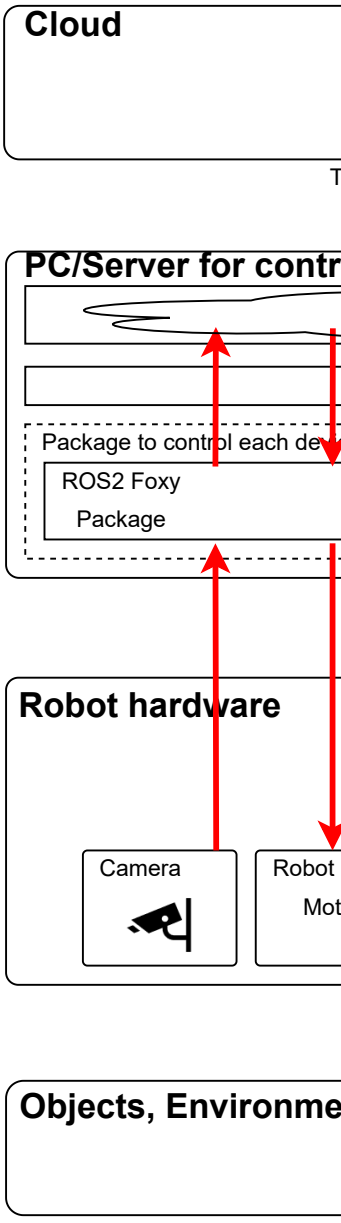
Dynamical action

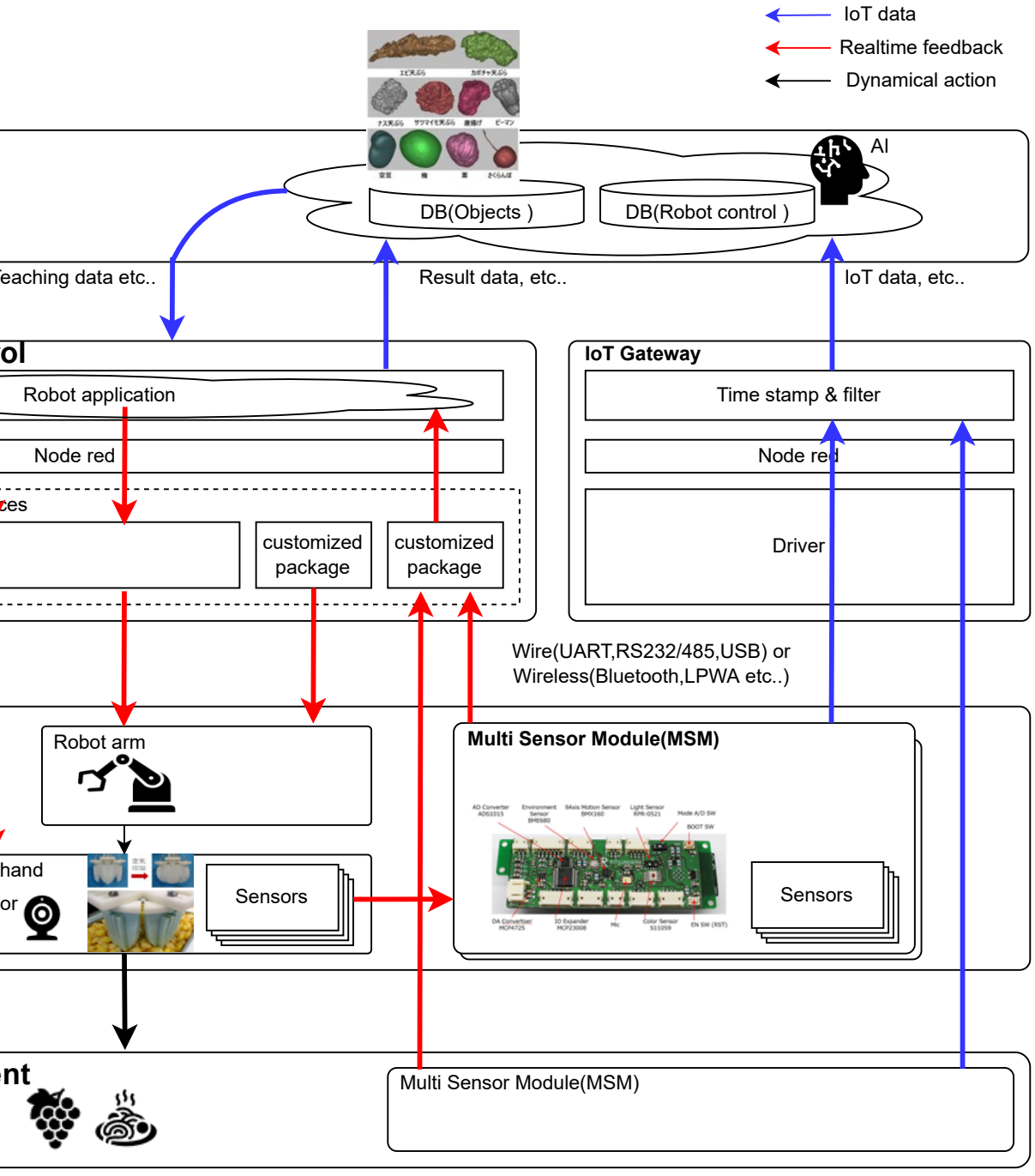
Cloud

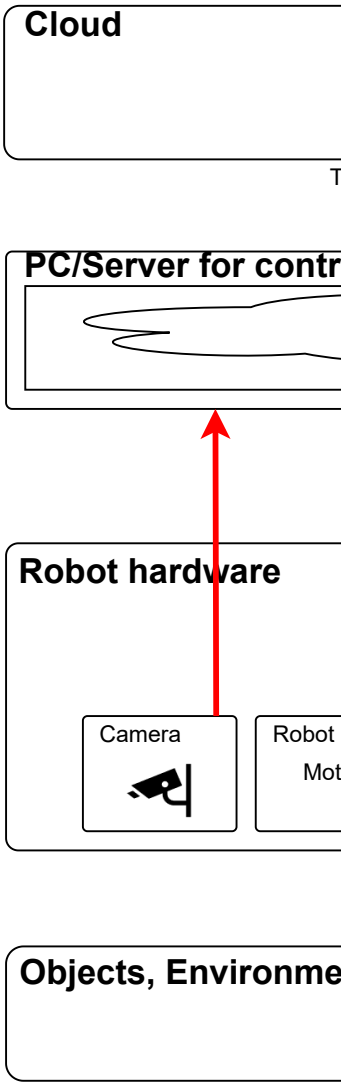
AI

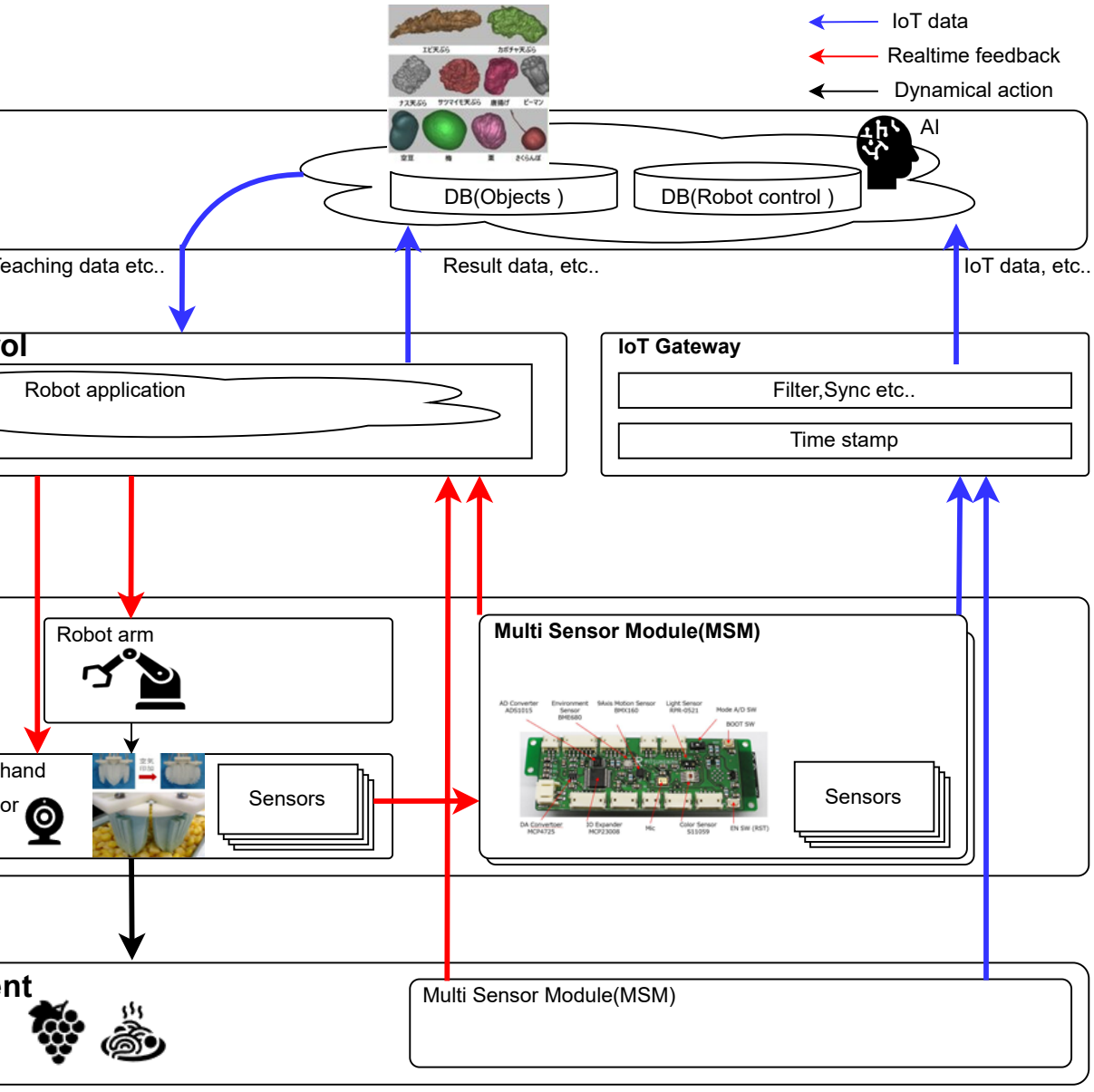

DB(Objects)
DB(Robot control)
Teaching data etc..
Result data, etc..
IoT data, etc..
Edge server
application
MQTT
Node red
OS(Ubuntu)
PC/Server for control
Robot application
Node red
Package to control each devices
ROS2 Foxy
Package
Camera
Motor
Robot arm
customized package
gtkterm
OS(Ubuntu)
IoT Gateway
Time stamp & filter
Node red
dnsmasq
hostapd
gtkterm for debug
blueman
OS
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
Robot hardware
Robot arm
Camera
Robot hand
Motor
Sensors
Multi Sensor Module(MSM)
CPU(ESP32 WROOM32E)
Firmware
arduino-esp32
IO Expander
Sensors
Objects, Environment
Multi Sensor Module(MSM)

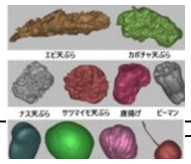

・Store sensor data, direction to robot and result.
・Create learning model about how control robot based on stored data.
・Feedback to robot control on a regular basis.
Edge or Cloud
How did app control the robot?
・Speed, orbit, force
Result of controlling the robot
・Success or fail to grab/transport/put object.
・How long did it take
Feedback
Contact, Pressure, Environment
PC/Server for control Robot app
IoT gateway
Image(Where is object?, Is object deformed?) Location information
Contact, Pressure, Environment
Feedback to robot control immediately
Contact, Pressure, Environment
MSM
Robot arm and hand
IoT data
Realtime feedback
Grab,transport and put object on a plate.


Cloud
T
PC/Server for contr
Package to control each de
ROS2 Foxy
Package
Robot hardware
Camera
Robot
Mot
Objects, Environme


IoT data
Realtime feedback
Dynamical action
AI
DB(Objects)
DB(Robot control)
eaching data etc..
Result data, etc..
IoT data, etc..
ol
Robot application
Node red
es
customized package
customized package
IoT Gateway
Time stamp & filter
Node red
Driver
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
Robot arm
hand
or
Sensors
Multi Sensor Module(MSM)
Sensors
nt
Multi Sensor Module(MSM)


Cloud
T
PC/Server for contr
Robot hardware
Camera
Robot
Mot
Objects, Environme


IoT data
Realtime feedback
Dynamical action
AI
DB(Objects)
DB(Robot control)
eaching data etc..
Result data, etc..
IoT data, etc..
ol
Robot application
IoT Gateway
Filter,Sync etc..
Time stamp
Robot arm
hand
or
Sensors
Multi Sensor Module(MSM)
Sensors
nt
Multi Sensor Module(MSM)



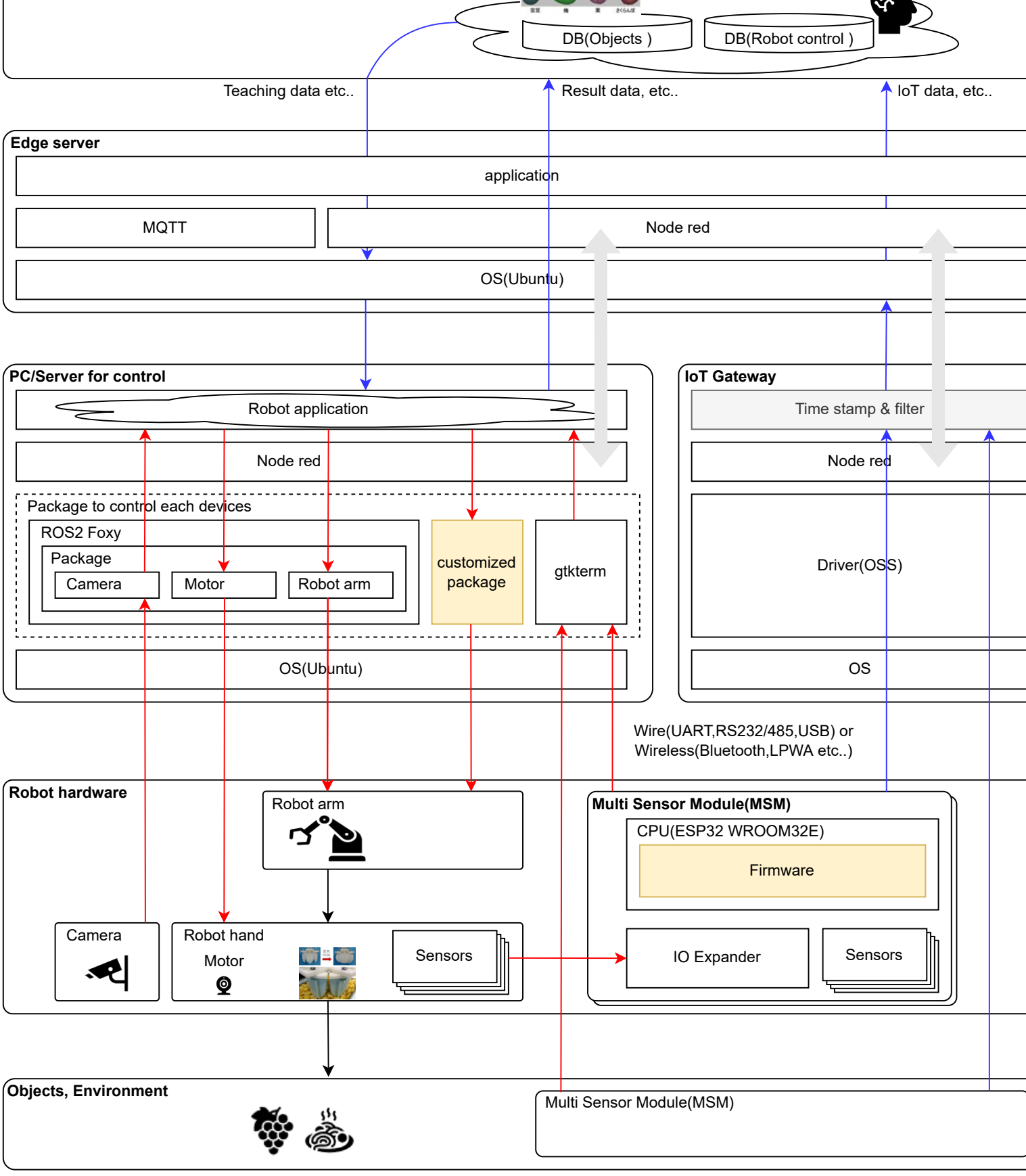
IoT data

Realtime feedback

Dynamical action

Cloud

AI


DB(Objects)
DB(Robot control)
Teaching data etc..
Result data, etc..
IoT data, etc..
Edge server
application
MQTT
Node red
OS(Ubuntu)
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Robot application
Node red
Package to control each devices
ROS2 Foxy
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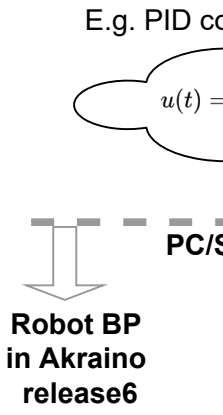
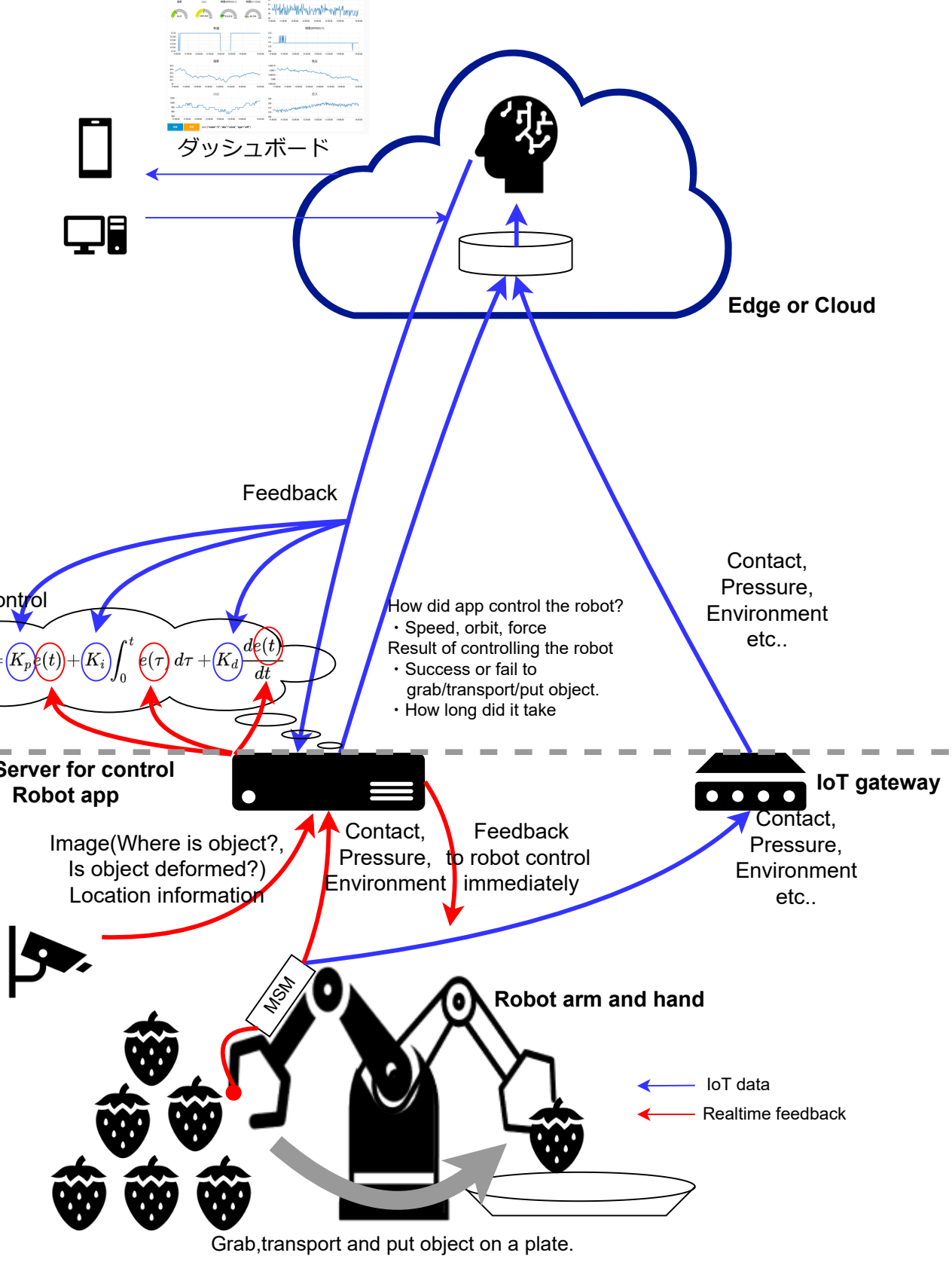
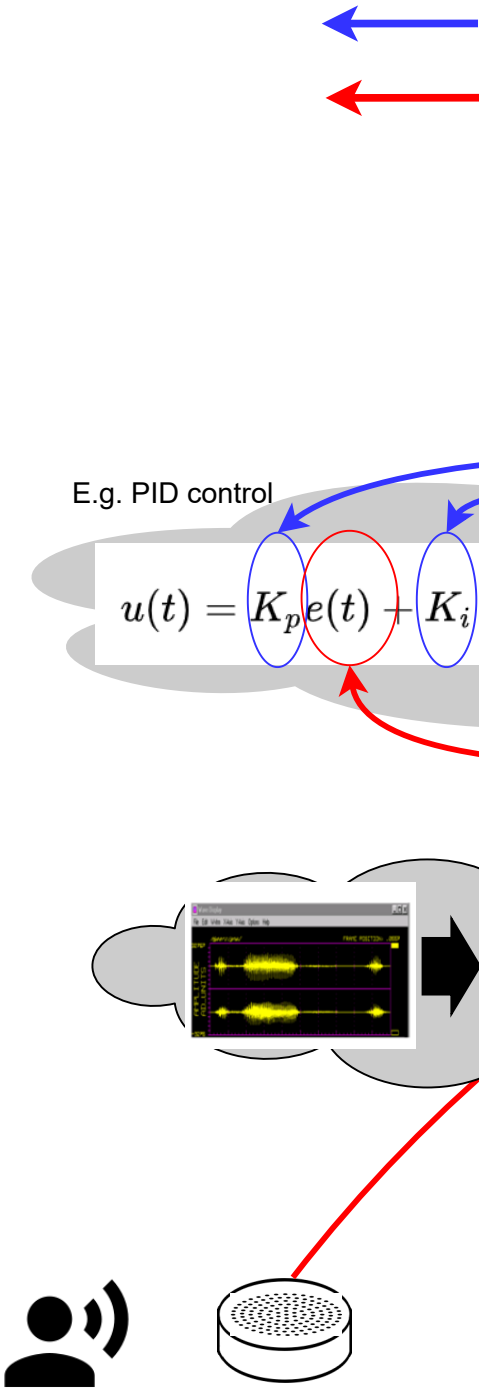
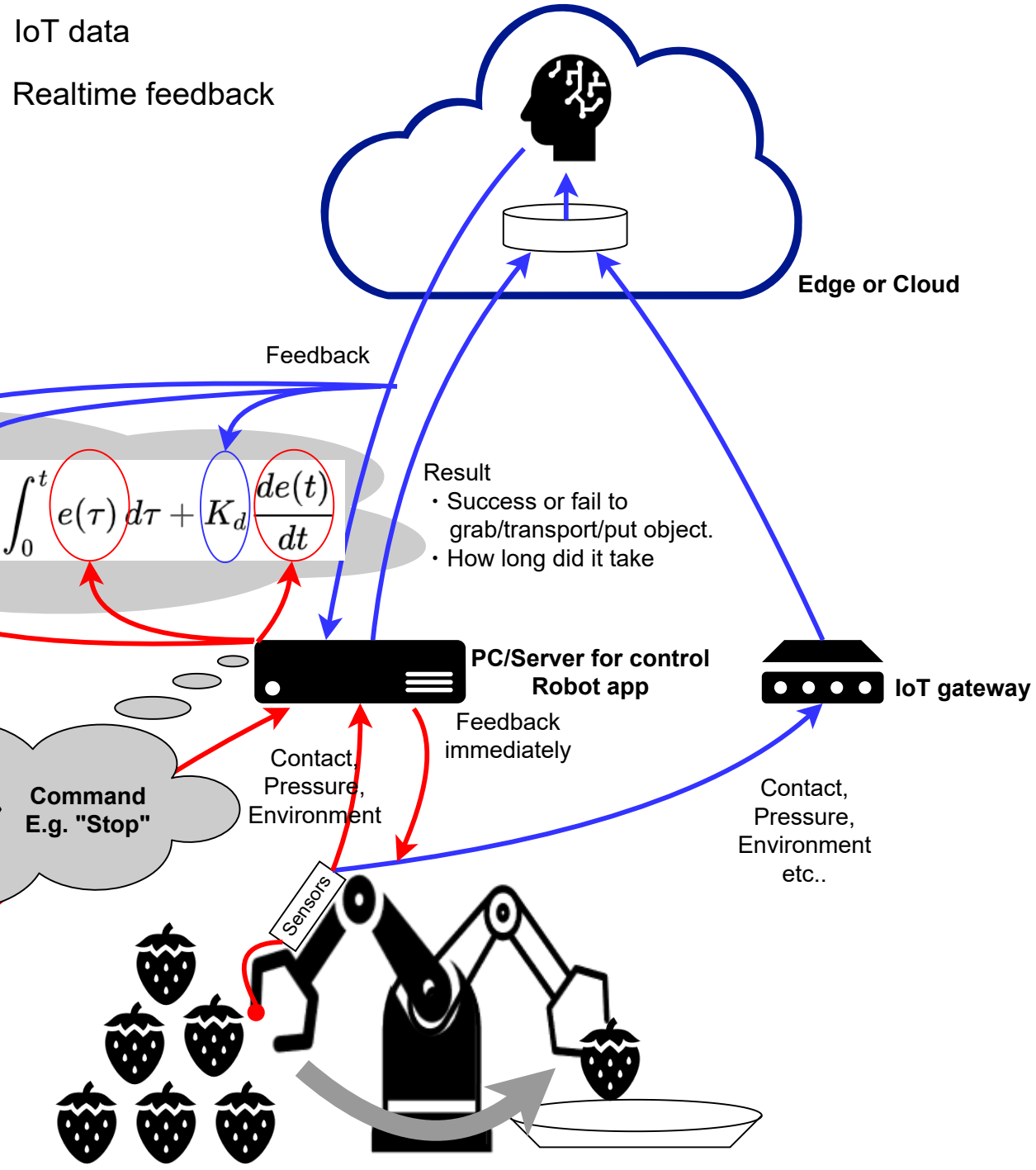
Camera
Motor
Robot arm
customized package
gtkterm
OS(Ubuntu)
IoT Gateway
Time stamp & filter
Node red
Driver(OSS)
OS
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
Robot hardware
Robot arm
Camera
Robot hand
Motor
Sensors
Multi Sensor Module(MSM)
CPU(ESP32 WROOM32E)
Firmware
IO Expander
Sensors
Objects, Environment
Multi Sensor Module(MSM)

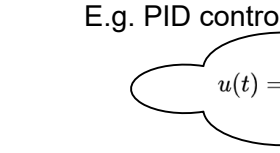
pandora.com
Environment
取量
高效
巨大
相関(217.0%)

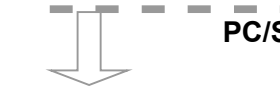

E.g. PID co
$u(t) =$
PC/S
Robot BP
in Akraino
release6


ダッシュボード
Edge or Cloud
Feedback
ontrol
$= K_p e(t) + K_i \int_0^t e(\tau)\, d\tau + K_d \frac{de(t)}{dt}$
How did app control the robot?
・Speed, orbit, force
Result of controlling the robot
・Success or fail to grab/transport/put object.
・How long did it take
Contact, Pressure, Environment etc..
Server for control Robot app
IoT gateway
Image(Where is object?, Is object deformed?) Location information
Contact, Pressure, Environment
Feedback to robot control immediately
Contact, Pressure, Environment etc..
MSM
Robot arm and hand
IoT data
Realtime feedback
Grab,transport and put object on a plate.

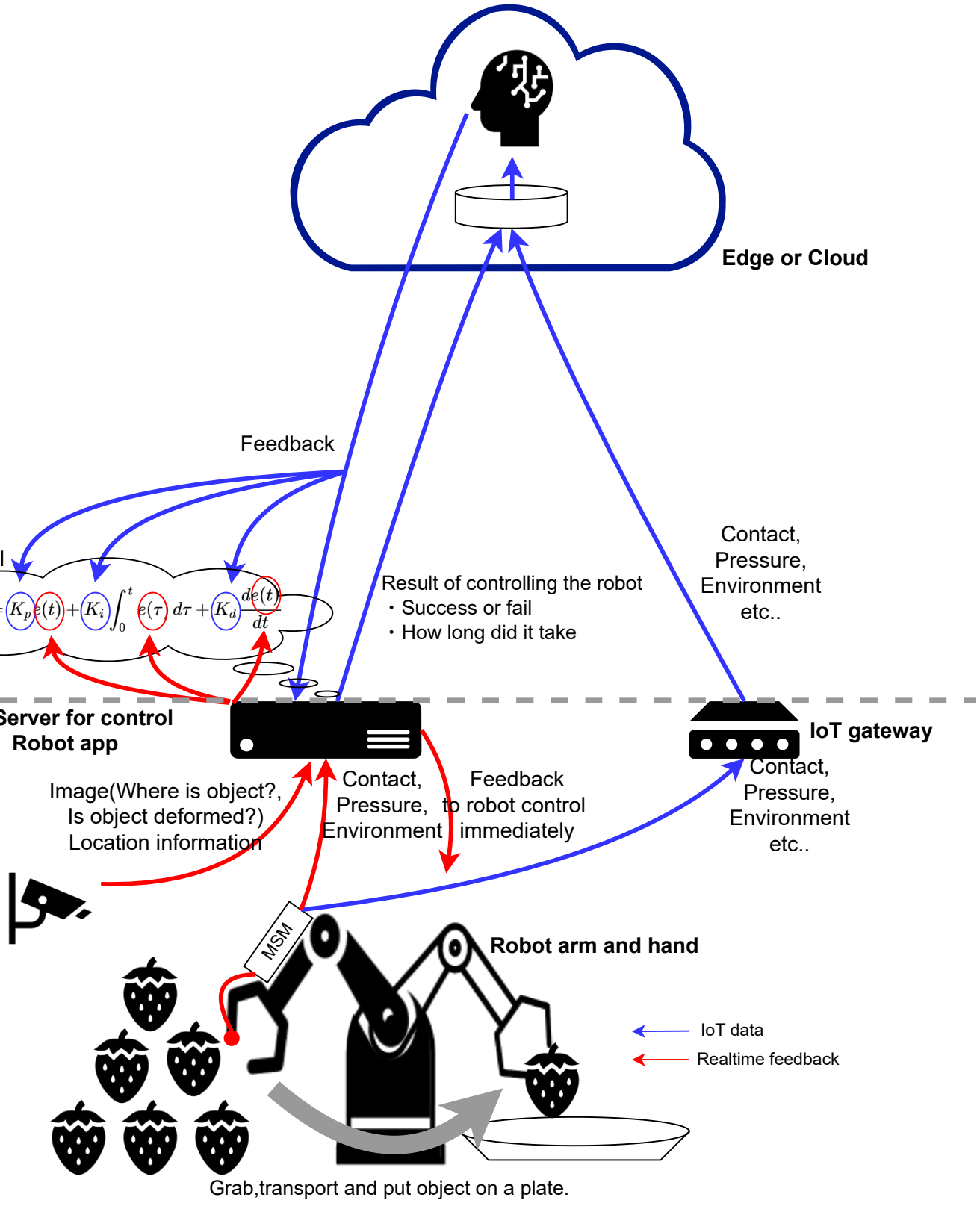

E.g. PID control
$u(t) = K_p e(t) + K_i$

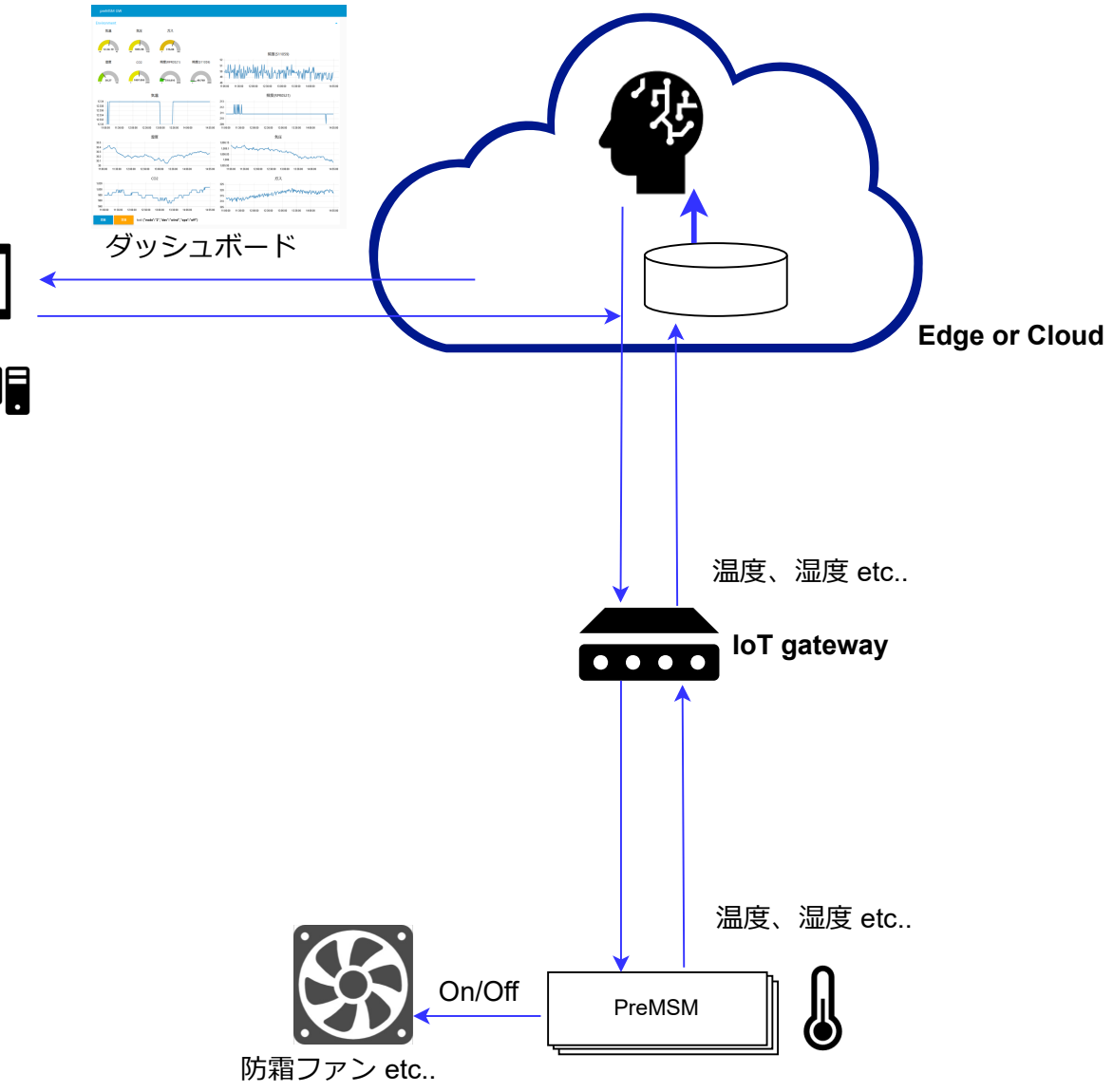

IoT data
Realtime feedback
Edge or Cloud
Feedback
$\int_0^t e(\tau)\,d\tau + K_d \frac{de(t)}{dt}$
Result
・Success or fail to grab/transport/put object.
・How long did it take
PC/Server for control Robot app
IoT gateway
Feedback immediately
Command E.g. "Stop"
Contact, Pressure, Environment
Contact, Pressure, Environment etc..
Sensors





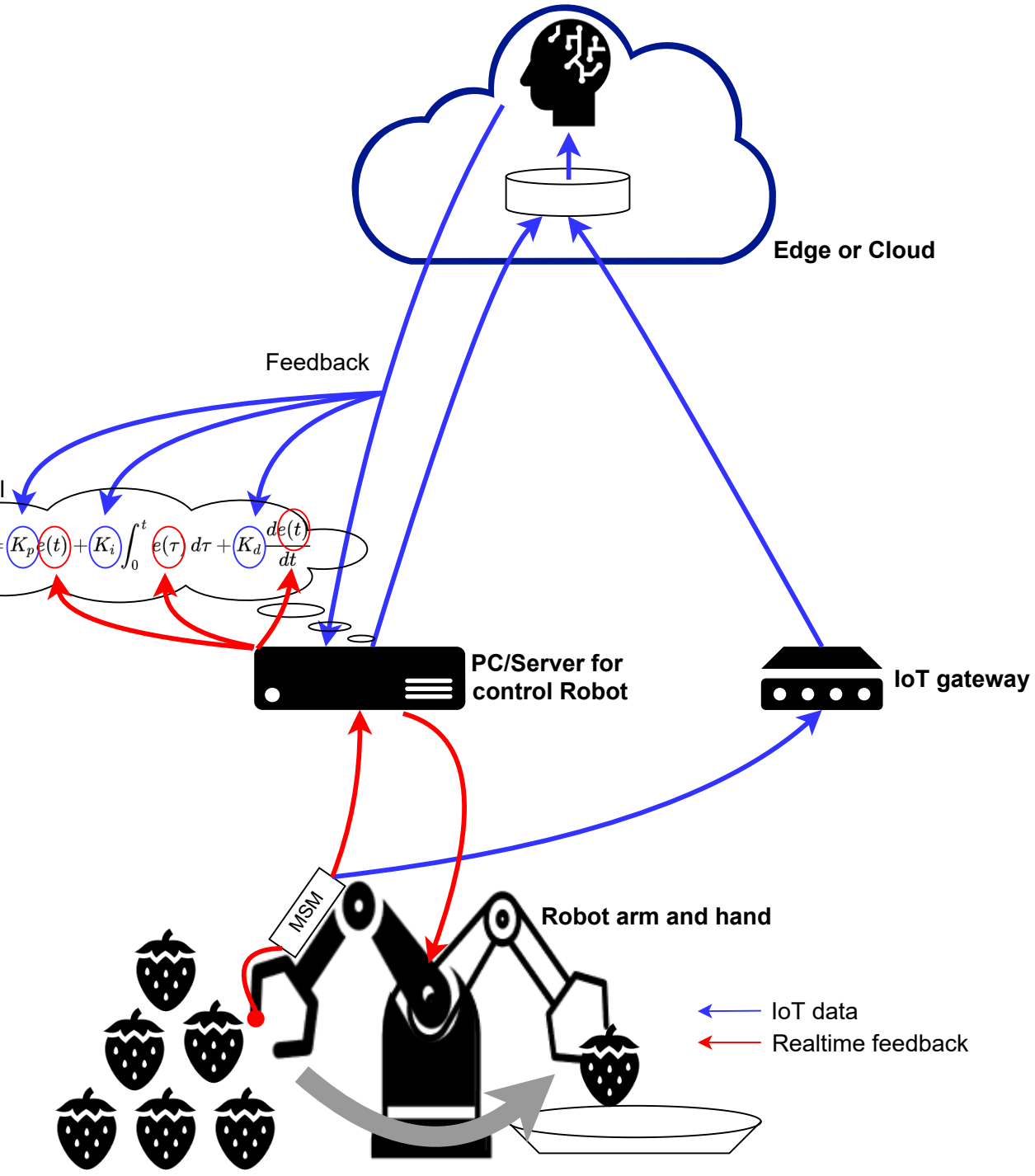
Robot BP
in Akraino release6

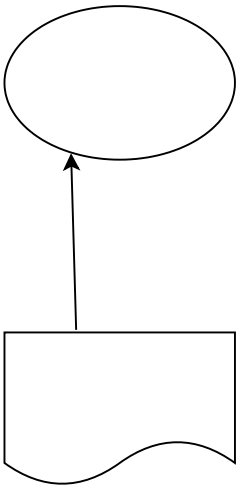

Edge or Cloud
Feedback
$K_p e(t) + K_i \int_0^t e(\tau)\, d\tau + K_d \frac{de(t)}{dt}$
Result of controlling the robot
・Success or fail
・How long did it take
Contact,
Pressure,
Environment
etc..
Server for control
Robot app
IoT gateway
Image(Where is object?,
Is object deformed?)
Location information
Contact,
Pressure,
Environment
Feedback
to robot control
immediately
Contact,
Pressure,
Environment
etc..
MSM
Robot arm and hand
IoT data
Realtime feedback
Grab,transport and put object on a plate.

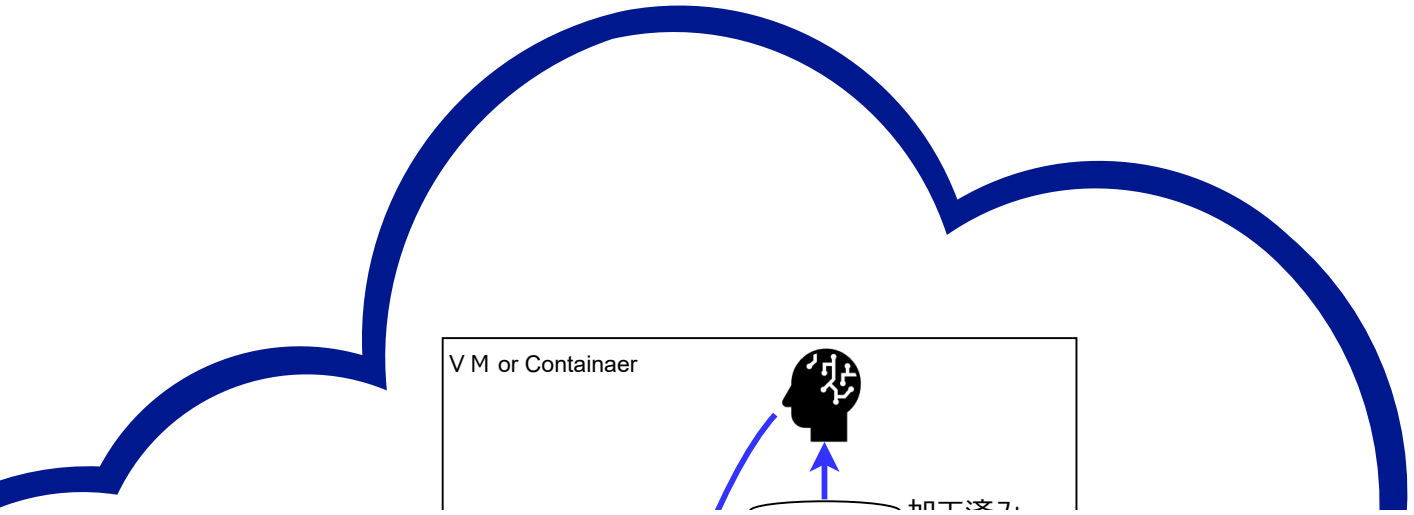

ダッシュボード
Edge or Cloud
温度、湿度 etc..
IoT gateway
温度、湿度 etc..
On/Off
PreMSM
防霜ファン etc..

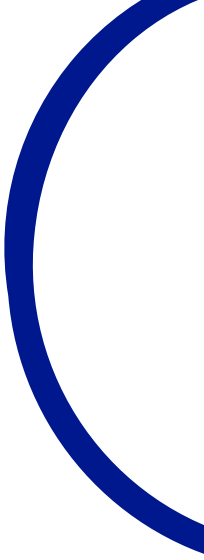
E.g. PID contro

$u(t) =$


Edge or Cloud
Feedback
$K_p e(t) + K_i \int_0^t e(\tau)\, d\tau + K_d \frac{de(t)}{dt}$
PC/Server for
control Robot
IoT gateway
MSM
Robot arm and hand
IoT data
Realtime feedback

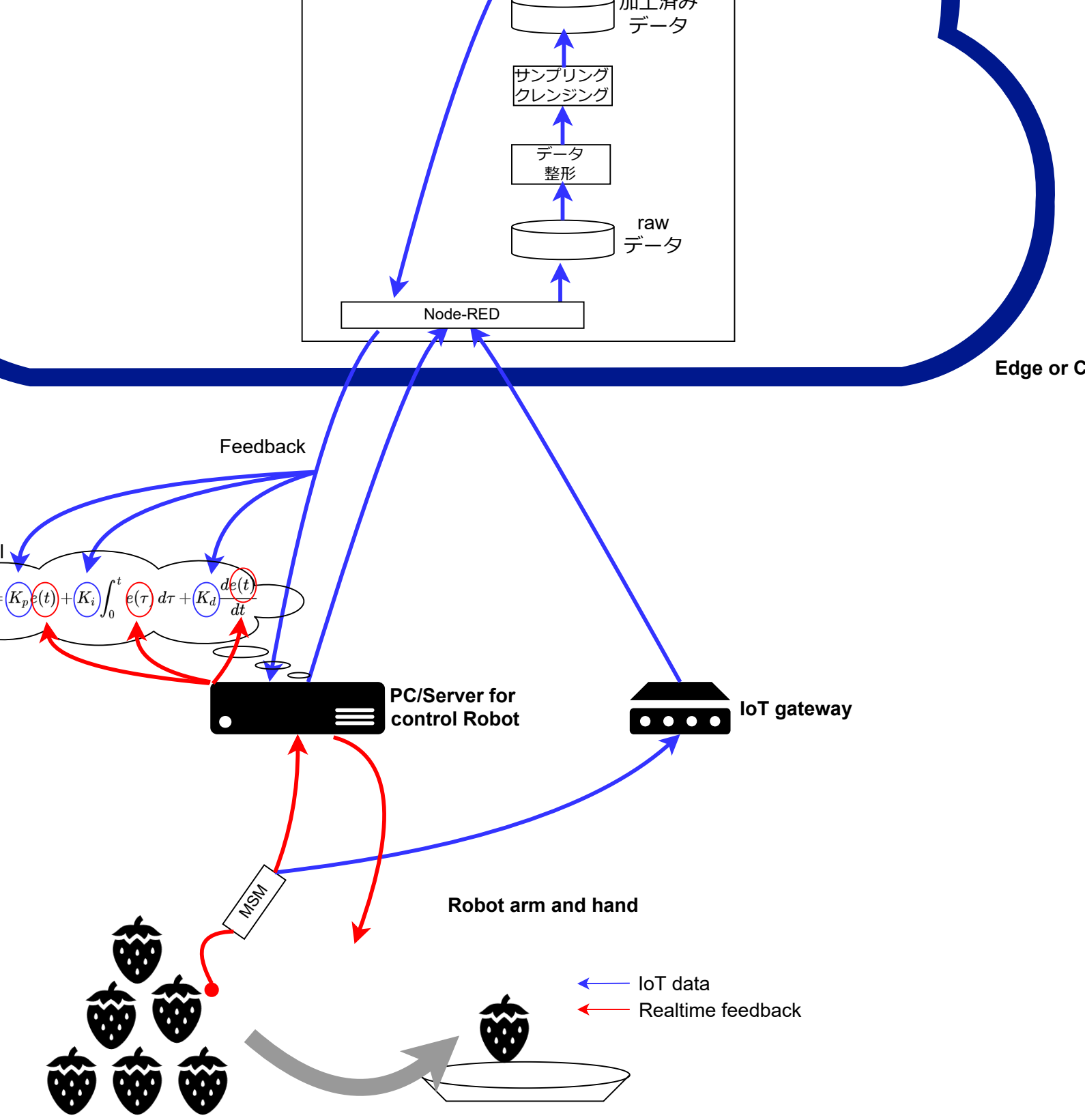



V M or Containaer



E.g. PID contro

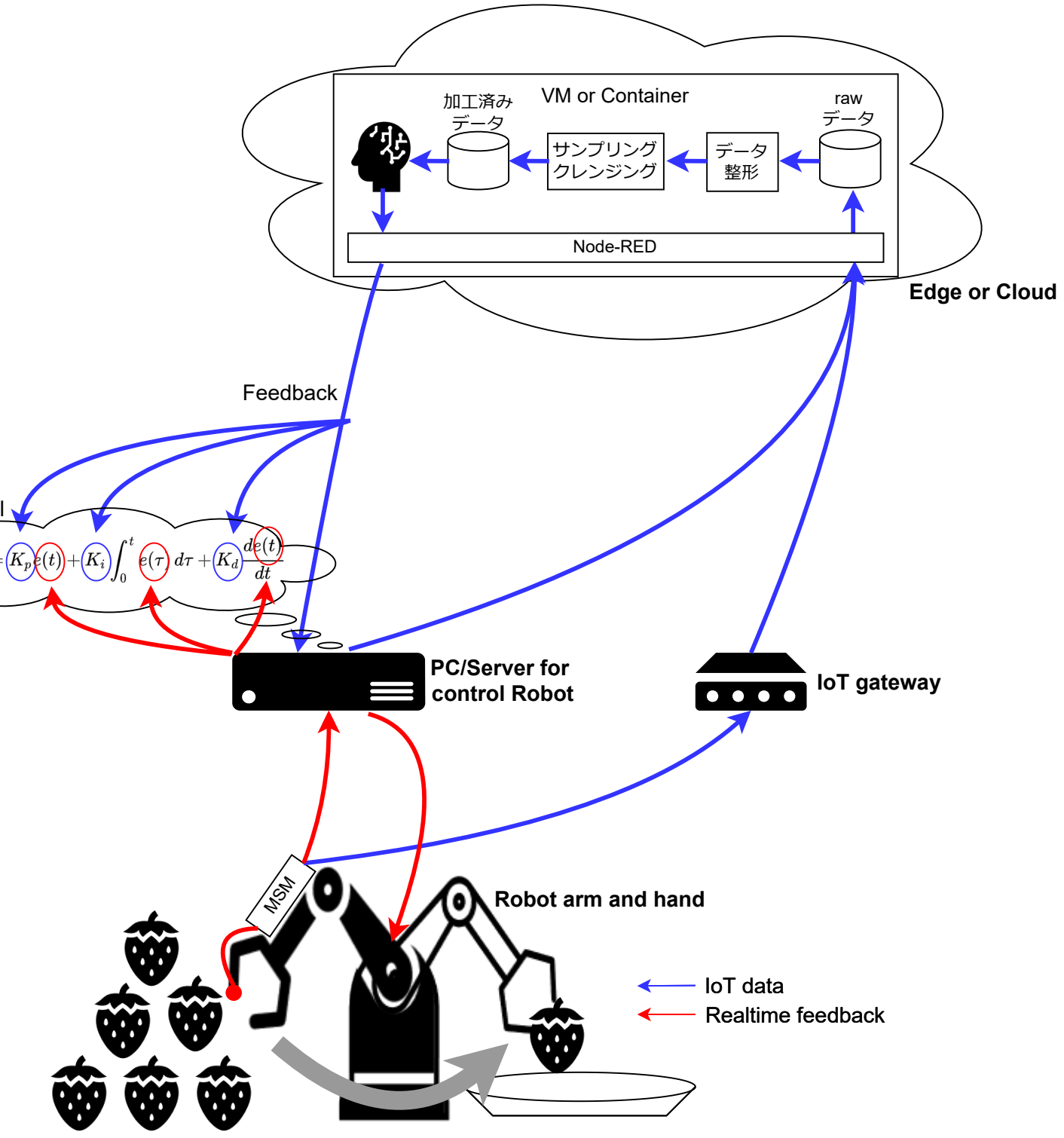
$u(t) =$

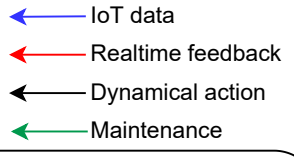

加工済み
データ
サンプリング
クレンジング
データ
整形
raw
データ
Node-RED
Edge or C
Feedback
$K_p e(t) + K_i \int_0^t e(\tau)\, d\tau + K_d \frac{de(t)}{dt}$
PC/Server for
control Robot
IoT gateway
MSM
Robot arm and hand
IoT data
Realtime feedback

Cloud

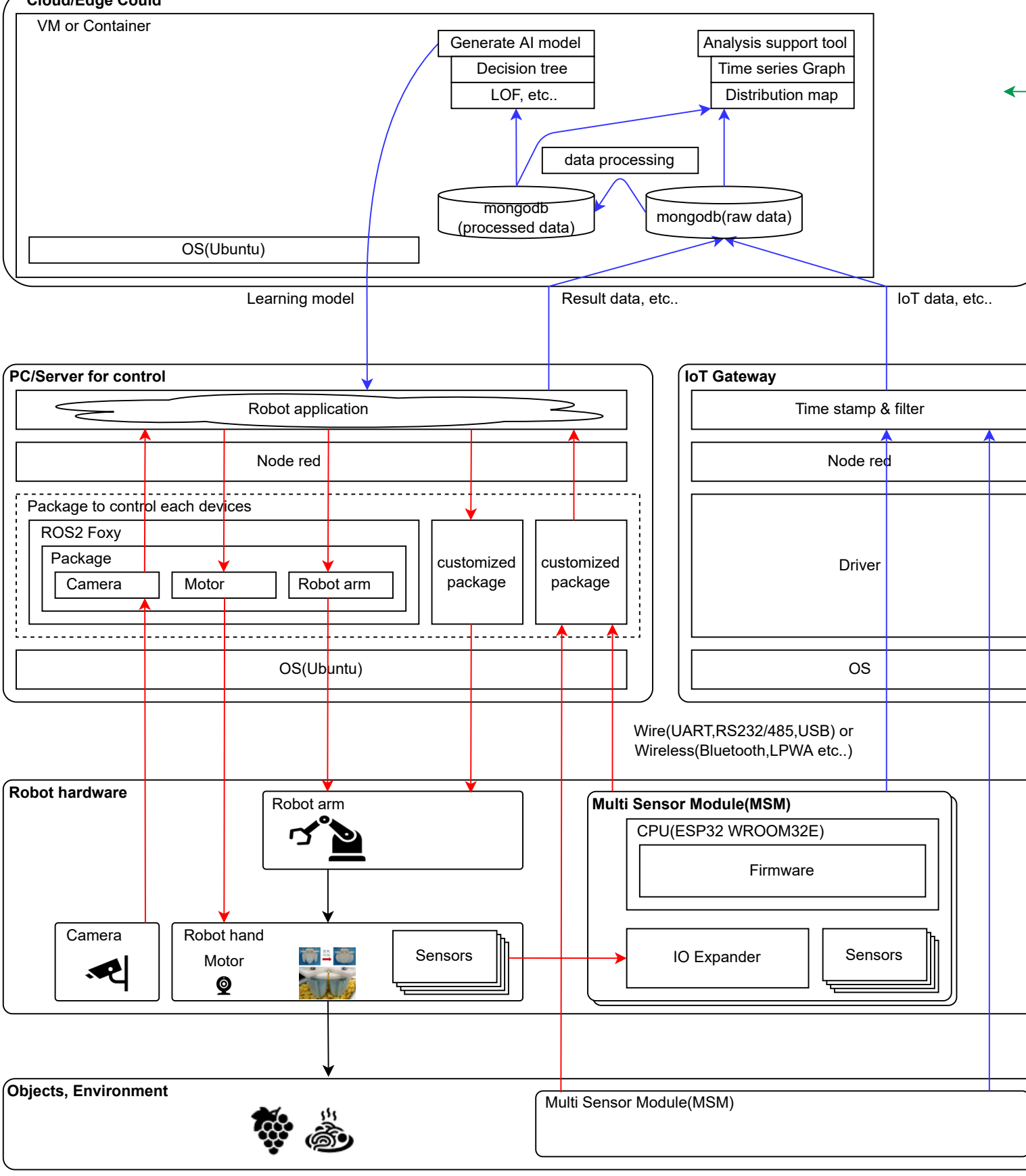
E.g. PID contro

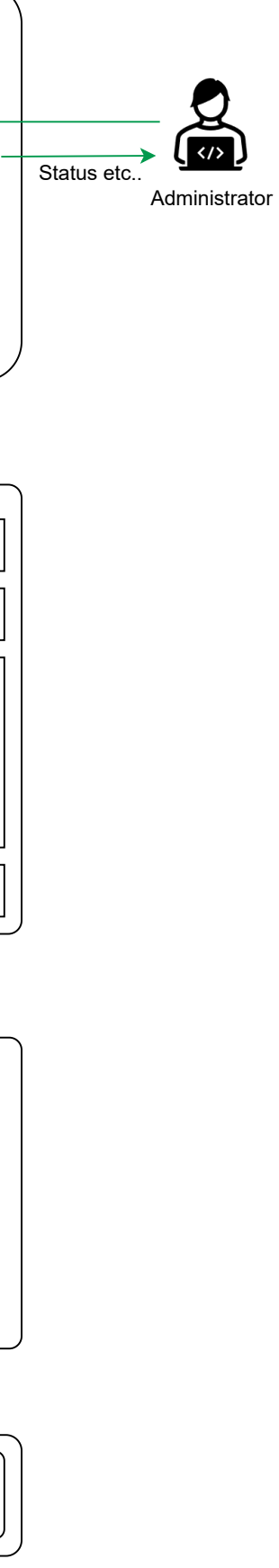
$u(t) =$

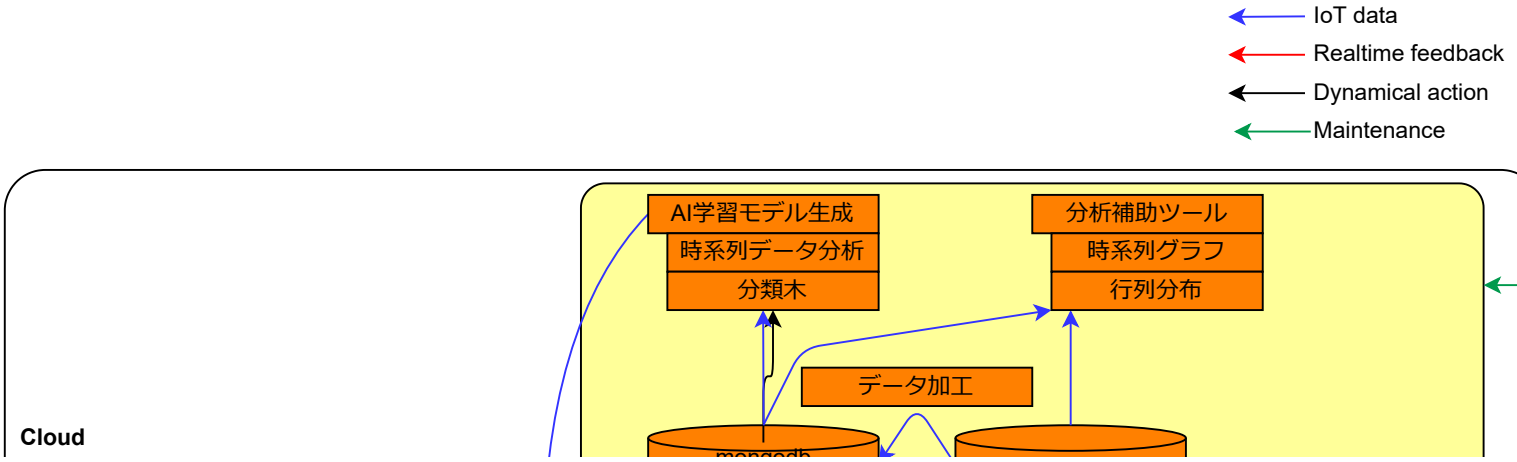

VM or Container
加工済み
データ
raw
データ
サンプリング
クレンジング
データ
整形
Node-RED
Edge or Cloud
Feedback
$K_p e(t) + K_i \int_0^t e(\tau)\, d\tau + K_d \frac{de(t)}{dt}$
PC/Server for
control Robot
IoT gateway
MSM
Robot arm and hand
IoT data
Realtime feedback

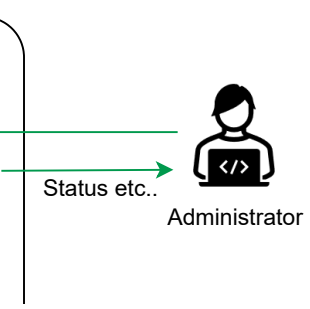


Cloud/Edge Could


Cloud/Edge Could
VM or Container
Generate AI model
Decision tree
LOF, etc..
Analysis support tool
Time series Graph
Distribution map
data processing
mongodb
(processed data)
mongodb(raw data)
OS(Ubuntu)
Learning model
Result data, etc..
IoT data, etc..
PC/Server for control
Robot application
Node red
Package to control each devices
ROS2 Foxy
Package
Camera
Motor
Robot arm
customized
package
customized
package
OS(Ubuntu)
IoT Gateway
Time stamp & filter
Node red
Driver
OS
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
Robot hardware
Robot arm
Camera
Robot hand
Motor
Sensors
Multi Sensor Module(MSM)
CPU(ESP32 WROOM32E)
Firmware
IO Expander
Sensors
Objects, Environment
Multi Sensor Module(MSM)

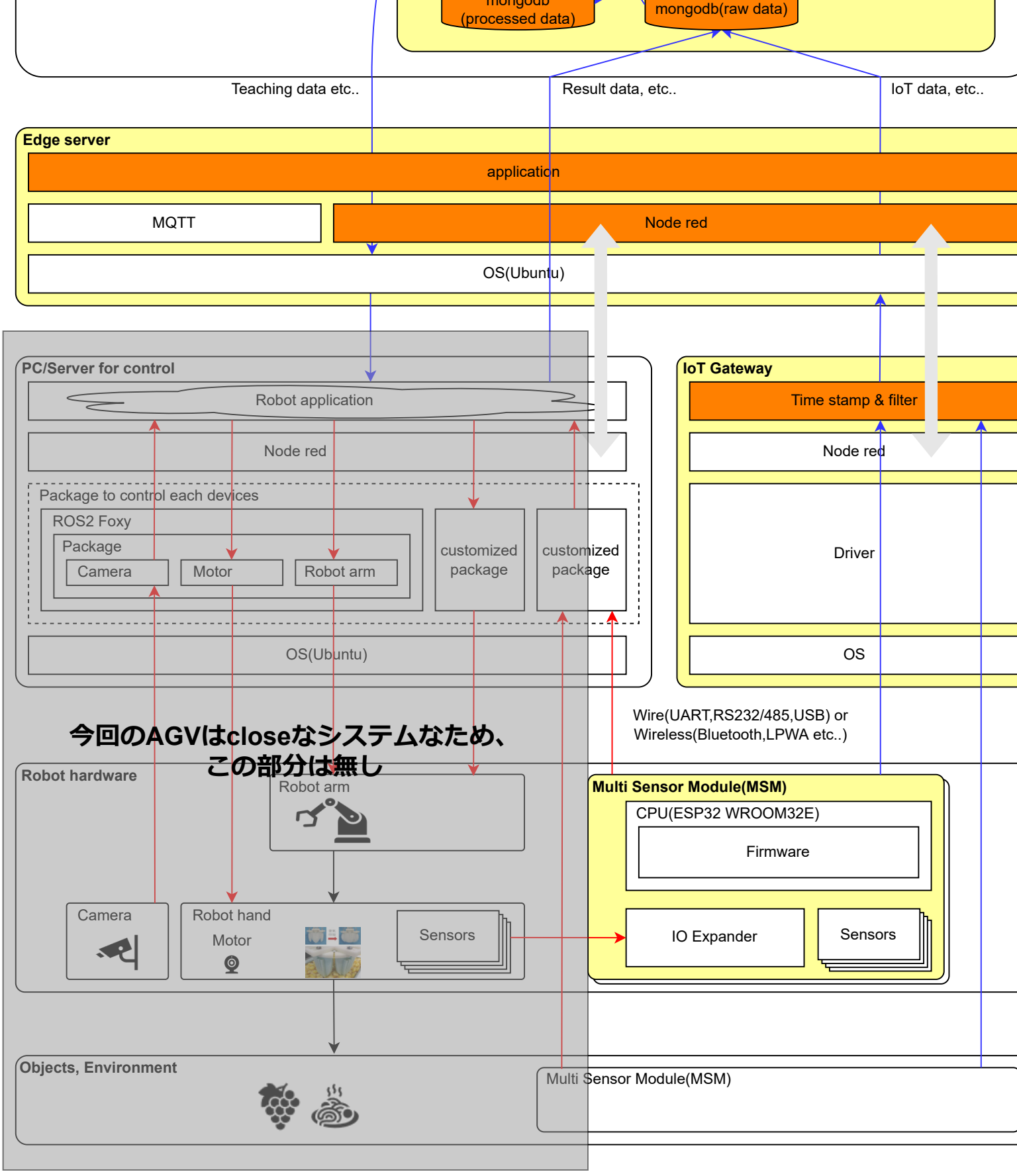

Status etc..
Administrator


IoT data
Realtime feedback
Dynamical action
Maintenance
Cloud
AI学習モデル生成
時系列データ分析
分類木
分析補助ツール
時系列グラフ
行列分布
データ加工



■デモ
■対象：コンポーネント/モジュー
■大きな流れ
①ライブラリ登録
■クラウド
app層

ールベンダー、サービサー向け


mongodb
(processed data)
mongodb(raw data)
Teaching data etc..
Result data, etc..
IoT data, etc..
Edge server
application
MQTT
Node red
OS(Ubuntu)
PC/Server for control
Robot application
Node red
Package to control each devices
ROS2 Foxy
Package
Camera
Motor
Robot arm
customized package
customized package
OS(Ubuntu)
IoT Gateway
Time stamp & filter
Node red
Driver
OS
Wire(UART,RS232/485,USB) or
Wireless(Bluetooth,LPWA etc..)
今回のAGVはcloseなシステムなため、
この部分は無し
Robot hardware
Robot arm
Camera
Robot hand
Motor
Sensors
Multi Sensor Module(MSM)
CPU(ESP32 WROOM32E)
Firmware
IO Expander
Sensors
Objects, Environment
Multi Sensor Module(MSM)

走行波形分類(学習)、走行
ライブラリ層
学習モデルをエッジに展開
波形分類(timeserieskmea
分析補助ツール
時系列グラフ、行列分
python
mongo db atlas

■IoT Gateway(MSM、上位と
Node red flow(MSMから受
Node red

■エッジ
app層
走行波形分類(判断)、走
ライブラリ層
分析補助ツール
MSMデータの加工
python
mongo db atlas

②カタログ作成
カタログ候補
①AGV上のMSMからの慣性
②AGV上のMSMからの慣性
また、環境データ基に、異
③MSMからの環境データを基

③デプロイ用設定作成
④デプロイ
⑤デプロイ後に実際のシステム
・リアルタイムなデータで見
タイミングよく異常が起こ
・用意したデータを解析して

※理想は食品工場に設置しているものに
デプロイ出来ることだが、
NWセキュリティ等の関係から難しい。

代替①GCP
代替②FJ内のラズパイ＋MSM借用

環境分類(学習)、ゆば製造分類(学習)

開
ans)、分類木、回帰木

布図、MSMデータの加工

と通信するためのスタック)
信&タイムスタンプ打って上位へ転送/mongodbへinsert)

行環境分類(判断)、ゆば製造分類(判断)、

データを基に、AGVの異常予兆検知
データを基に、AGVの異常予兆検知
異常予兆が表れやすい環境条件算出
基に、食品製造が最適となる環境条件を算出

ム動作
見せたいところだが、
こらないので、データは用意しておく。
てその結果をユーザーに表示(色分けした波形、異常波形を異常として検出)