

Introduction to CPS Robot blueprint family

March 9, 2022

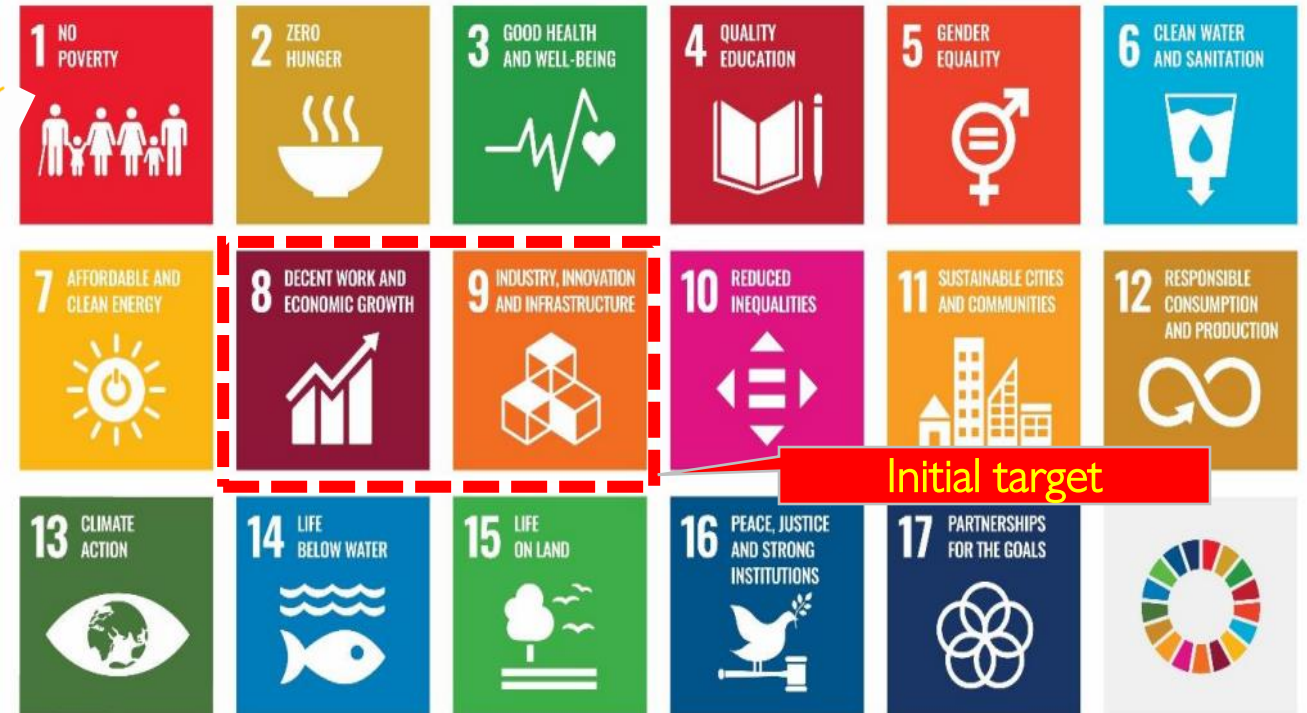
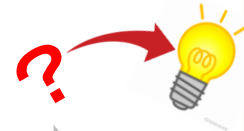
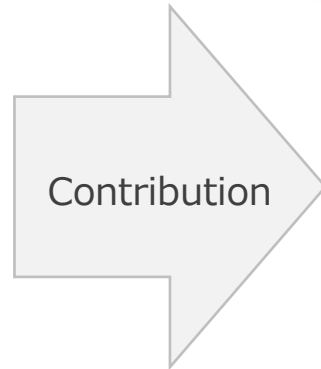
Haruhisa Fukano, TSC member of akraino, Fujitsu

Reo Inoue, Fujitsu



Vision

› Robotics can contribute to achievement of SDGs



SDGs

[\[https://www.mofa.go.jp/policy/oda/sdgs/pdf/Japans_Effort_for_Achieving_the_SDGs.pdf\]](https://www.mofa.go.jp/policy/oda/sdgs/pdf/Japans_Effort_for_Achieving_the_SDGs.pdf)

Vision(How to contribute SDGs)

- › Build robotics platform (SDGs #9)
- › Apply to various industries (SDGs #8)

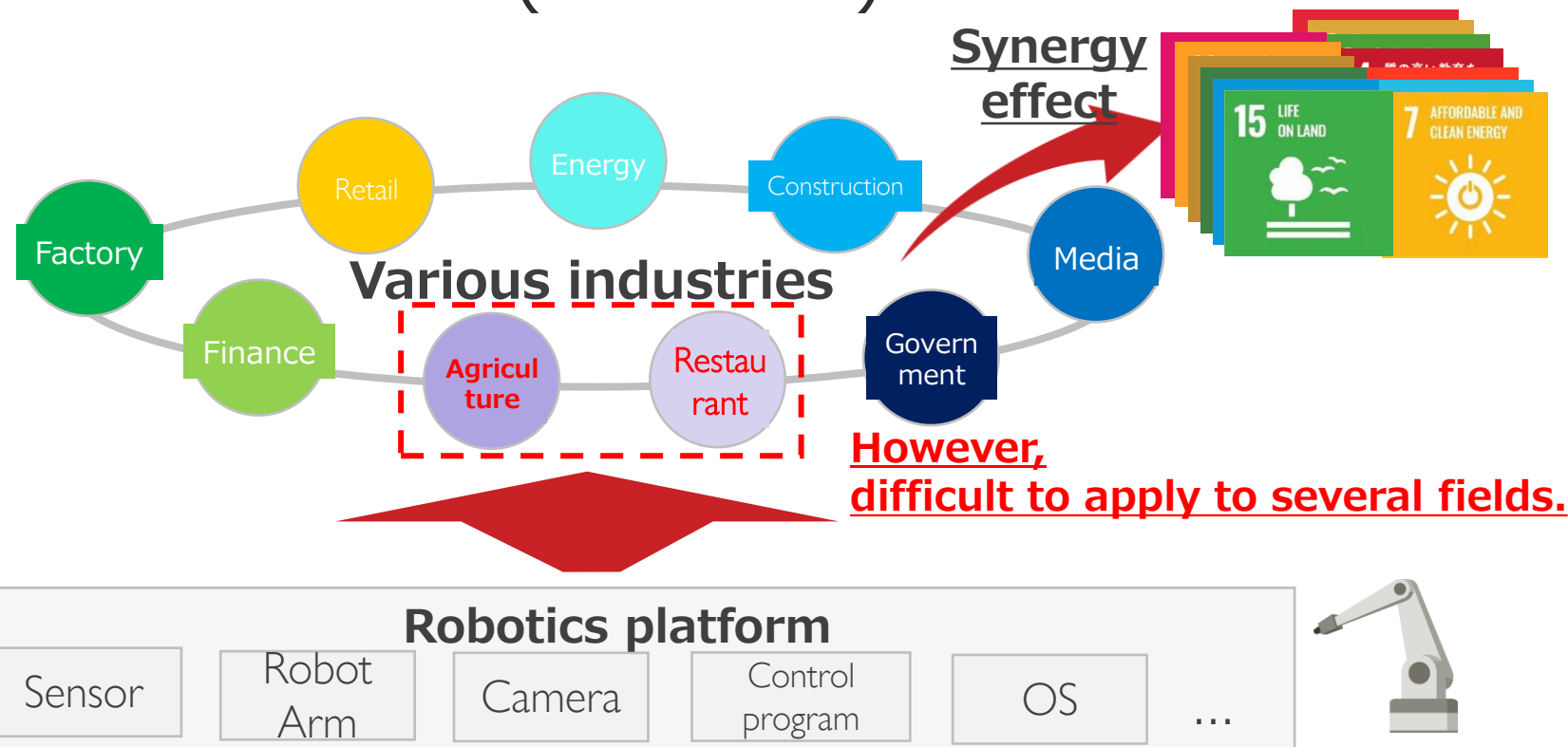
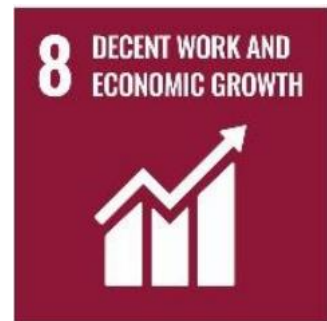


Figure: How does robotics contribute SDGs

Fields where current robots are difficult to apply

E.g. Food-service industry, Agriculture, ...

- › Challenges in these fields
 - › Objects with diverse shapes, flexibility, and frictional properties
 - › Uncertain environment
 - › High-mix small-lot production



“SIP SSES”

<https://sip-sSES.net/wp-content/uploads/2022/01/%E3%83%A2%E3%83%8E%E3%81%A5%E3%81%8F%E3%82%8A%E6%97%A5%E6%9C%AC%E4%BC%9A%E8%AD%B0%E5%8E%9F%E7%A8%BF.pdf>

SSES(Sensor-Rich Soft End-Effector System)

Ritsumeikan University and other companies research and develop SSES to solve challenges.

› SSES Approach

- › Enhancement of cognitive ability
 - › Sensor-rich technology for multi-dimensional data acquisition
 - › AI/IoT technology with force/contact information
 - › IoT maintenance and inspection technology
- › New Mechanical
 - › Flexible hands by Polymer Materials
 - › Advanced 3D printing technology

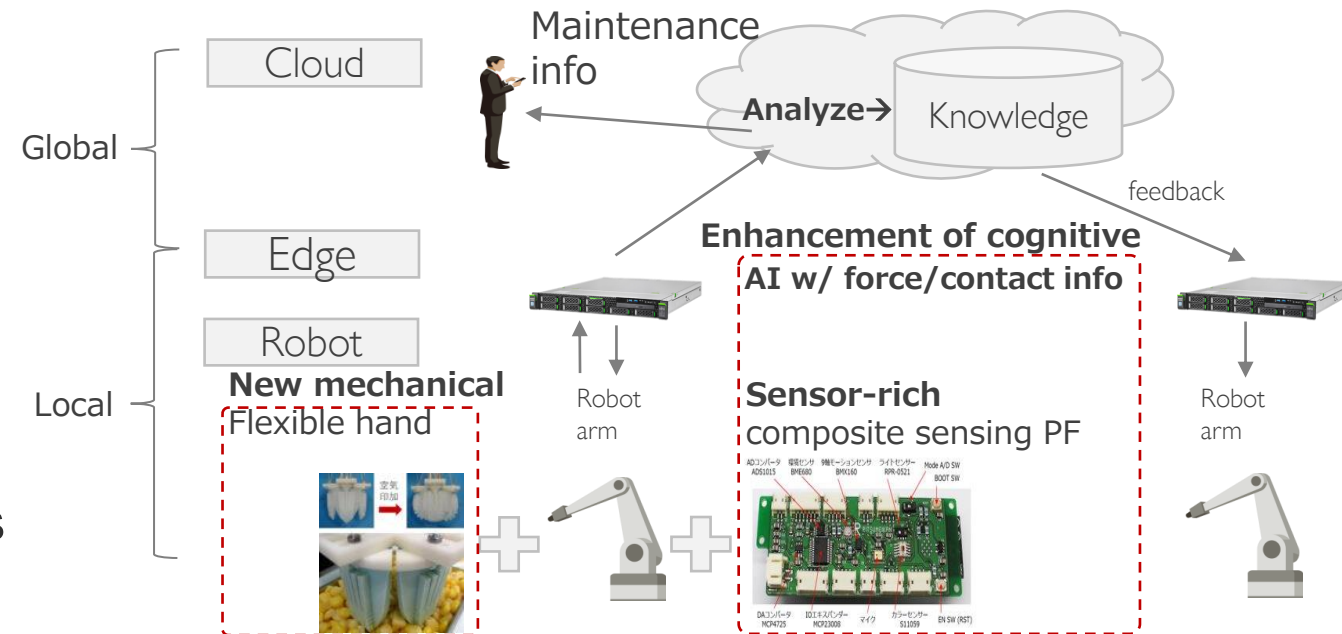


Figure: SSES architecture(<https://sip-sses.net/>)

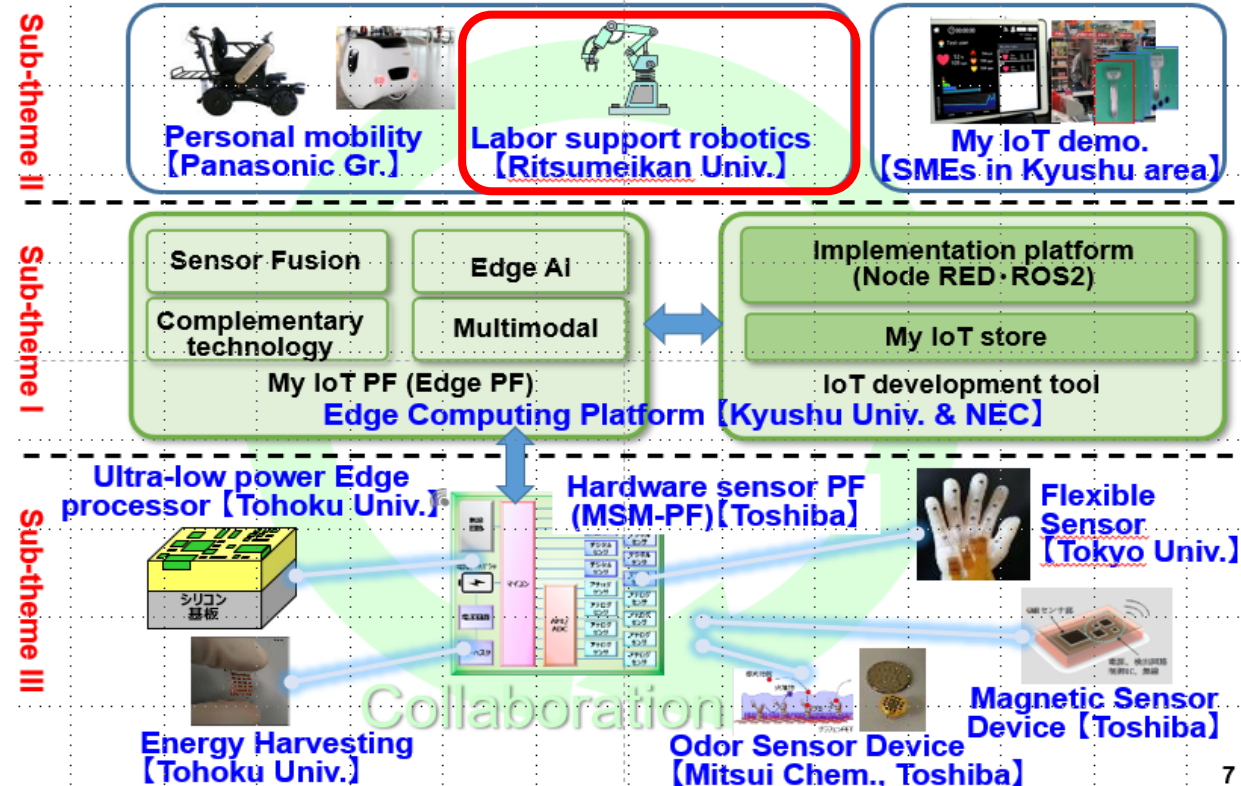
SIP and SSES

› SSES is one of theme in SIP (Cross-ministerial Strategic Innovation Promotion Program)

Features of SIP

- Cross-ministerial efforts through industry, academia and government cooperation.
- Focused, end-to-end R&D from basic research to practical application and commercialization. Utilize results in reform of regulations and/or systems, special wards, government procurement, etc. Significant for international standardization.
- Intellectual property management system facilitating strategic corporate use of R&D outcomes.
- 11 programs were adopted for the 1st term (2014-2018), and 12 new programs for the 2nd term (2018-2022).
- 28 billion yen is allocated as budget per year to all programs in total.

R&D Topics



3

7

“Introduction of SIP. Dr Saso, in 09/15/2021 Akraino IoT Area webinar”



SSES use case and demo



Remove dishes from table



Dishwashing

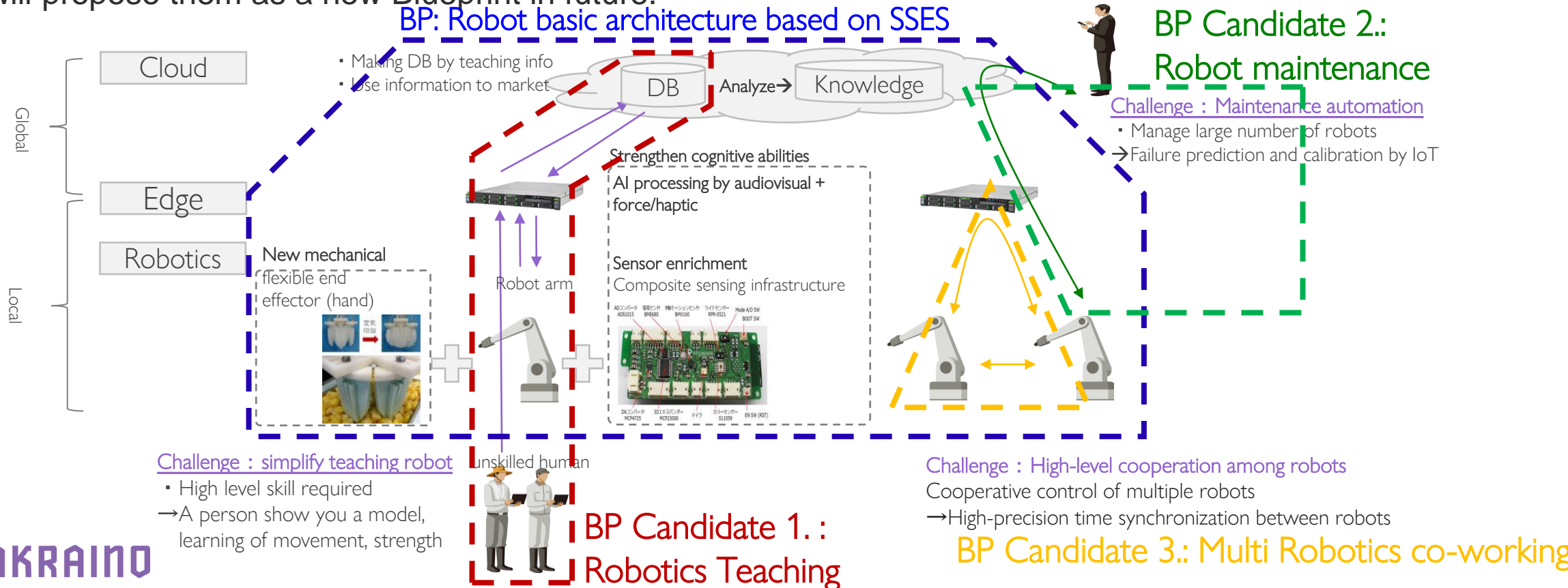


Serve on plate

All video from
SIP SSES project
<https://sip-sses.net/publicinformation/>

CPS Robot Blueprint family overview

- › Approved “CPS Robot Blueprint family” and “Robot basic architecture based on SSES” on 01/06/2022.
- › Provide open software stack based on SSES to apply robotics to any industry easily.
- › There are some Blueprint candidate based on challenges in social implementation of robots. We will propose them as a new Blueprint in future.



Robot basic architecture based on SSES Blueprint

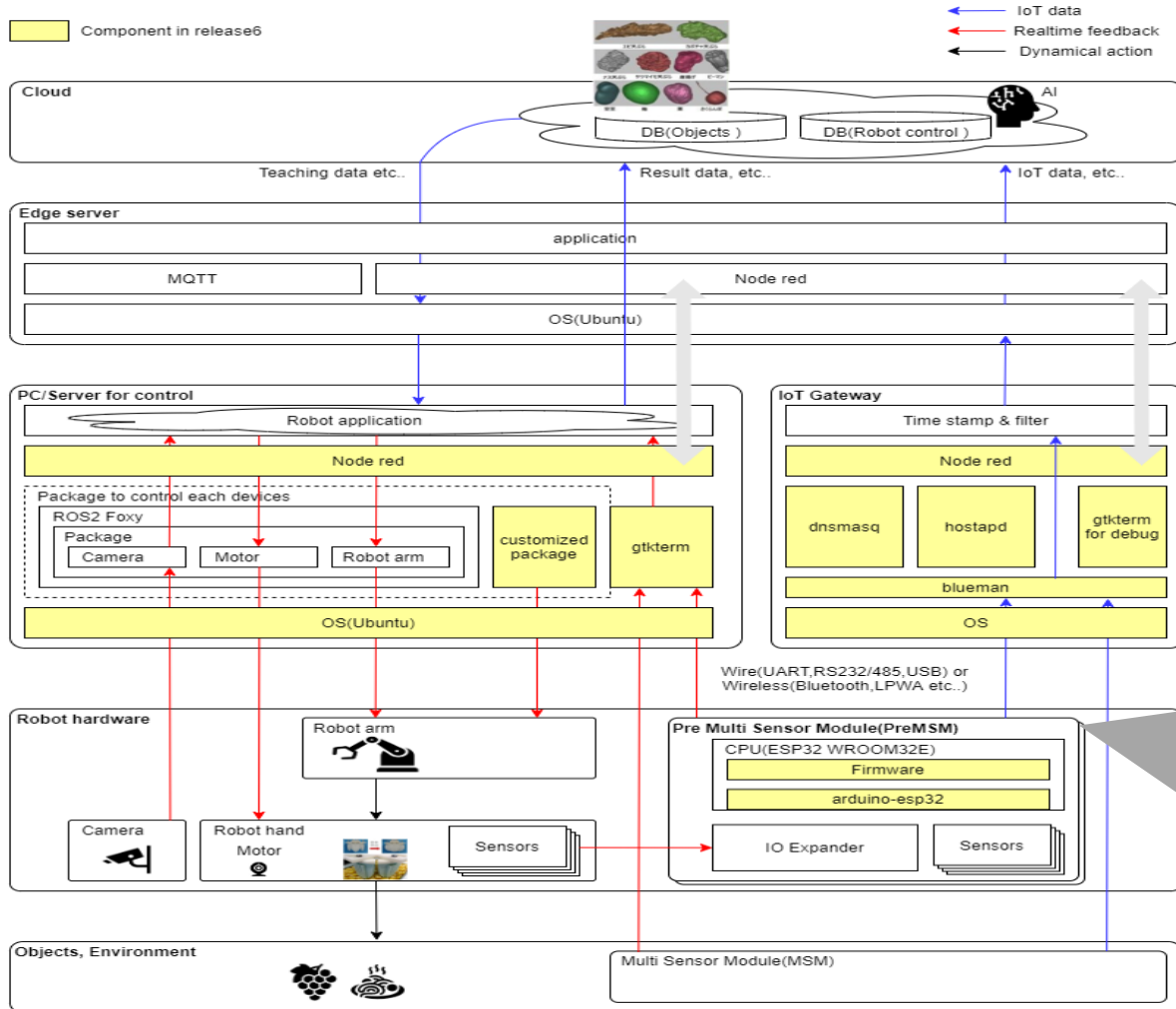
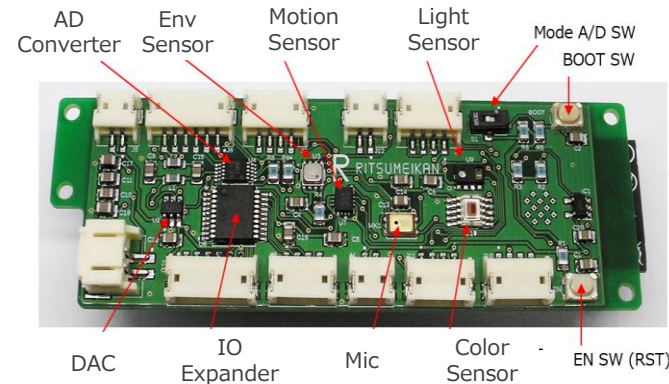


Figure: Detail of architecture

- › Under testing for Akraino release6
- › Documents are available on wiki [Robot basic architecture based on SSES - Akraino - Akraino Confluence](#)
 - › Architecture document
 - › Installation document
 - › Test document

PreMSM(Multi Sensor Module) •Sensor-rich



Robot basic architecture based on SSES Blueprint activities in 2022

- › Enhance current blueprint functionality
 - › Autonomous optimization of Robot Control
e.g Parameter optimization of PID control
 1. Store data measured by robot control PC and PreMSM
(Robot control result, contact, pressure etc..)
 2. Analyze data in the cloud for better parameters
 3. Feedback parameters to robot control

➔ We will add AI and database components to current blueprint for autonomous optimization.

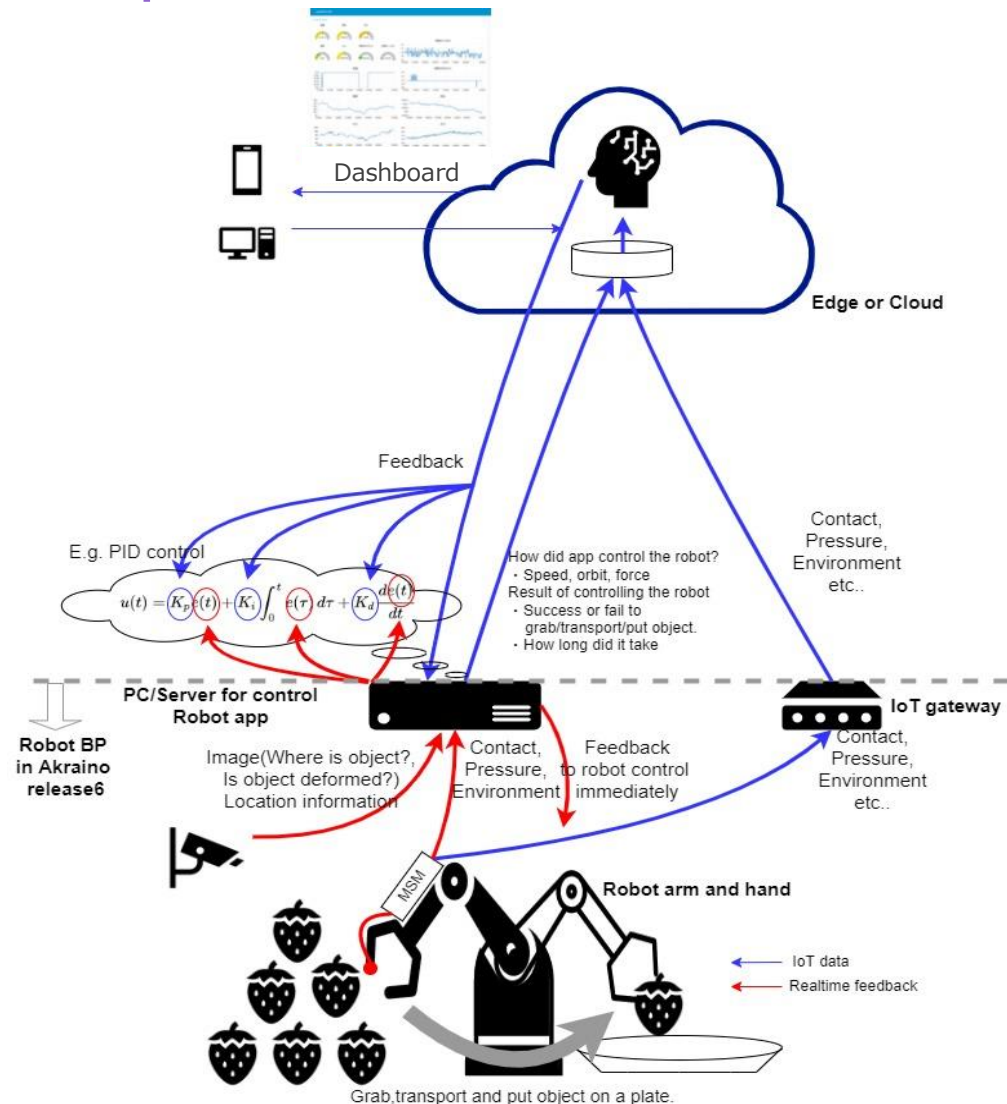


Figure: Enhance Robot basic architecture based on SSES Blueprint

Conclusion

- › Will release Robot basic architecture based on SSES Blueprint in Akraino release 6.
- › Will enhance Robot basic architecture based on SSES Blueprint functionality.
Autonomous optimization of Robot Control
- › Will propose blueprint based on SSES
 - › Candidate 1. : Robotics teaching
 - › Candidate 2. : Robot IoT maintenance, calibration
 - › Candidate 3. : Multi robot co-working
- › Welcome participants
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Thanks

