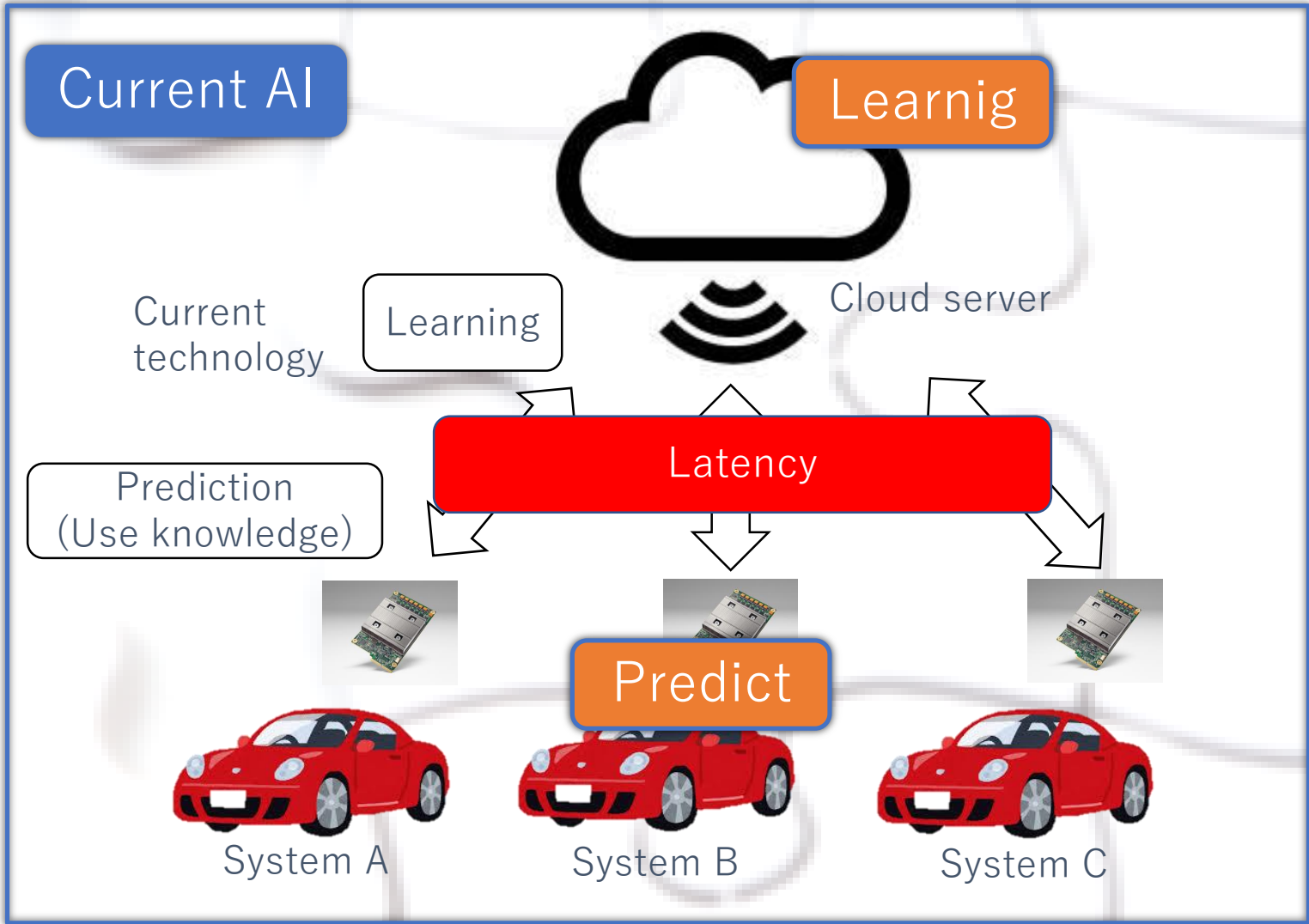
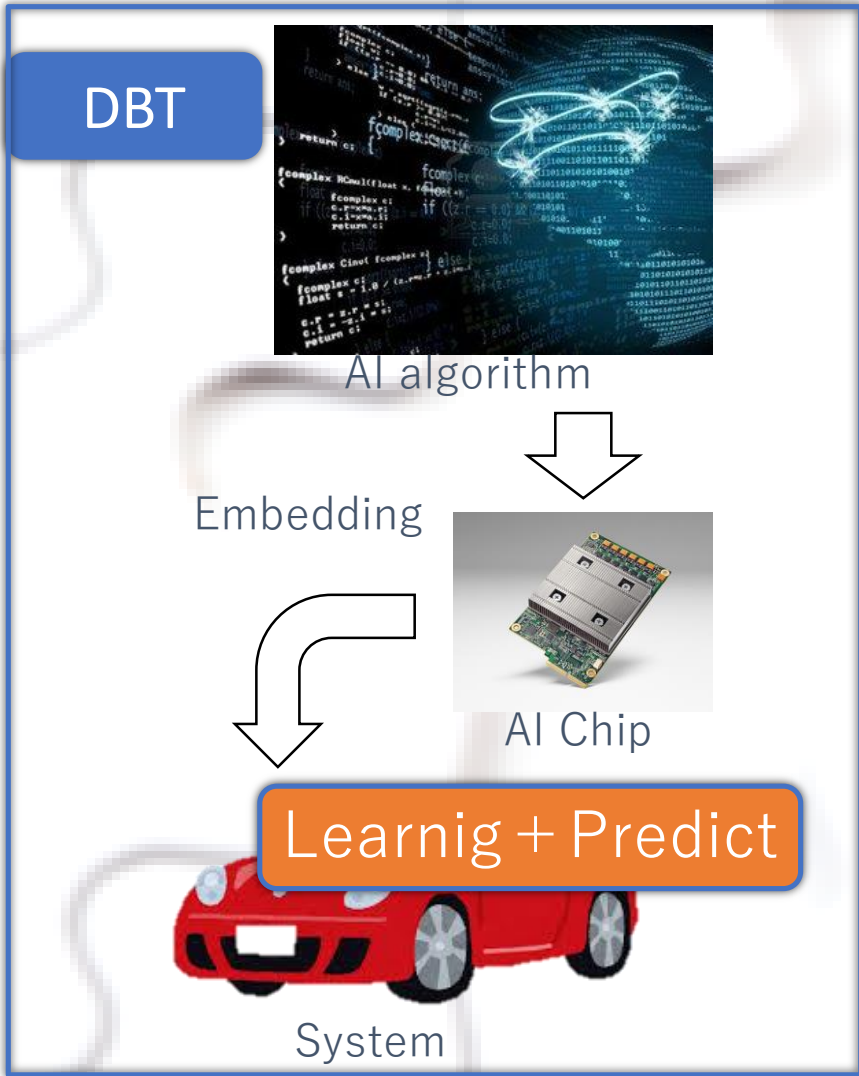




# Value of Edge AI



## Vision

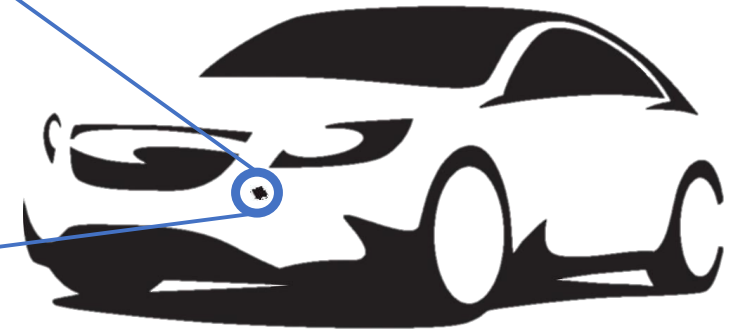
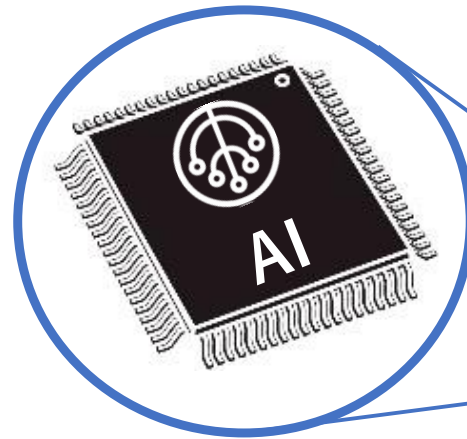
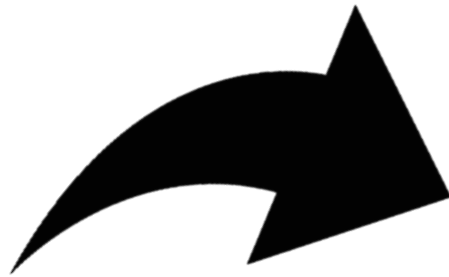
**We make edge devices smarter  
to realize an efficient society**



# Our business

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Provide our **original AI** algorithm license for **machine control**



# Founders



**Jun-ichi Idesawa**

Graduate form Waseda Univ.

**Master** of mechanical engineering



**KIM Chyon Hae**

Graduate form Waseda Univ.

**Doctor** of mechanical engineering

**Associate professor** at Iwate Univ.

**Research AI for machine control**

**Over 12 years**

# Problems of traditional machine control

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1. Need to make **individual** control model for accuracy

2. Need to **always keeping update** the model to keep high accuracy

3. Can only use **low performance computer** resource



## Solution

Original AI algorithm

Deep Binary Tree



**DBT**

- Up-to-date **Live training**
- Processing on **the edge side**
- **Explainable AI**

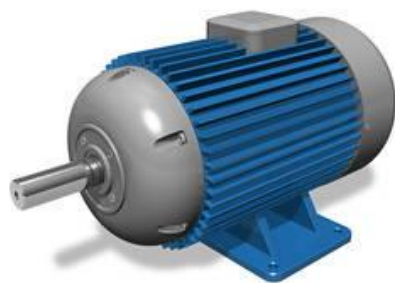
# Up-to-date **Live training**

## Value

Can always **keeping update** the model so it dose not deteriorate

Can make **individual** control model considering individual differences

Does not deteriorate



Consider individual differences





# Processing on **the edge side**

Value

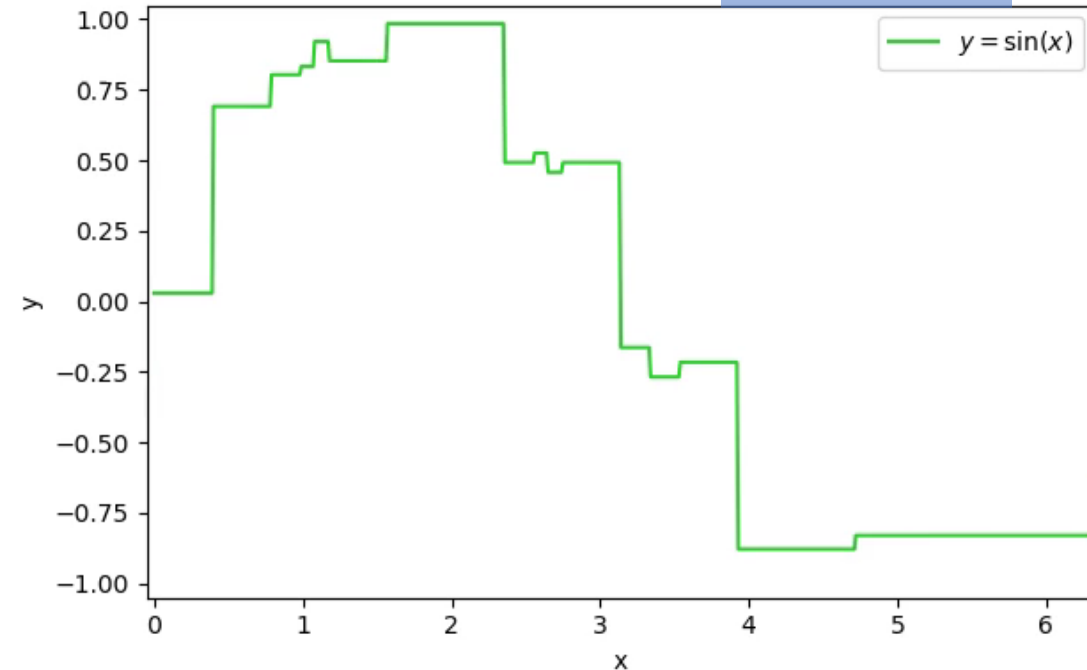
**Never delay** the control cycle  
→ The calculation time is **constant**

**Low performance computer** is available



 **#PIZERO**

Number of training data is 13.  
Average of error is 0.16762973053259142.  
Processing time of learning is 94 microsecond.  
Processing time of prediction is 3 microsecond.



# Explainable AI

Single tree structure



Can explain why the output was  
(Answer by the width of the input space)

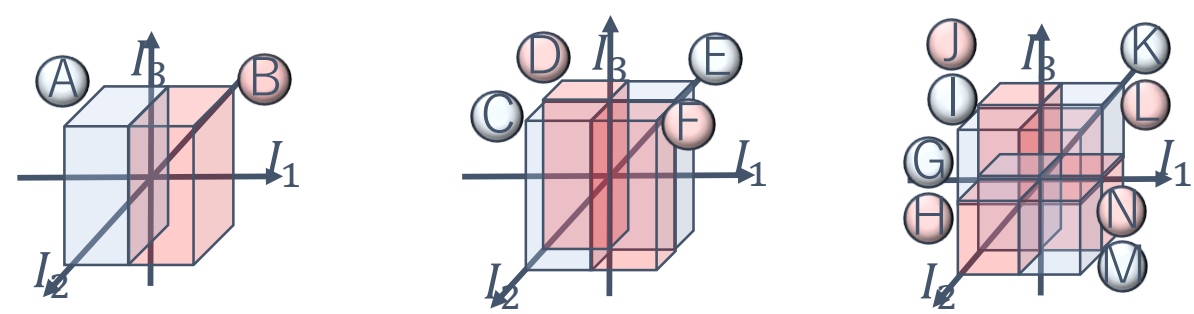


Image of state space assignment

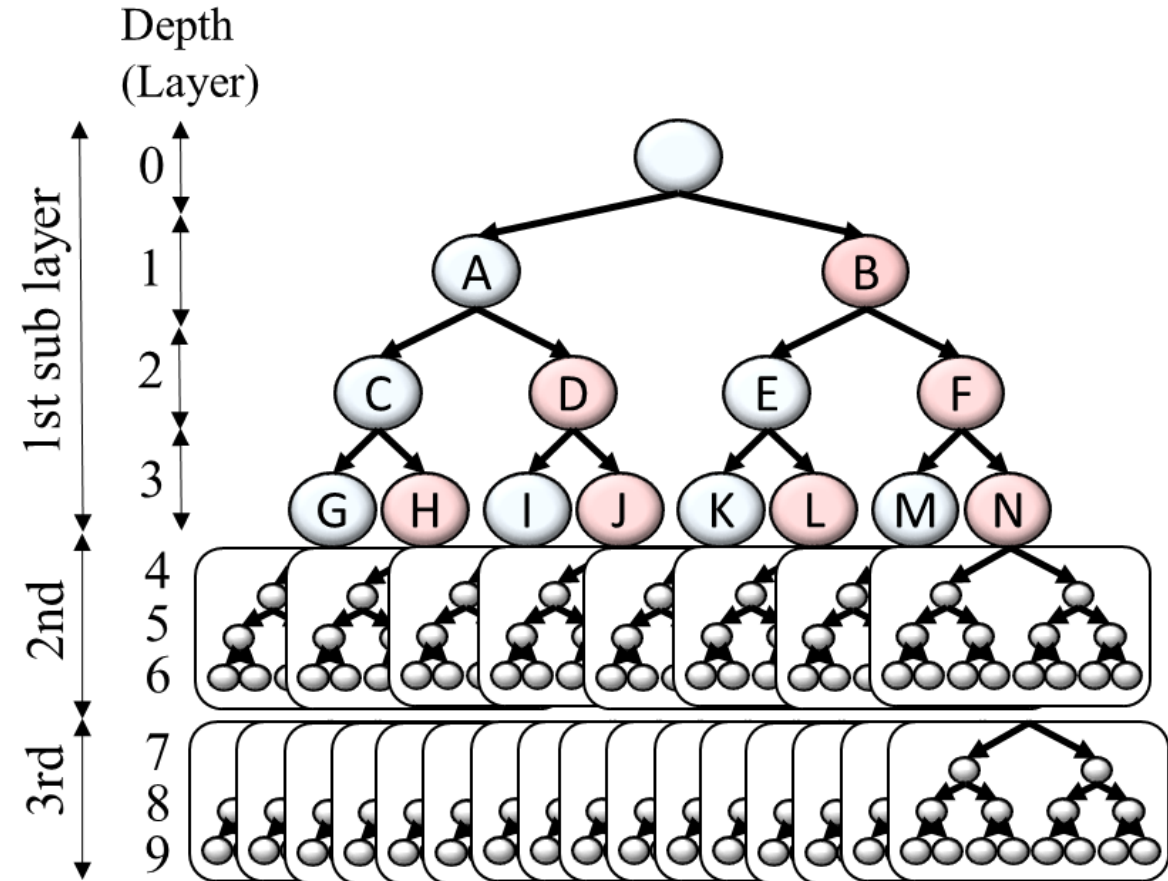


Image of structure of DBT  
(※When learning to infinity)

# Use Cases

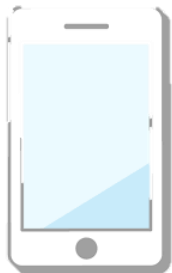
## Individual difference correction



Response to aged deterioration



Correction of product individual difference

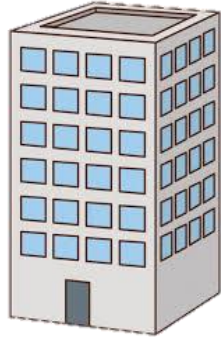


Individual difference correction



Individual difference correction of biometric information

## Predictive control



Air conditioning control



Slip prediction



Damping control

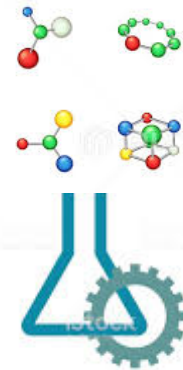


Corresponding to gusts

## Complex system



Modeling complex systems

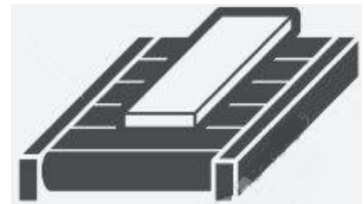


Manufacturing control

## Craftsman's intuition



lathe manufacturing



Rolling process



# Disclosable clients



**Business partnership**

Market capitalization: \$ 10billion



**Co development about UAV**

Market capitalization: \$ 37billion



**Co development with about Train**

Market capitalization: \$ 39billion



# Case 1 : Co-development with OMRON

Machine : **winding machine**  
( Attach the sheets wound on the reel )

Issue : **Occurrence** of defective product  
after changing the reel

Cause : Vibration of the machine

Solution : ① Predict the movement by **DeepBinaryTree**  
② Correct the vibration according to the prediction

Result : **Reduce** the occurrence of defective products to **1/3**



OMRON



## "Control + DBT technology"

Defective item  
Generation section

10sec

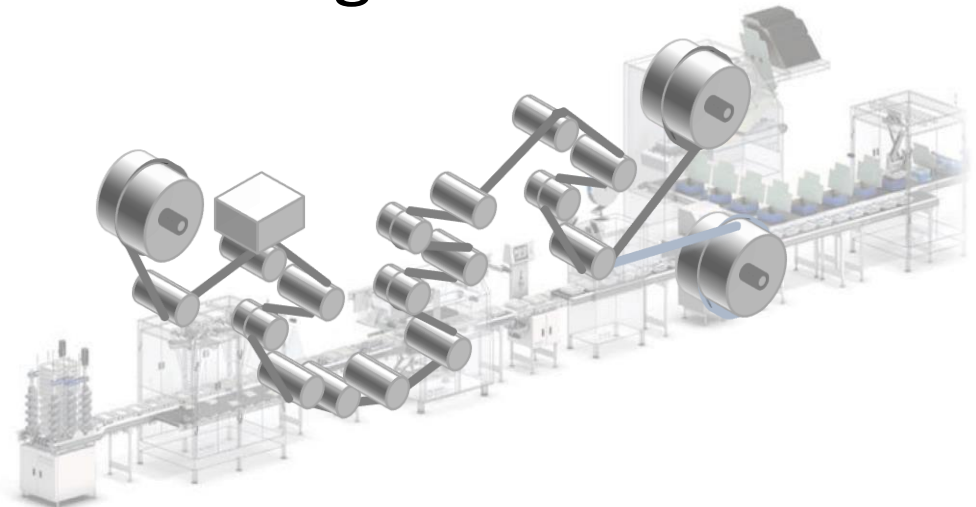
1/3

3sec

Conventional control technology

Control + DBT

## winding machine



# Case 2 : Co-development with DENSO

Machine : UAV ( 6 Drive, Variable pitch mechanism)

Goal 1 : Risk prediction avoidance

Current status : Avoid after reaching dangerous condition

Goal 2 : More **stable** flight

Current status : High athletic performance and trade-off stability

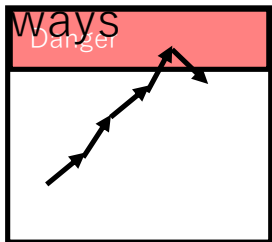
**DENSO**  
Crafting the Core



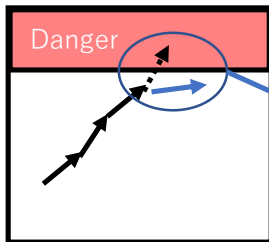
Goal 1 : Risk prediction avoidance

1. **Future prediction** of aircraft inclination with DBT
2. Avoid before getting into danger

Current



Using DBT



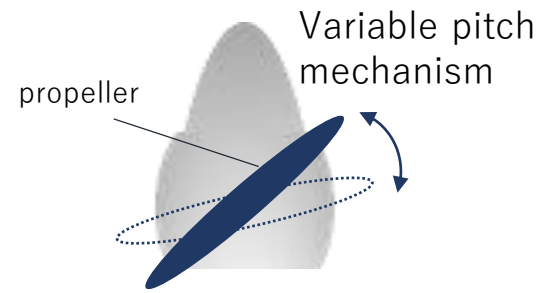
Avoid before getting into danger

Goal 2 : More stable flight

**DBT predicts** change in motion due to change in pitch angle

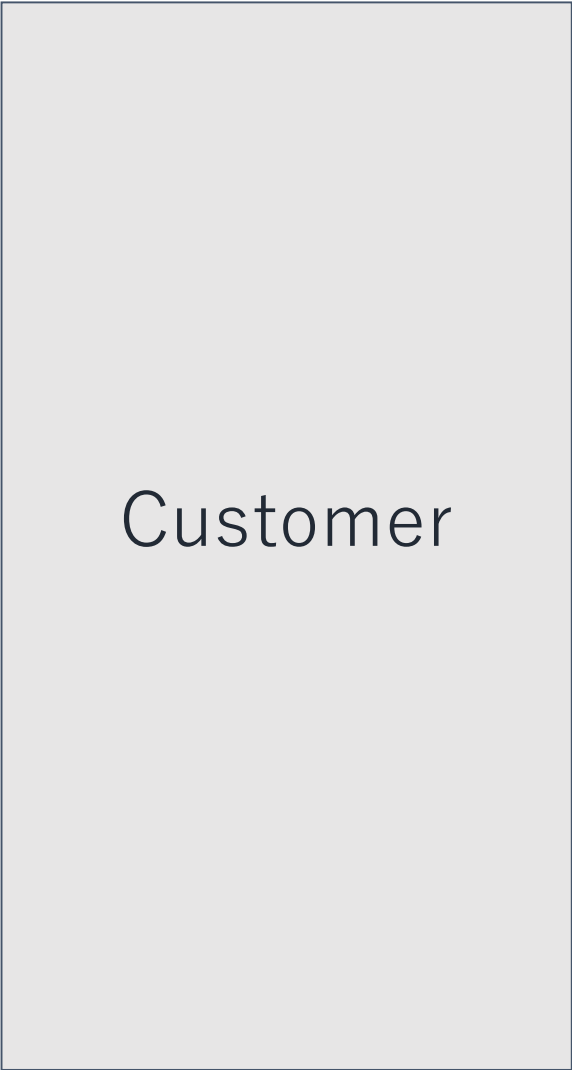
Predictive control

- **High efficiency** (smooth)
- **Stable**





# Business Model



# Technology roadmap

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2019 1 Starting to provide DBT as a **IP** for every device which has **Trust Zone** (Arm's architecture)



2020 Starting to provide DBT as a **IP(RTL) for every FPGA**

