

Wall Drawing Robot

TW044

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Outline

- Motivation
- Features
- System Architecture
- Hardware software co-design
- Summary

Motivation

- Robot has been **applied in various field**, the robot has become an assistant in **human's life**. For example: **cleaning robots !!**

Pool Cleaning Robot



Pool Cleaning Robot



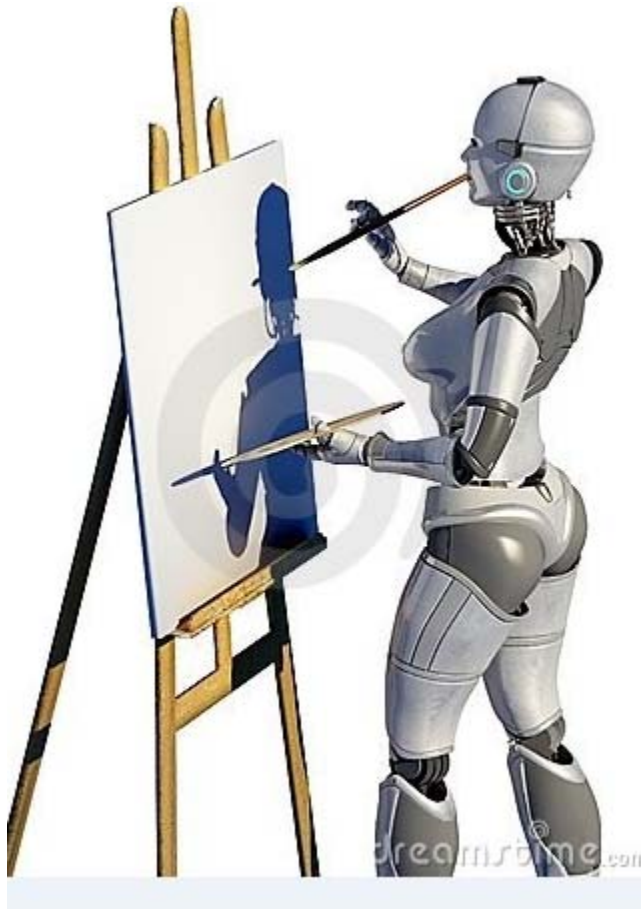
City Art

- Some place is **too high** for people to draw for city art. Some wall is vary large, it is **very dangerous** to draw on it.

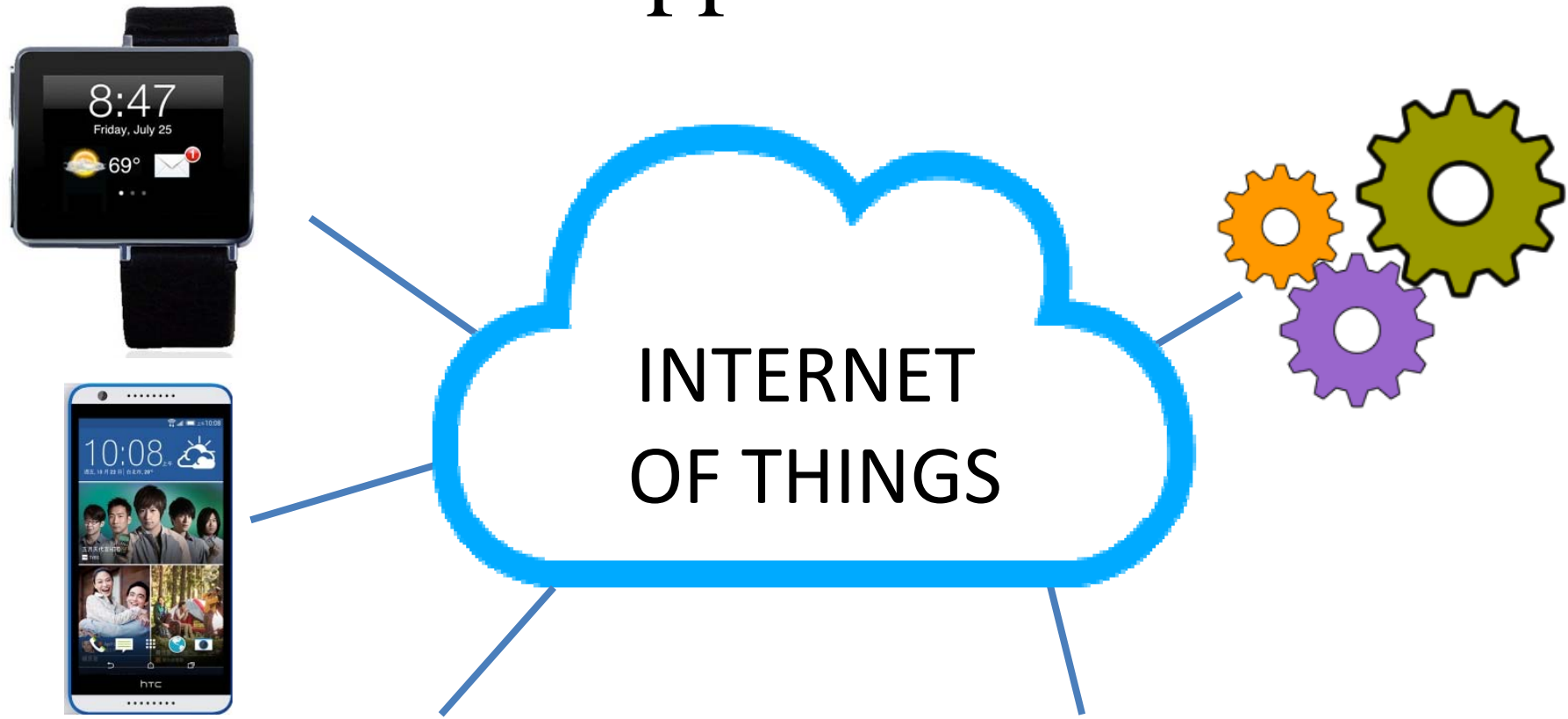


Can a robot be an artist?

- A robot artist will be very cool!



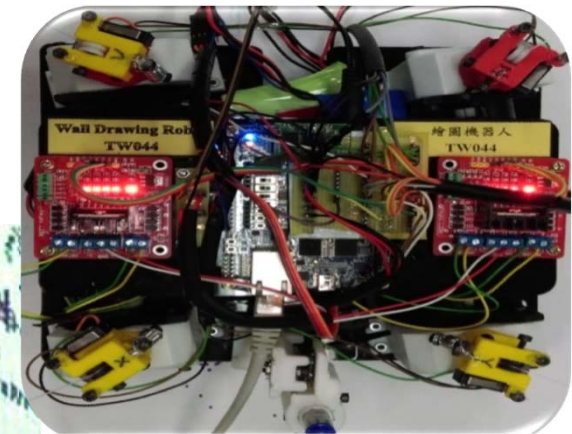
IoT Applications



iBongo robot

- We want to develop a painting robot- **iBongo robot** that can draw what it sees.
- The user can **monitor and control the robot with the website.** (IoT)

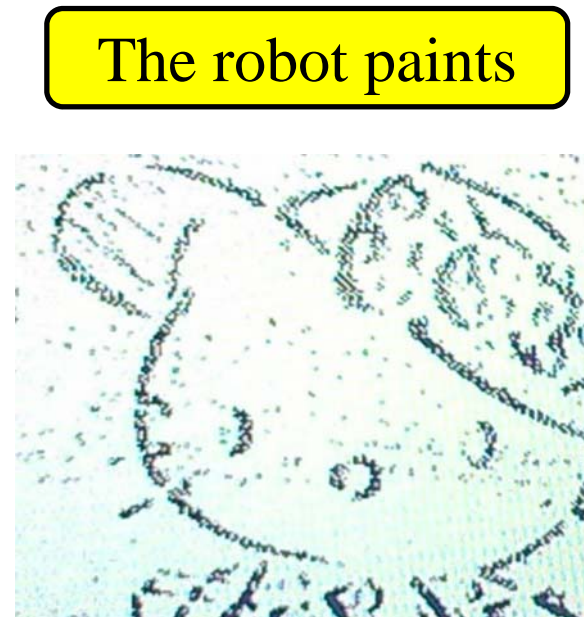
Hello kitty is our model



iBongo robot

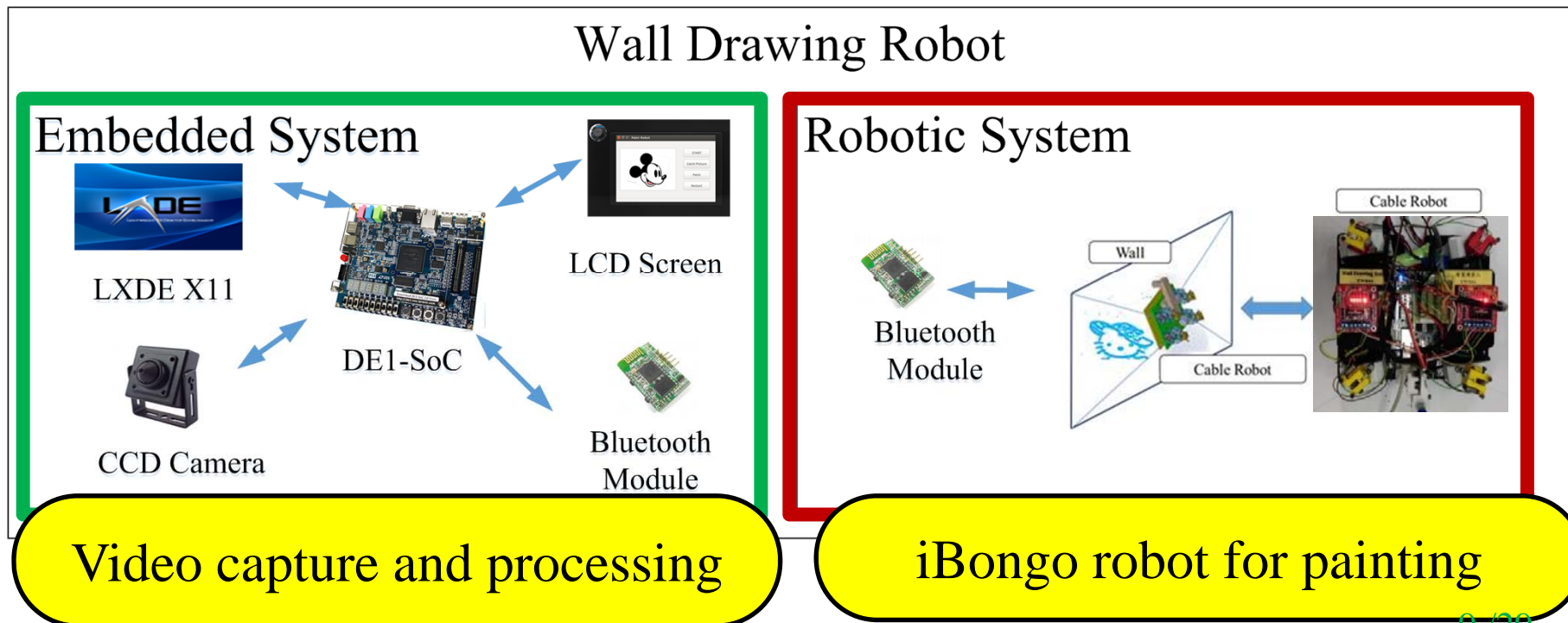
Many people like **selfie**

- The user can **take a picture first** and use **iBongo robot** to draw selfie picture.



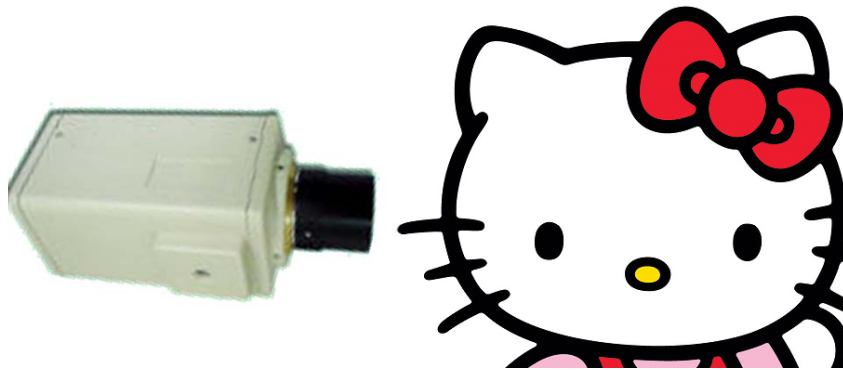
System Architecture

- The system includes an **embedded system** (video capture and processing part) and an **iBongo robot**.



System Architecture

Take a picture



ZnYnXn

...

...

Z5Y5X5

Z4Y4X4

Z3Y3X3

Z2Y2X2

Z1Y1X1

AA

Z

Y

X

Contour
Coordinates



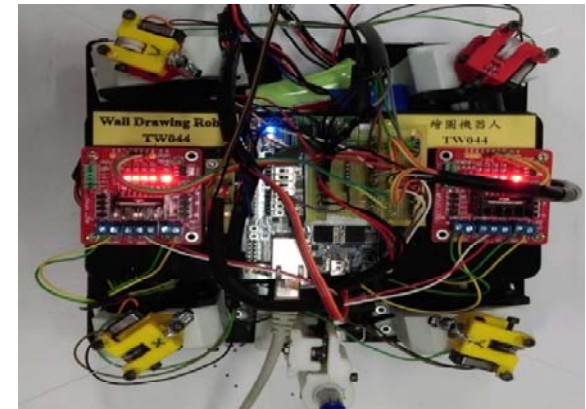
Bluetooth®



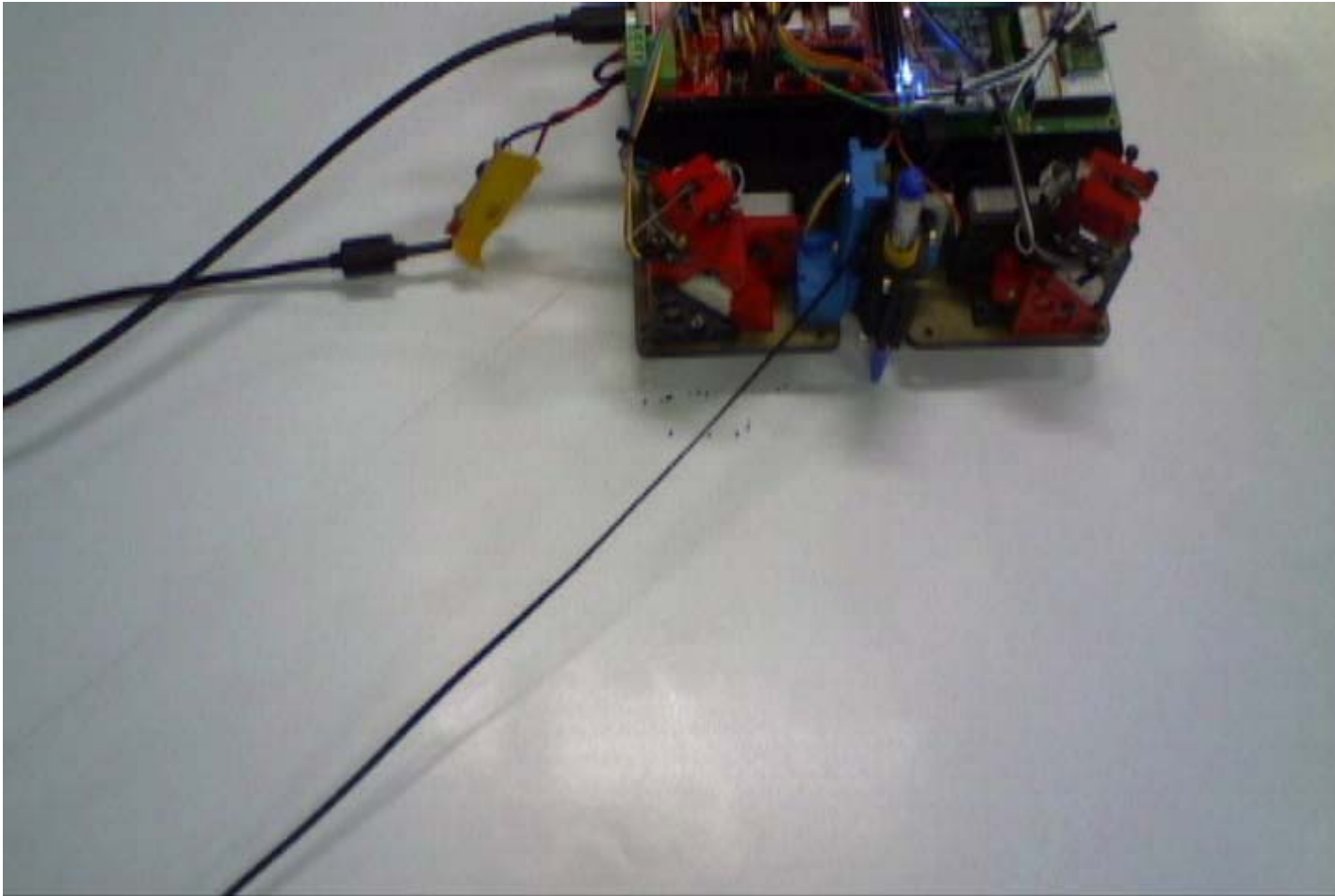
DE1-SoC



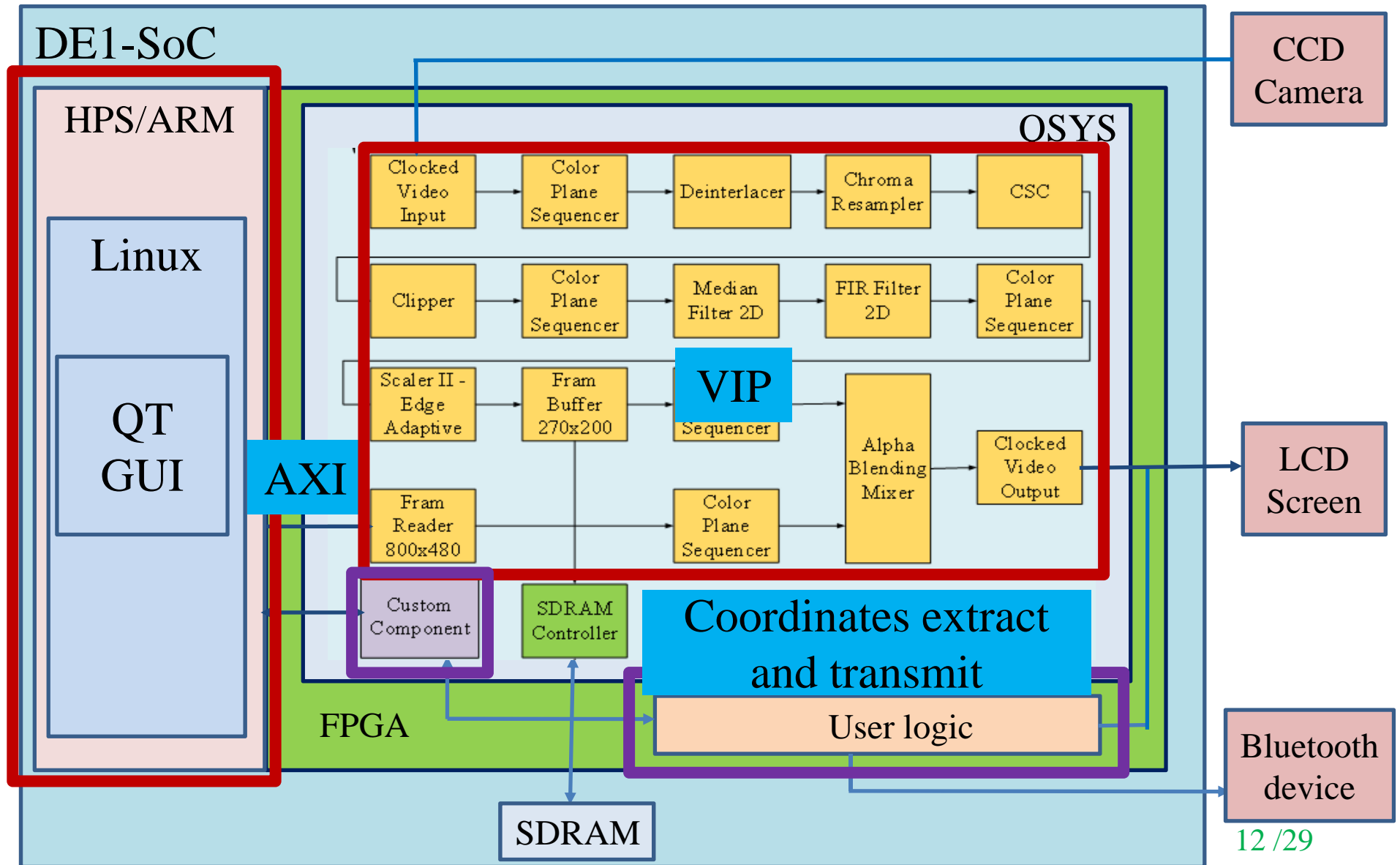
iBongo Robot



iBongo Robot Video



Block Diagram of the Embedded System



How to extract the contour coordinates?

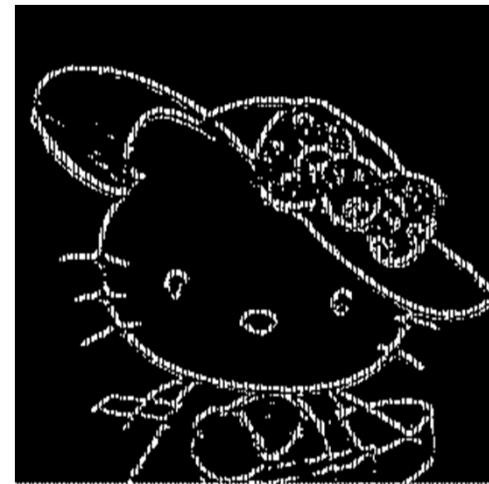
Hello kitty is our model



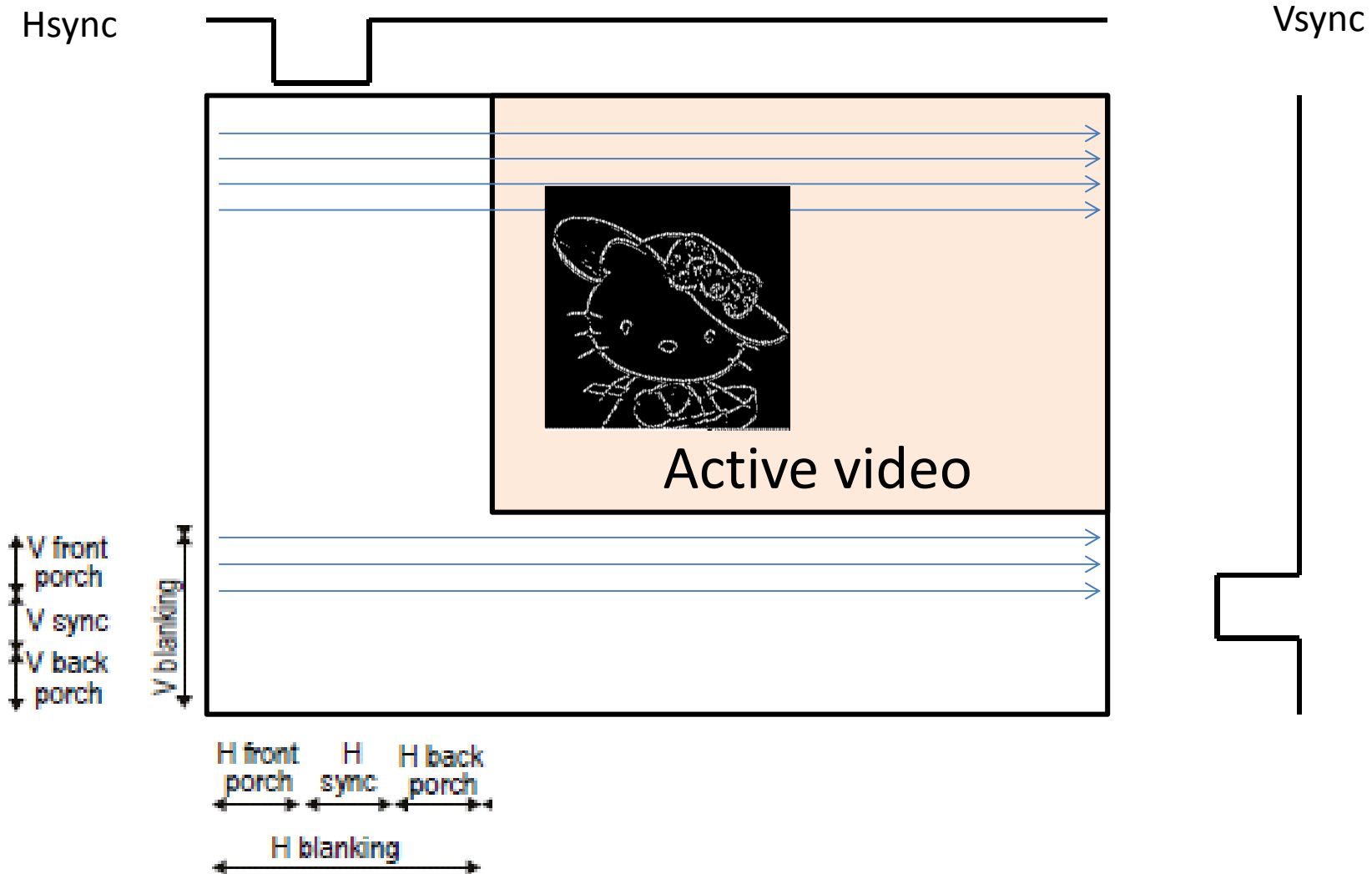
Image
Processing
with VIP
function



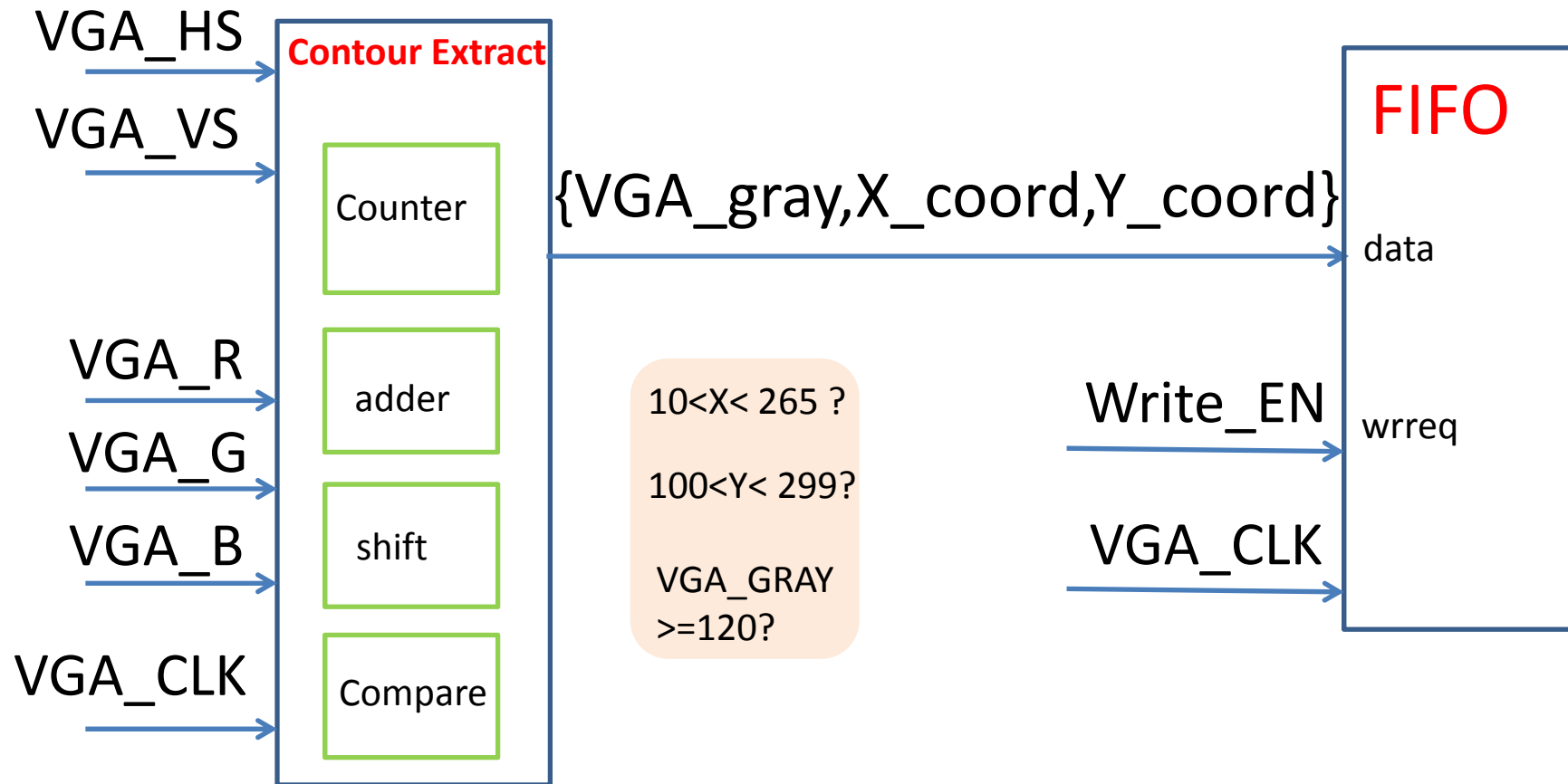
**Edge Detected and
shown on LCD screen**



LCD Signal



How to extract the contour coordinates?



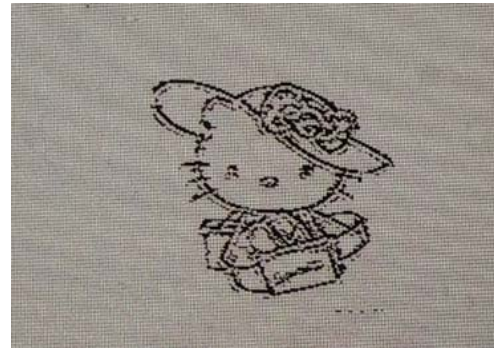
Hardware Software Co-design

GUI

Video data



Data in the FIFO



Start

Open picture

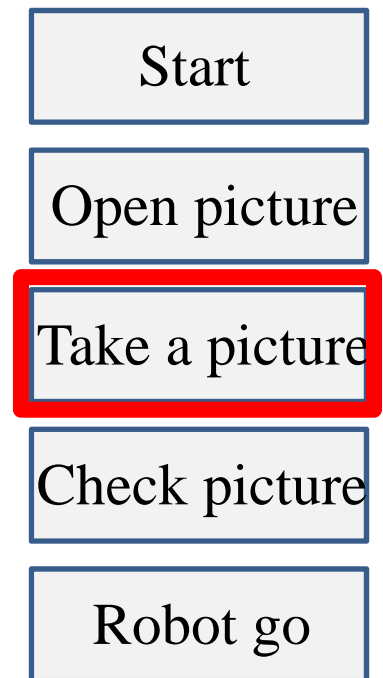
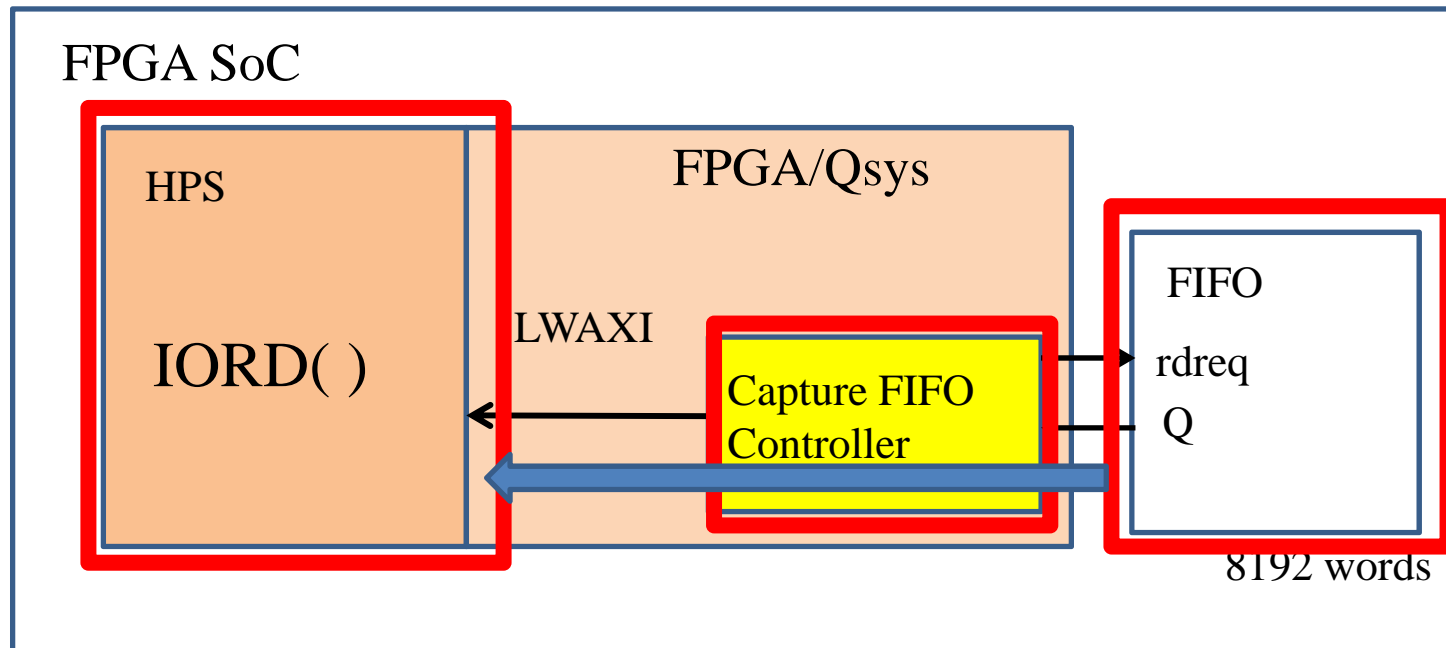
Take a picture

Check picture

Robot go

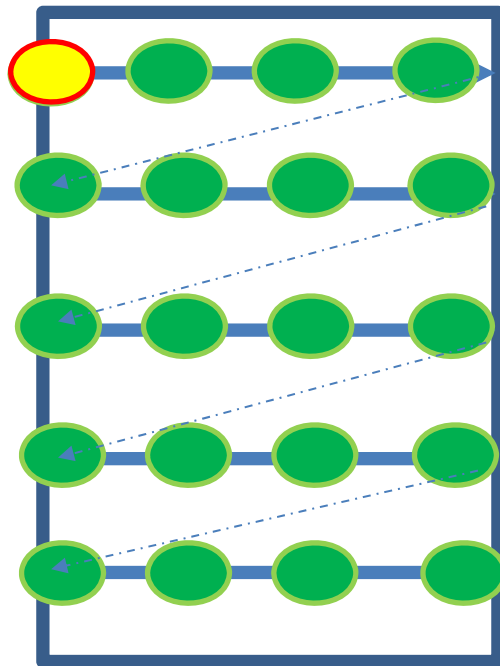
Take a picture

- Read coordinates from FIFO to HPS
- Resequence the coordinates.



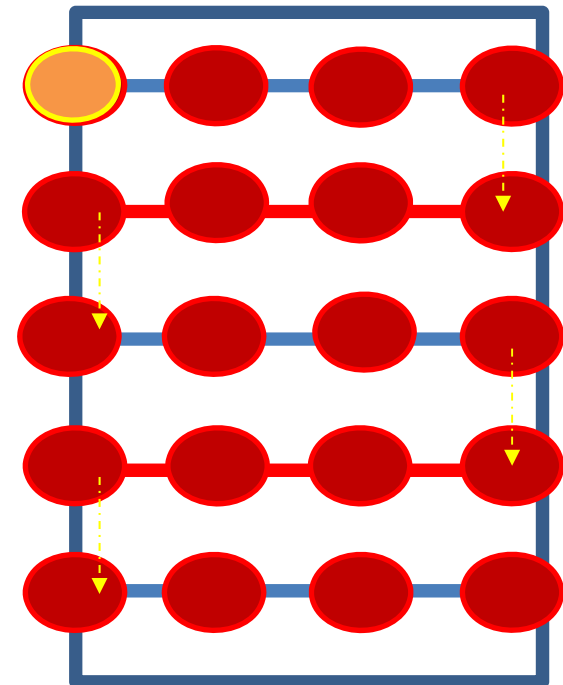
Resequence the coordinates

Original



Path is shorter

Resequence



Check picture

Set white color for all pixel

Sets the color for the pixel that is specified by the x and y coordinates

Write the x and y coordinates to FIFOX, FIFOY, FIFOZ

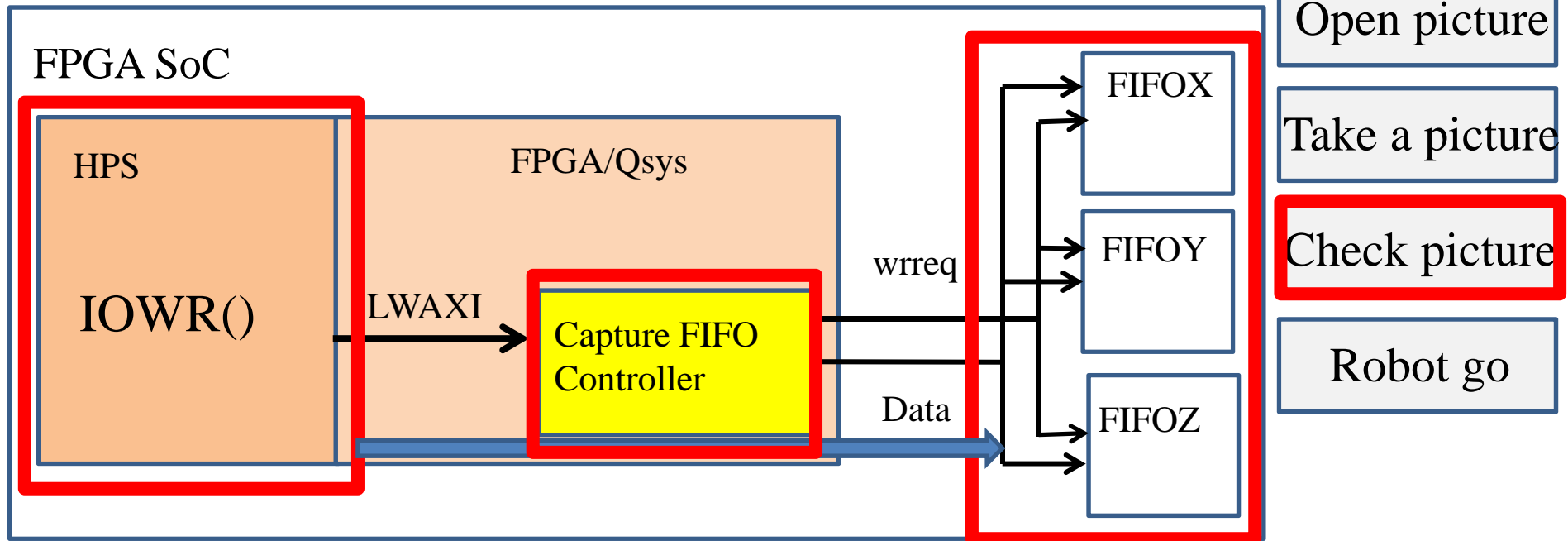
Start

Open picture

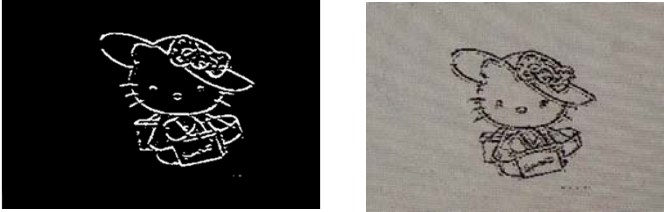
Take a picture

Check picture

Robot go



Robot go



Start

Open picture

Take a picture

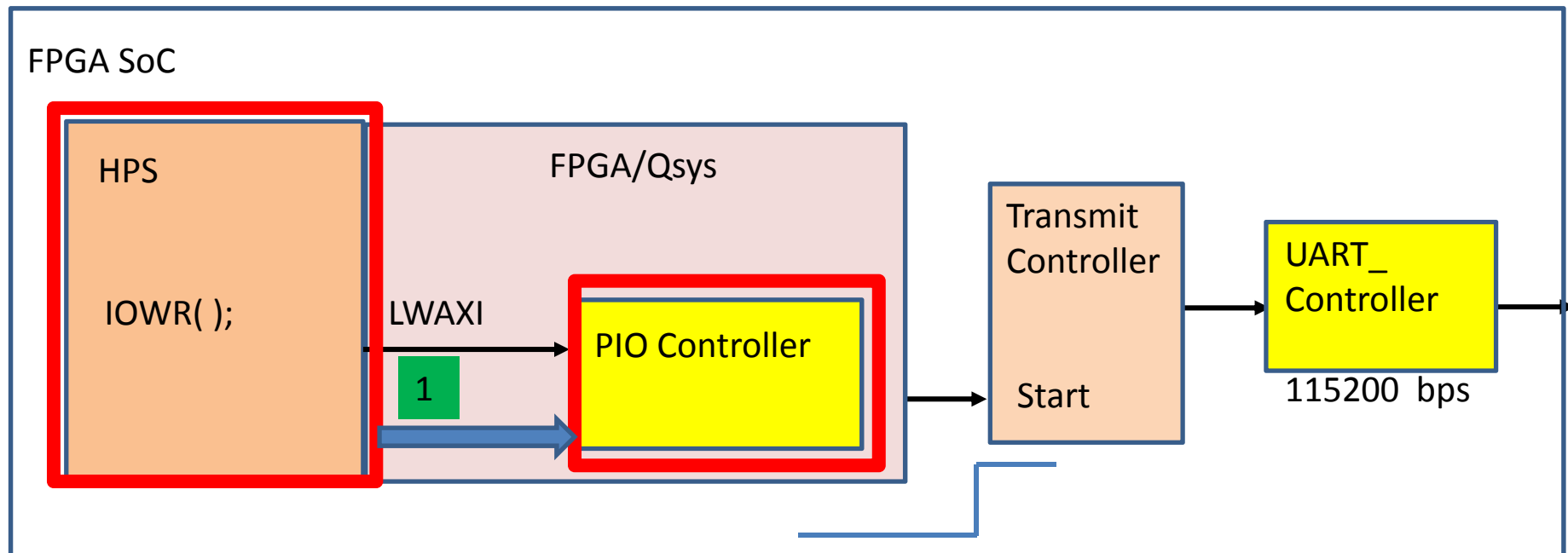
Check picture

Robot go

Robot go

- HPS write to PIO : High level

- transmit



Website – Internet of Things

- The user can **monitor** the **captured picture** and **control** the coordinates transmission with the website.

Lighttpd Webserver

Wall Drawing Robot (TW044)

Monitoring and Control of Robot

DE0-Nano-SoC

Left-UP: 20.913235 Right-UP: 24.353897
Left-Down: -18.675926 Right-Down: -22.038733

index: 4

down next
stop repeat

Control Robot Paint

DE1-SoC
Start to print
Robot Go

Restart System
ReStart

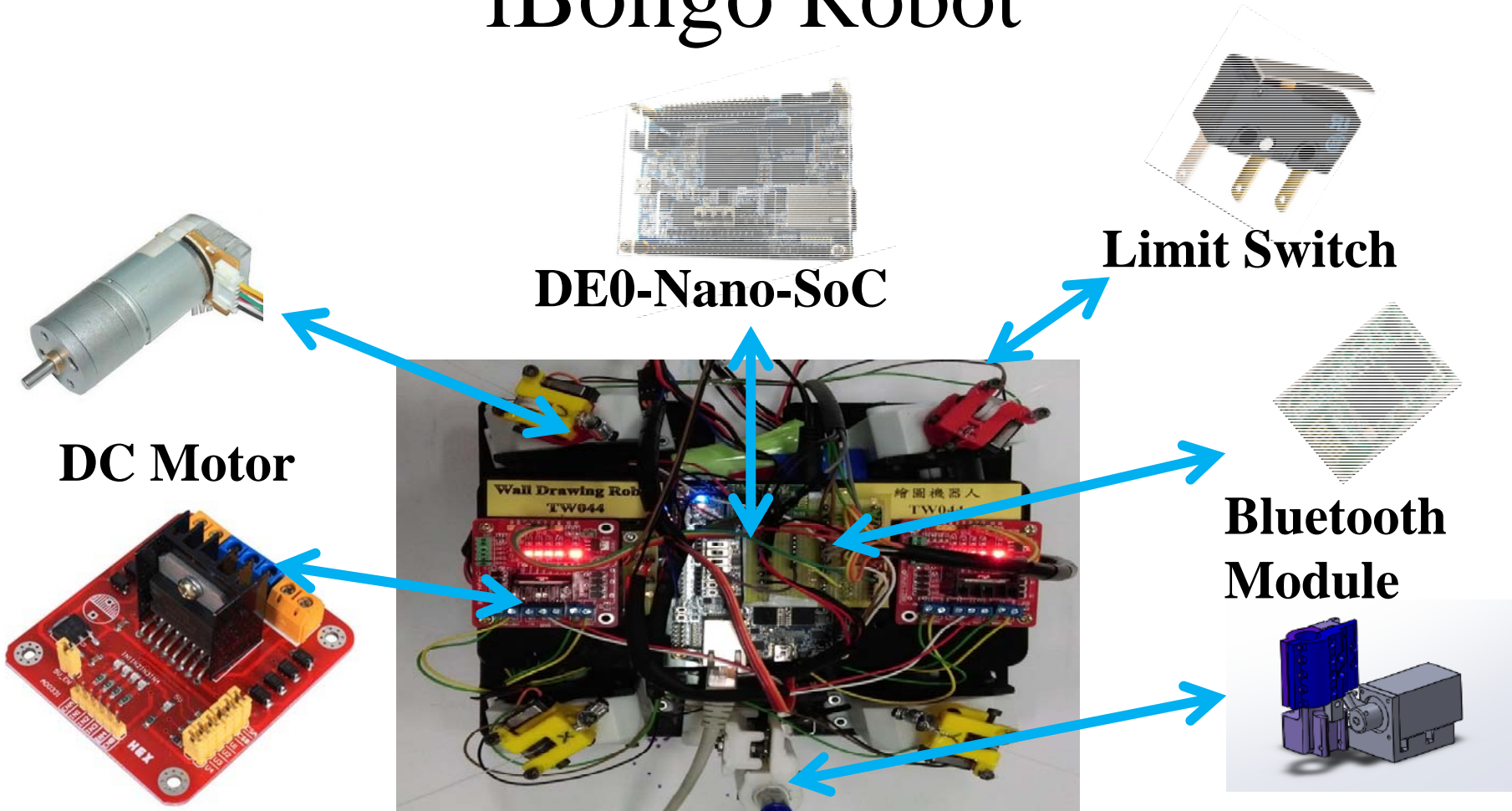
Check Picture

DE1-SoC

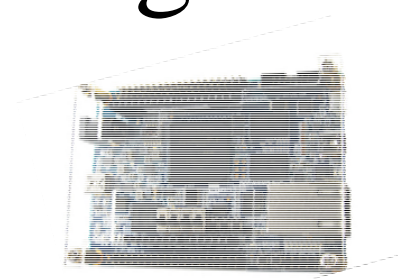
Robot Go

22 / 29

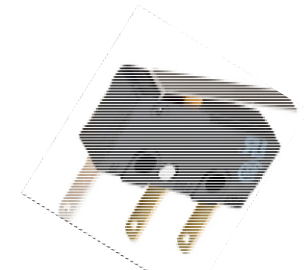
iBongo Robot



DC Motor



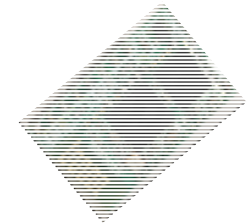
DE0-Nano-SoC



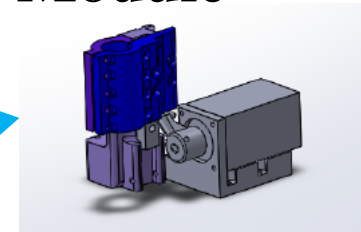
Limit Switch



Motor Driver



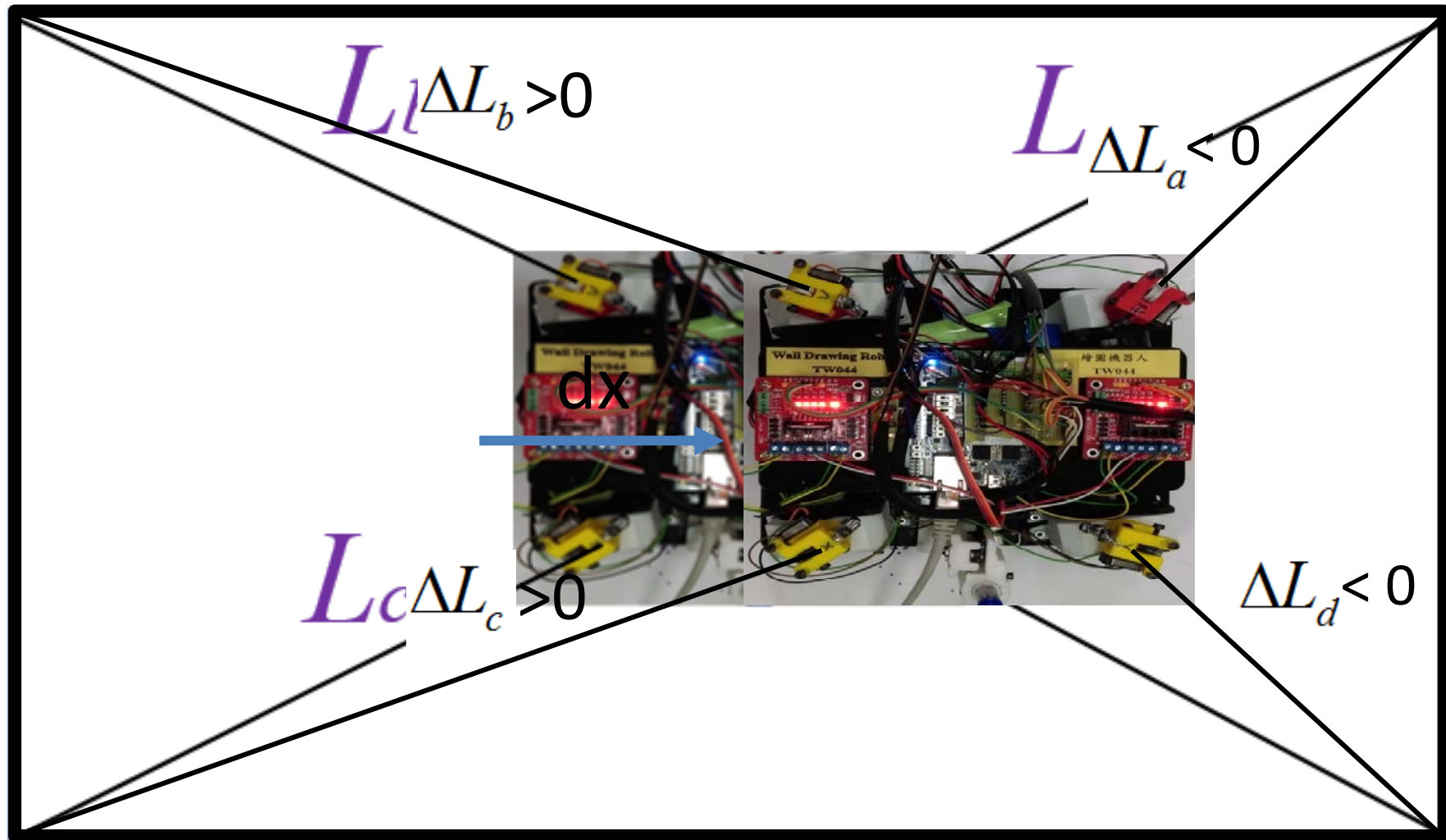
Bluetooth Module



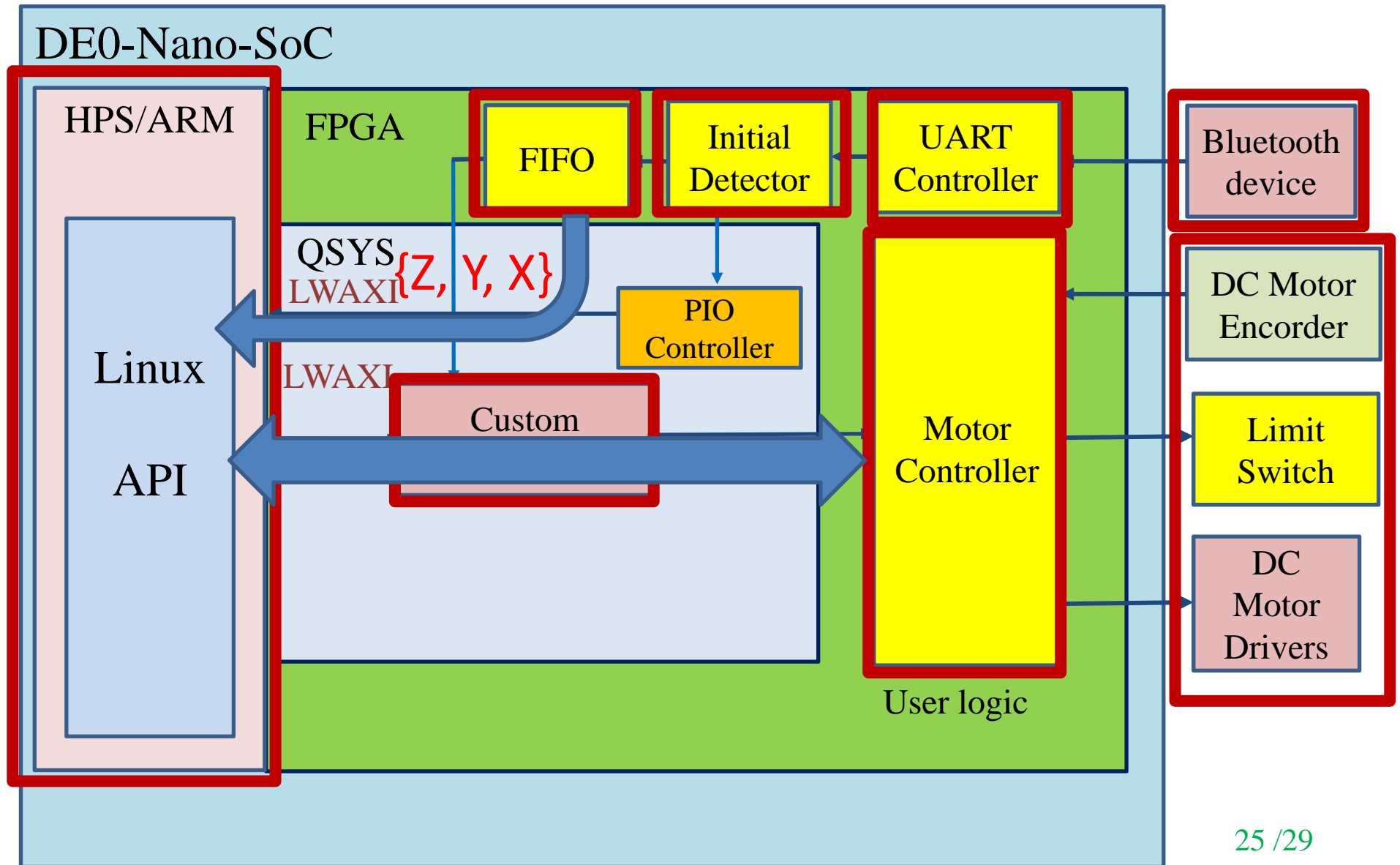
Color Pen

iBongo robot

iBongo Motion Control



Block Diagram on **iBongo**



Website – Internet of Thing

- The user can monitor and control **iBongo** with the website.

Lighttpd Webserver

Monitoring and Control of Robot

DE0-Nano-SoC

Left-UP: 20.913235 Right-UP: 24.353897
Left-Down: -18.675926 Right-Down: -22.038733

index: 4

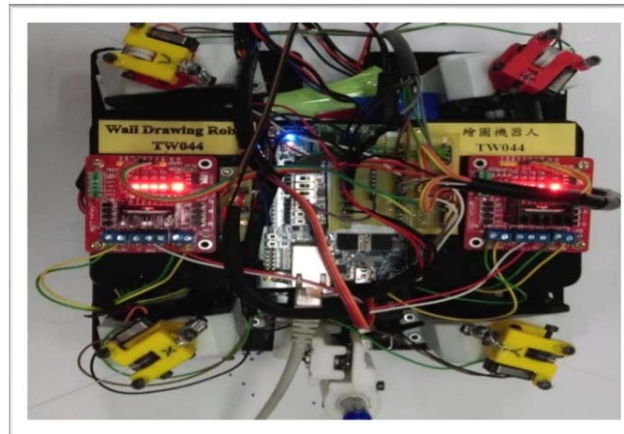
down next
stop repeat

IoT Demo

IoT iBongo Robot

Summary

- We've implemented a **painting robot** based on **DE1-SoC** and **DE0-Nano-SoC**, called **iBongo**.
- **iBongo** can **draw the portrait** of what it sees.
- It's **co-design** between **hardware and software**.
- The user can **monitor and control the robot with the website**. (IoT)
- We have developed an algorithm to **shorten the robot painting path**.



Thanks for Your Attention!

TWO44

