PROTOTYPE OF USING DC MOTOR TO DRIVE WHEELCHAIR THROUGH EEG SIGNAL

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PROBLEM TRY TO SOLVE

PEOPLE WHO HAVE DIFFICULTY MOVING LIMBS WITHOUT COGNITIVE PROBLEMS

- POLIO
- PARKINSON'S DISEASE
- MOTOR NEURON DISEASE, (MND)

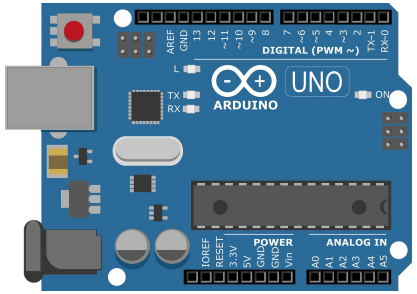
TARGETING

SYSTEM STRUCTURE

EEG Signal

Labview

Microcontroller

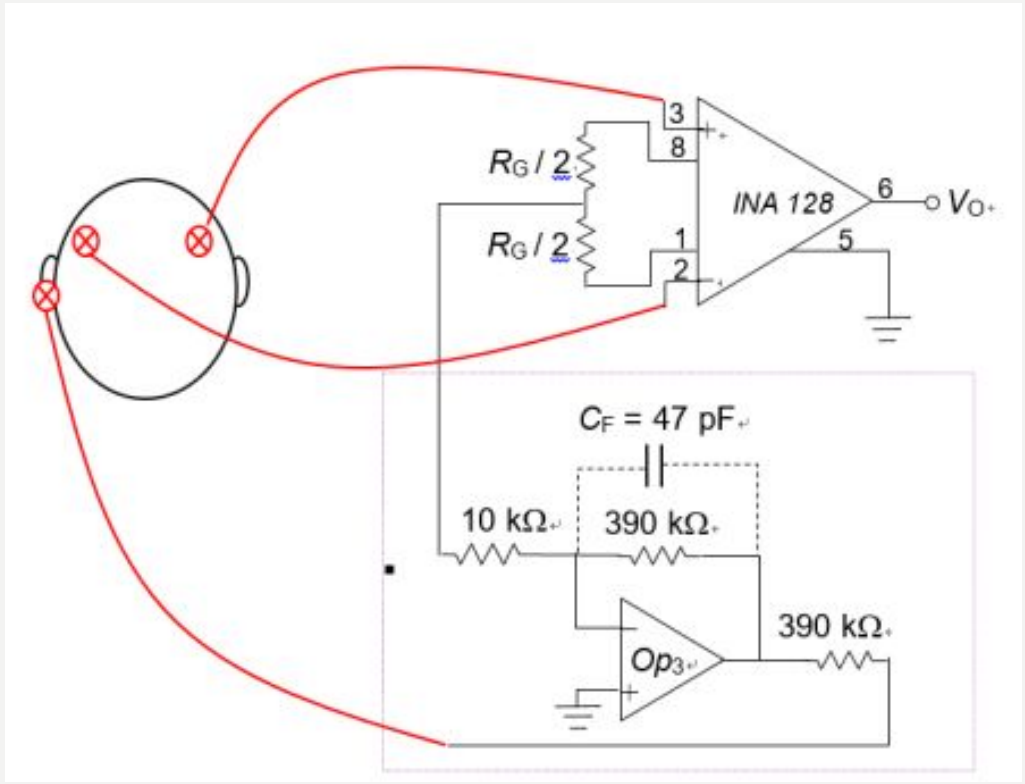


Arduino

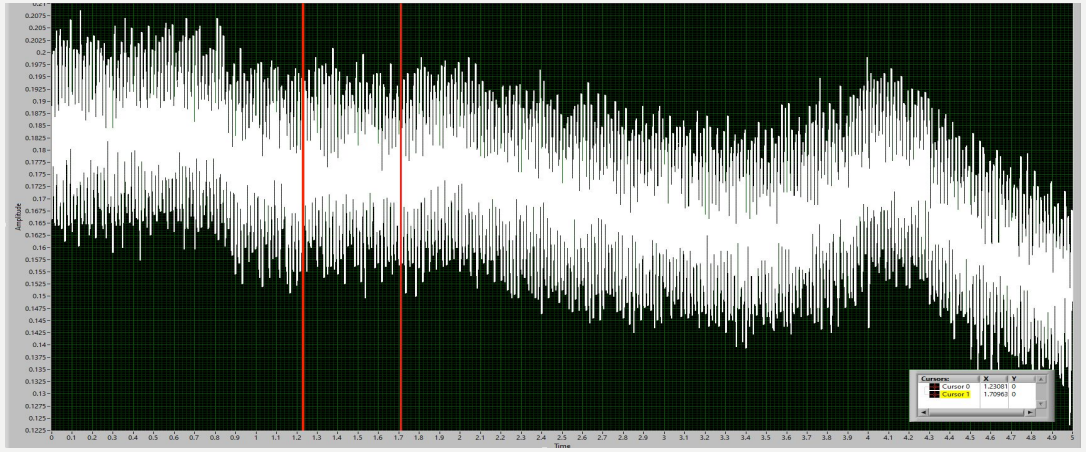
Hardware

Wheelchair

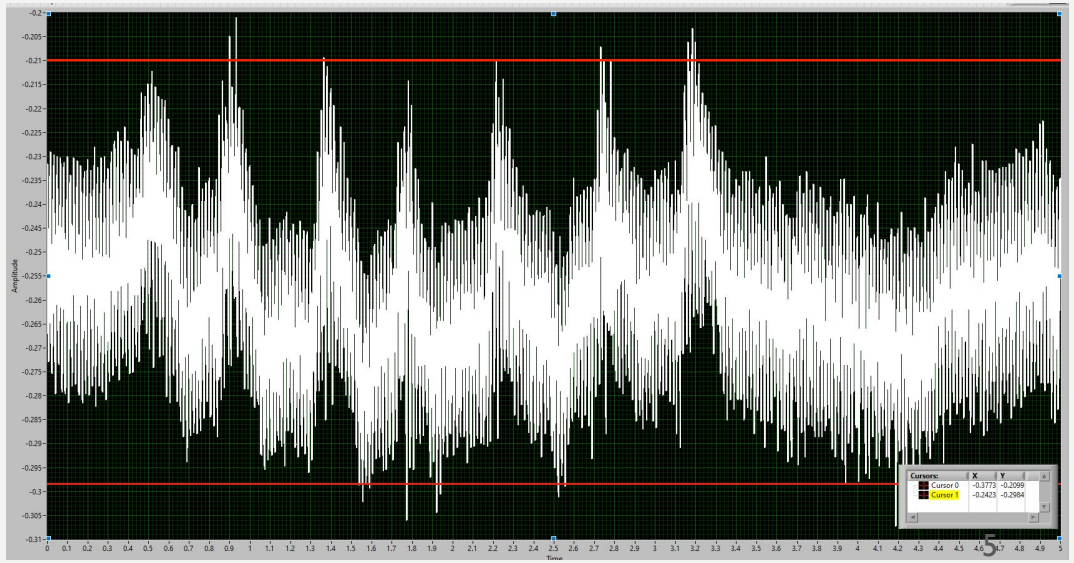
CIRCUIT SYSTEM FROM LAB 10



None

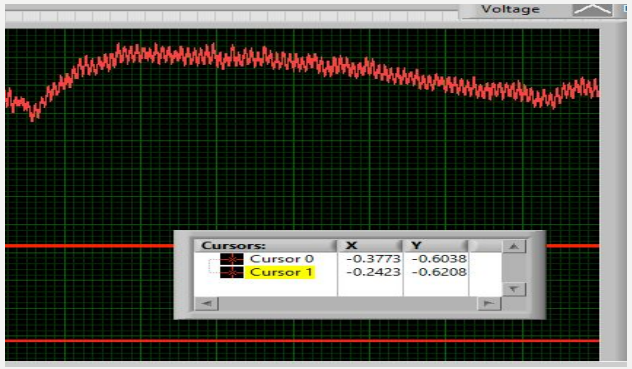


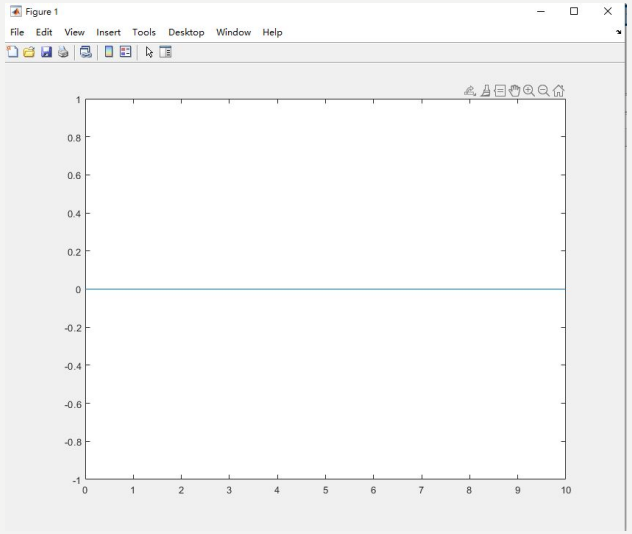
Blink



SIGNAL PROCESSING

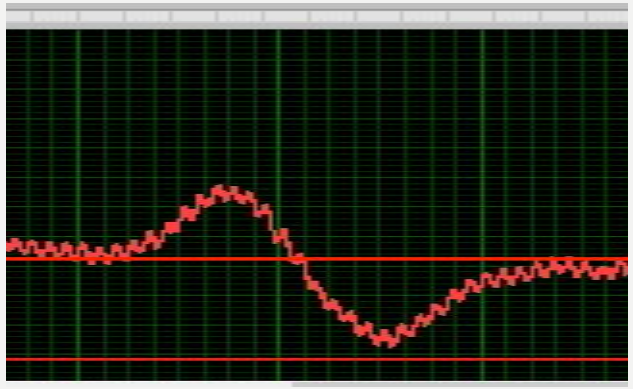
Desired None motion signal

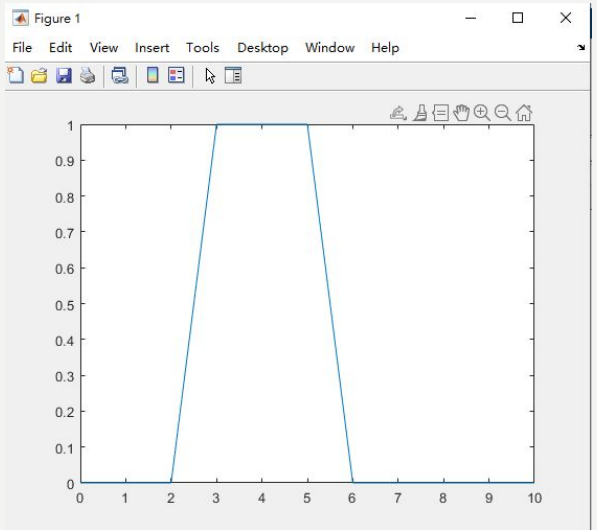




→ 0

Desired Blink Signal

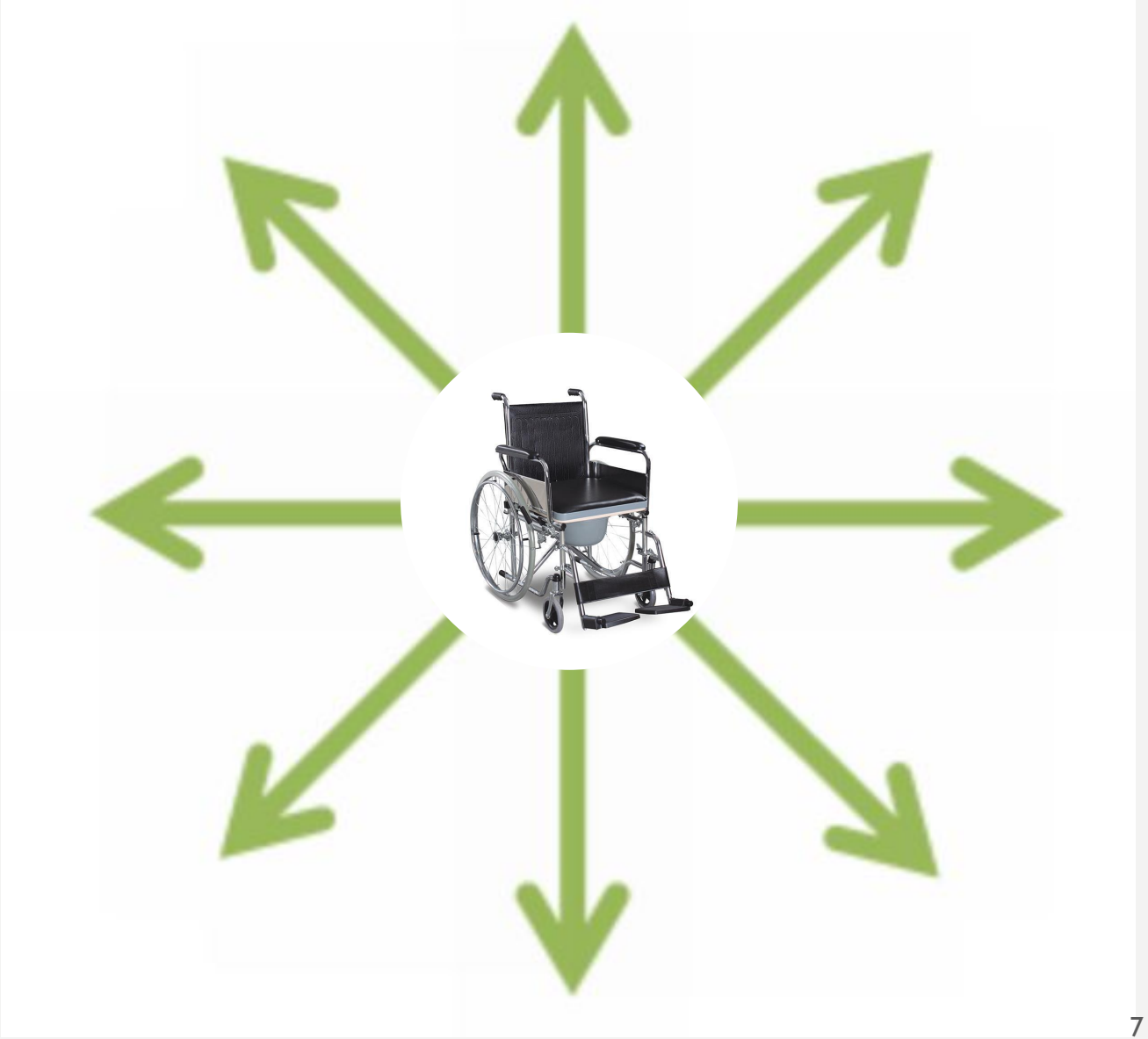




→ 1

TARGET

WHEELCHAIR CAN MOVE IN 8 DIRECTION BY EEG.



SIGNAL PROCESSING

We decide to access EEG signal six durations in one small process to decide the direction of our wheel chair

First three Signal

We will measure none motion signal as our Reference Signal 0, in order to ensure the accuracy Of distinction of 0 and 1.

	Fourth Signal	Fifth Signal	Sixth Signal
Forward	0	0	0
Front left	0	0	1
Left	0	1	0
Back left	0	1	1
Right	1	0	0
Back left	1	0	1
Backward	1	1	0
Front right	1	1	1

SIGNAL PROCESSING

First three Signal

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Forward	0	0	0
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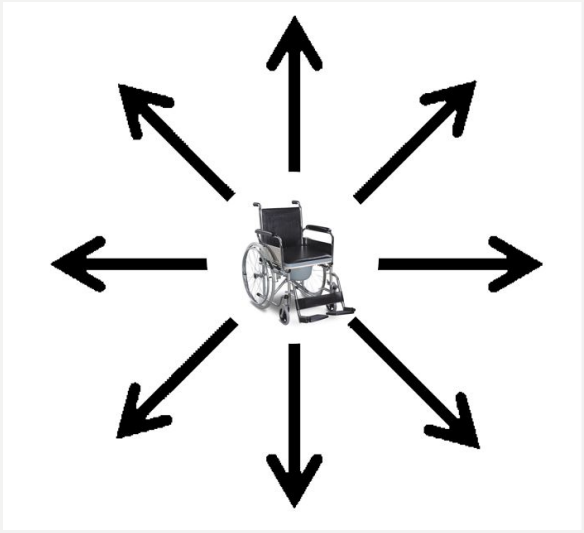
Left	0	1	0
Back left	0	1	1
Right	1	0	0
Back left	1	0	1
Backward	1	1	0
Front right	1	1	1

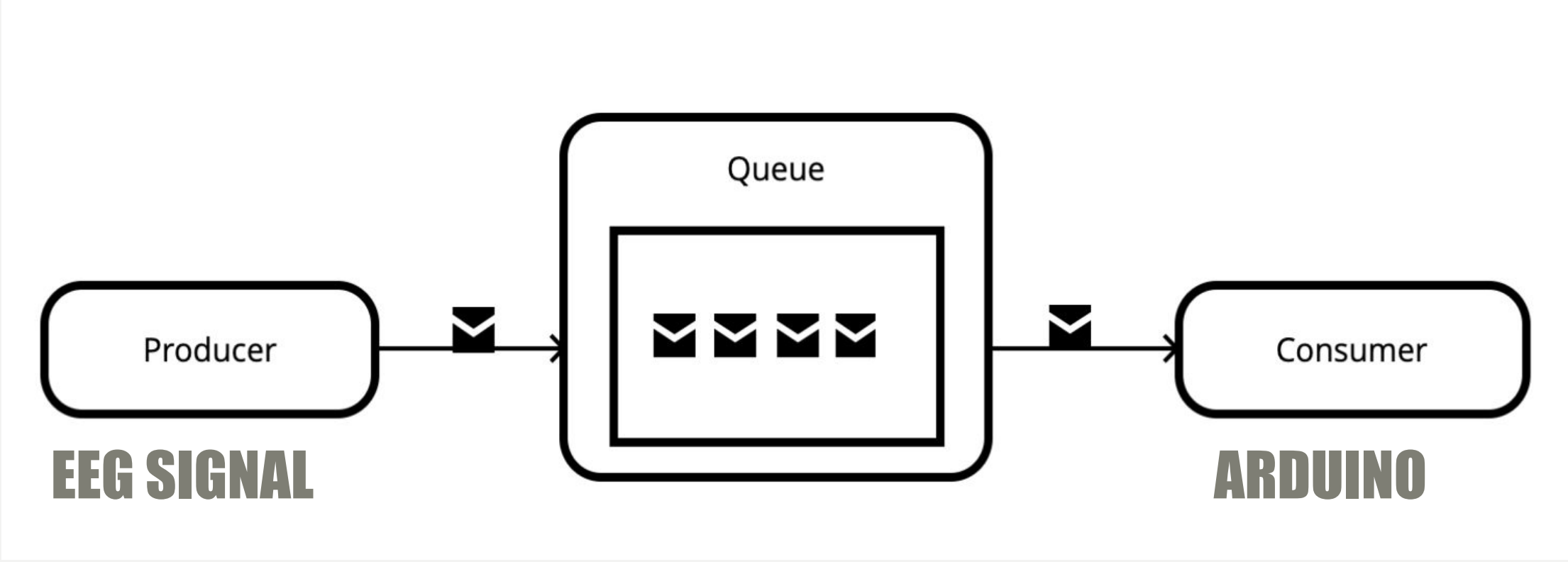
Labview



Arduino Uno

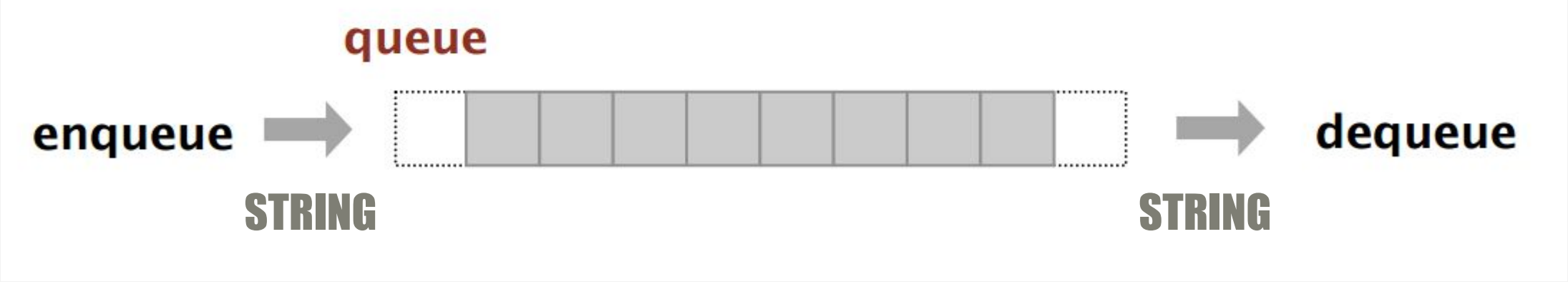
PRODUCER AND CONSUMER STRUCTURE

CONCEPT



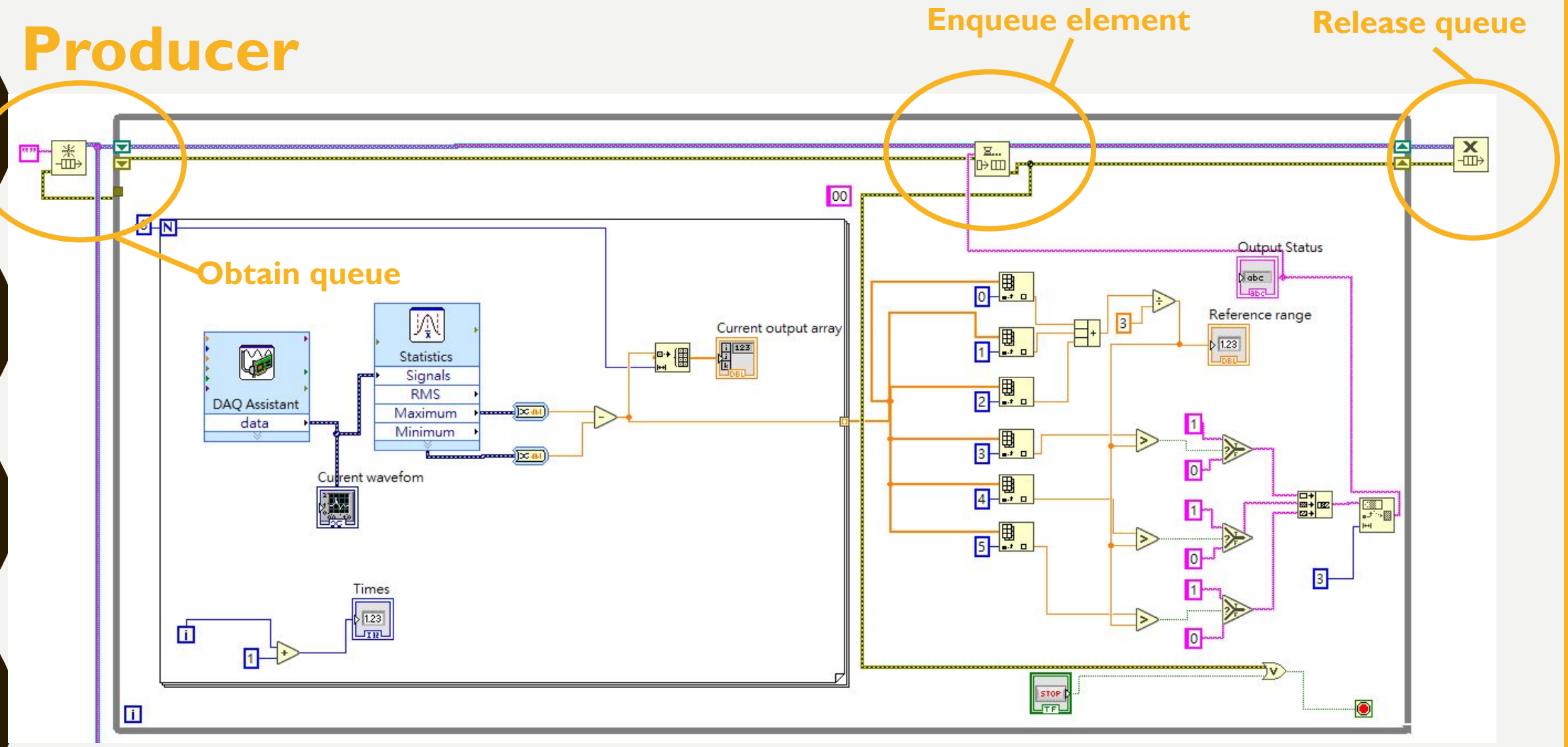
PRODUCER AND CONSUMER STRUCTURE

IN LABVIEW



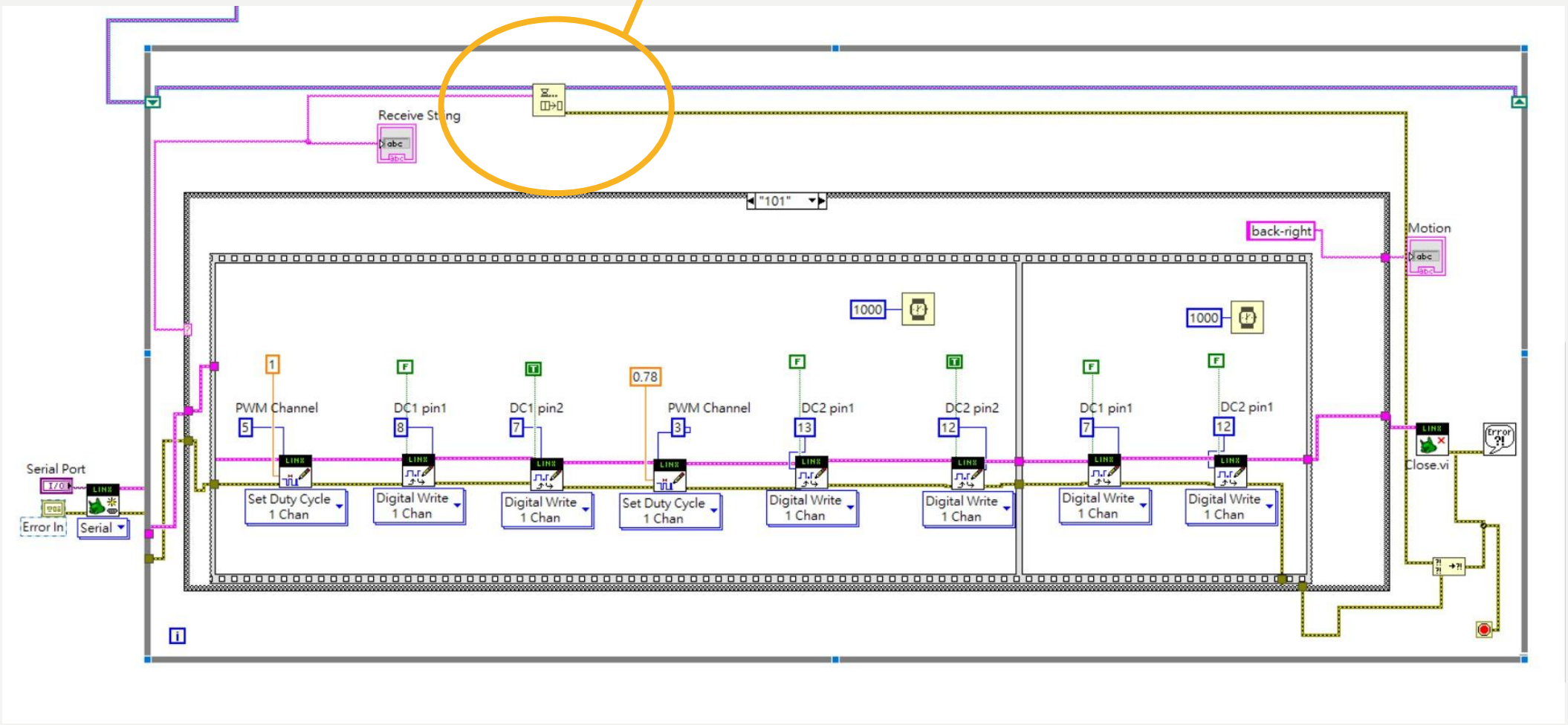
PRODUCER AND CONSUMER STRUCTURE

Producer



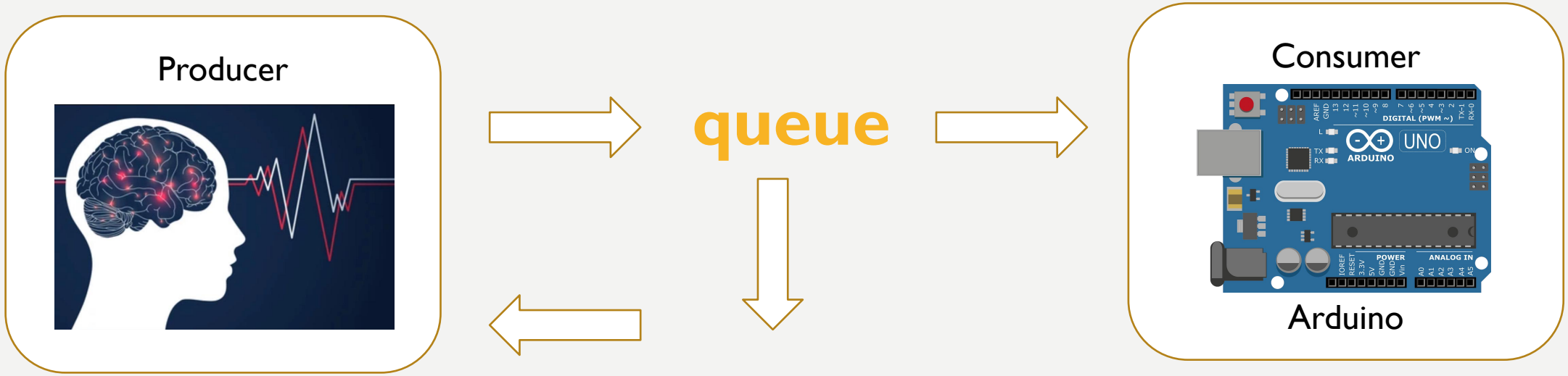
PRODUCER AND CONSUMER STRUCTURE

Consumer



PRODUCER AND CONSUMER STRUCTURE

Advantage



Do not need to wait each other !!!

PRODUCER – SIGNAL PROCEESING

EEG Signal

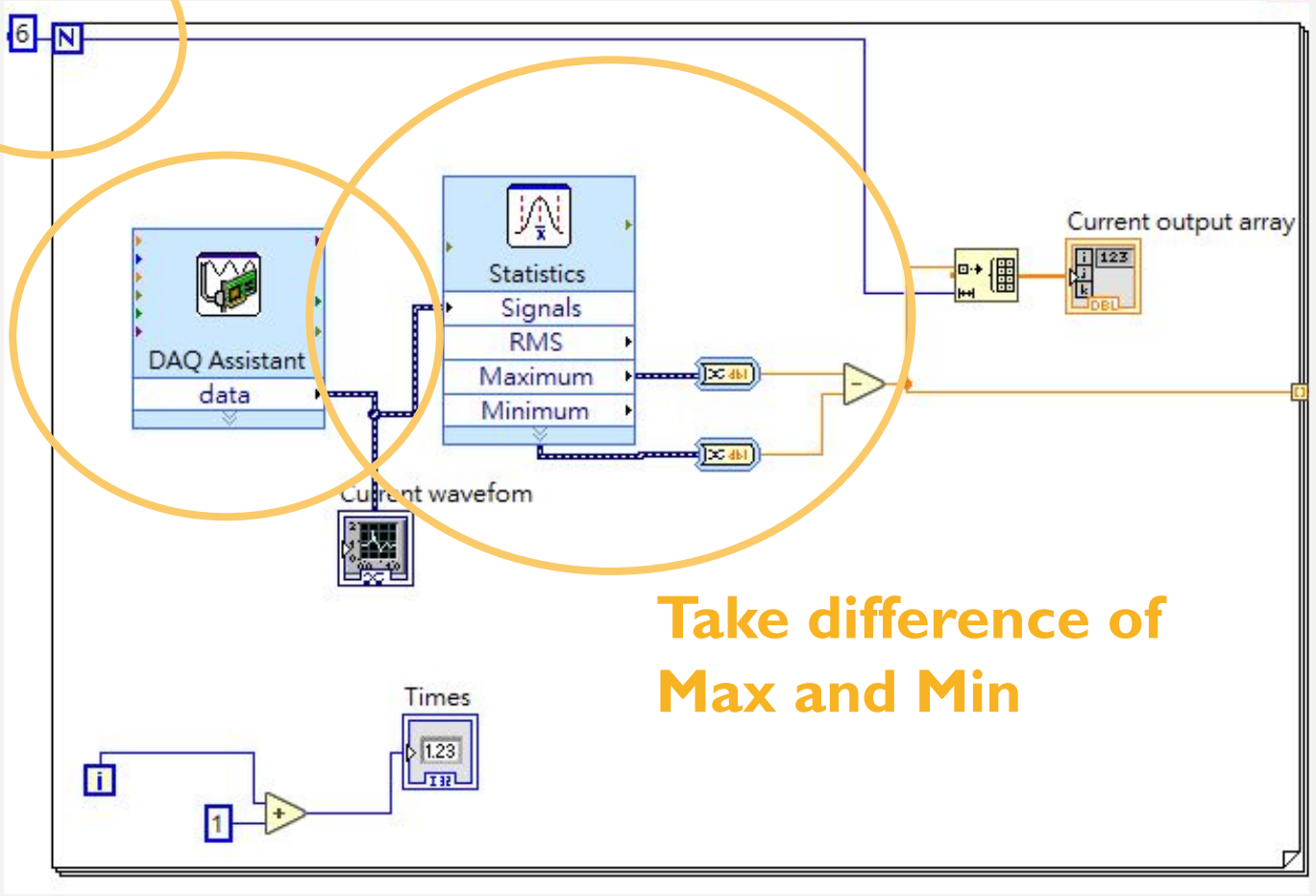
Try

1. ~~Set threshold to compare signal if over specified voltage~~
2. Use average max – min as reference
3. ~~To compare average~~

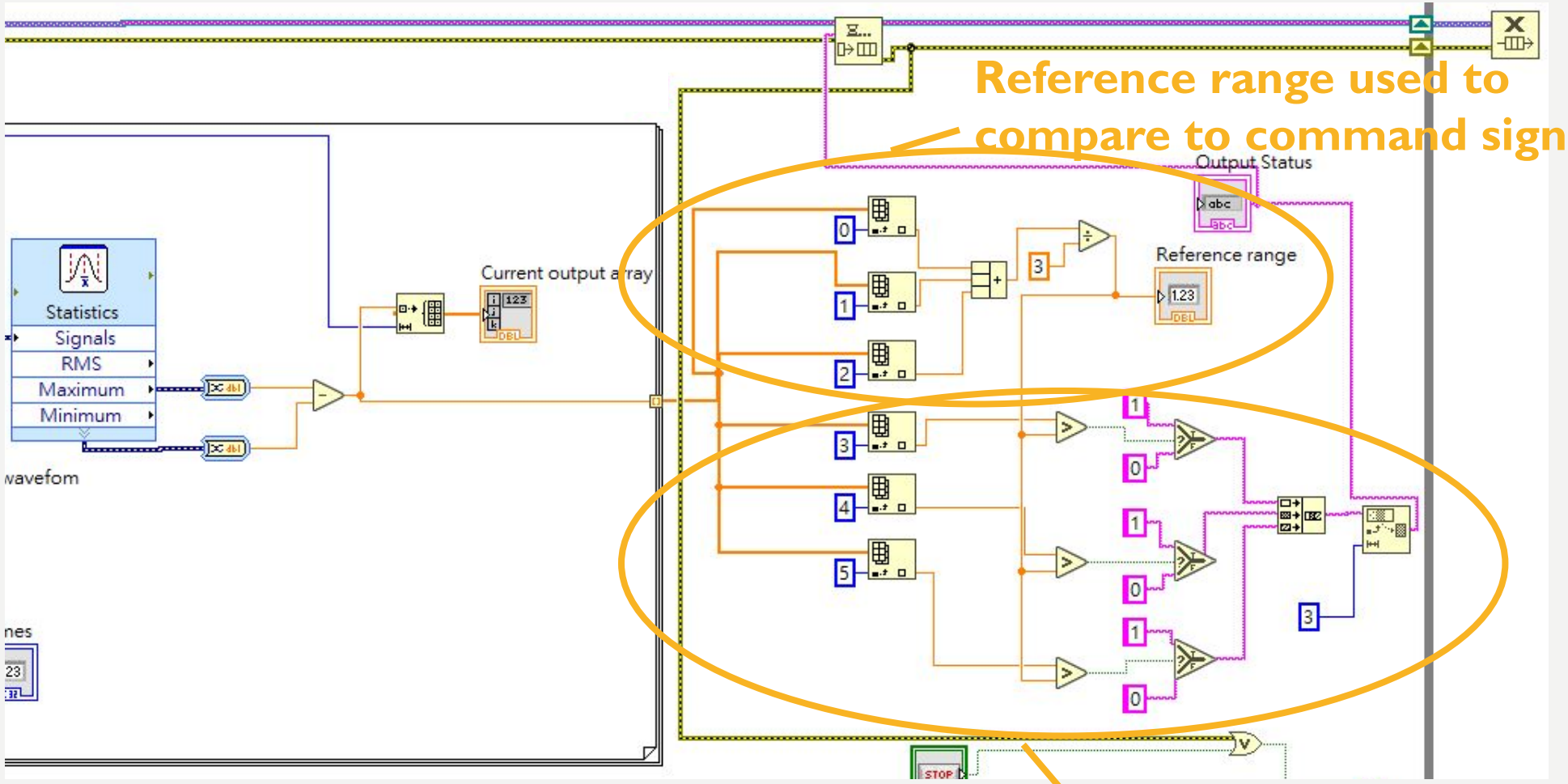
PRODUCER – SIGNAL PROCEESING

EEG Signal

Take times

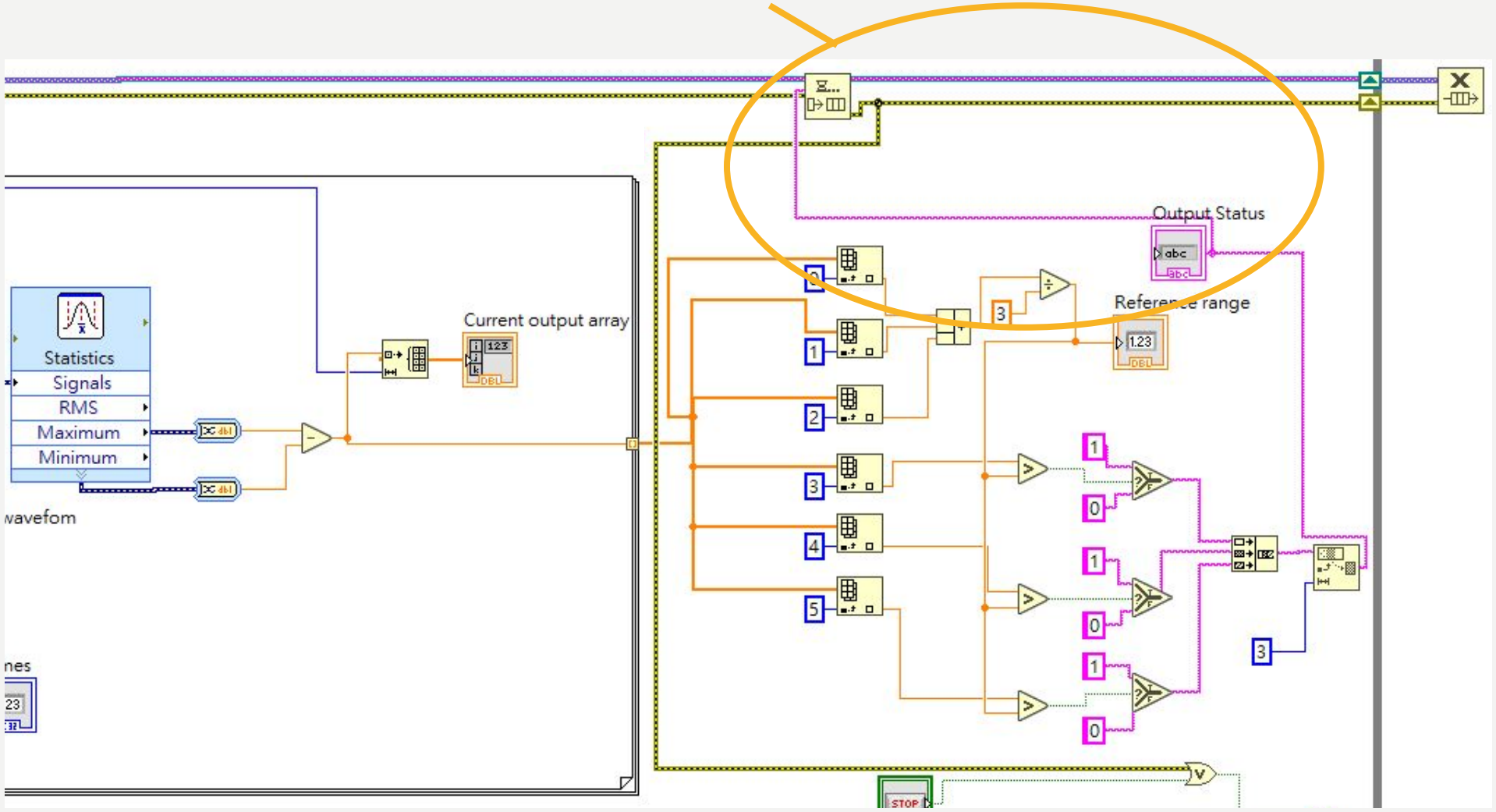


PRODUCER – SIGNAL PROCEESING



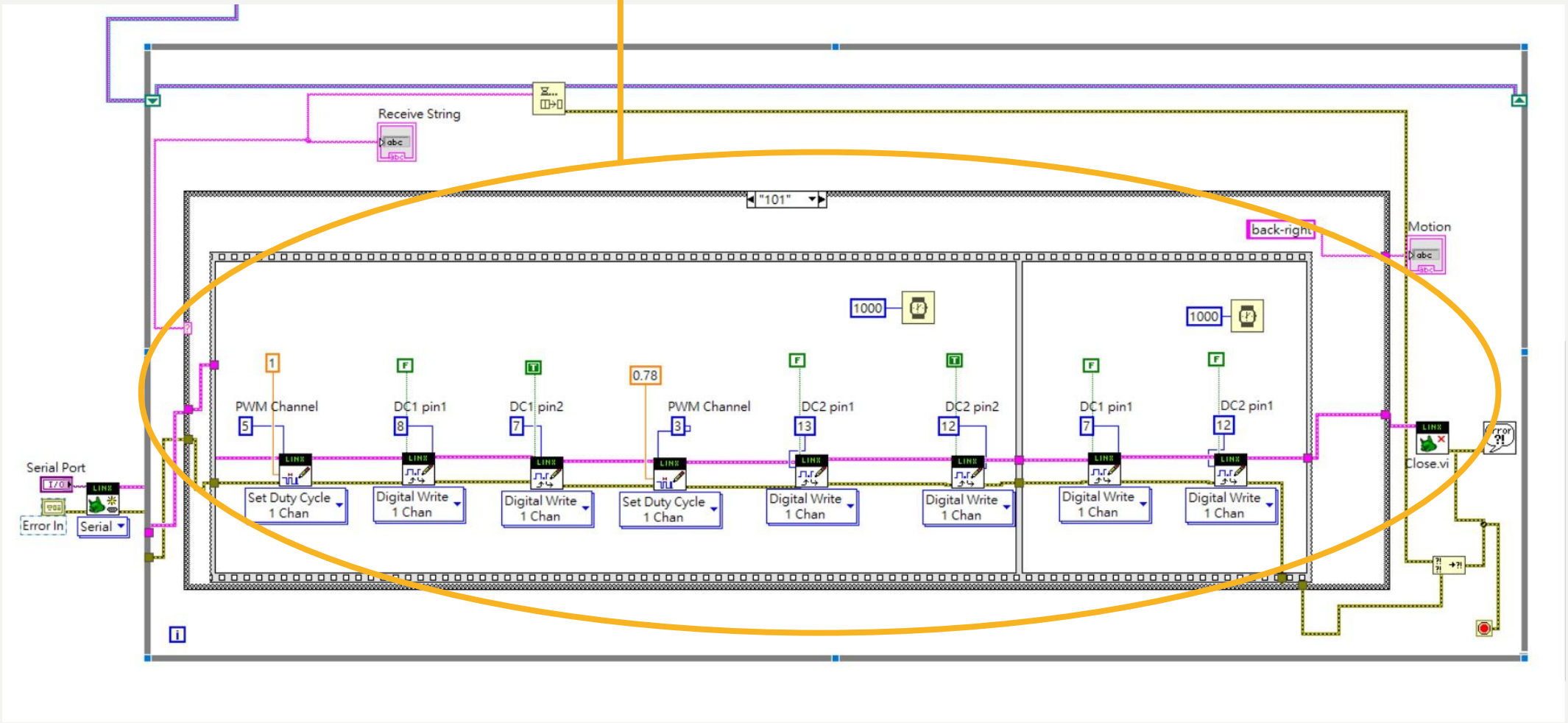
PRODUCER – SIGNAL PROCEESING

Output compared result – string type to Queue



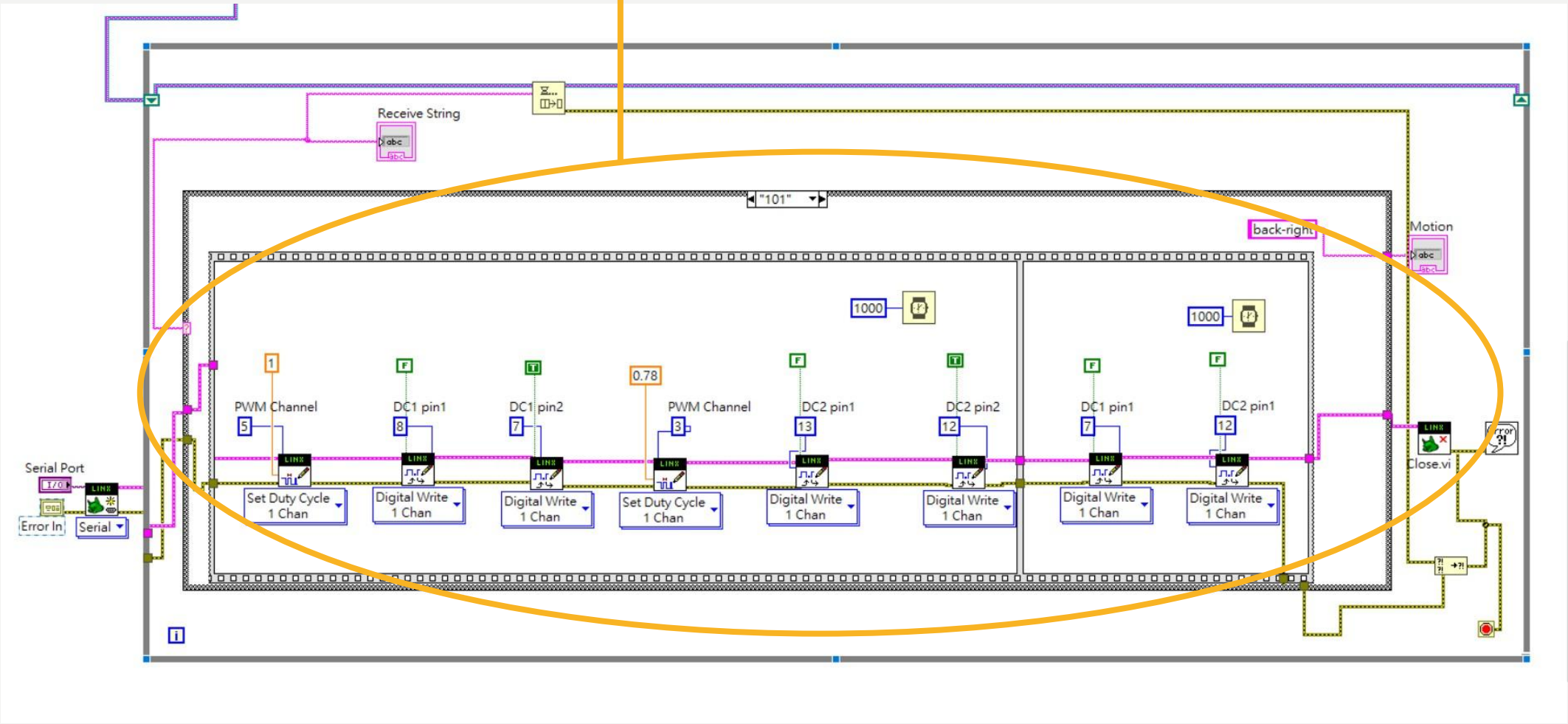
PRODUCER – SIGNAL PROCEESING

Flat structure to contain sequence motion in each case



PRODUCER – SIGNAL PROCEESING

Case structure – 8 different cases



MOTOR CONTROL WITH LABVIEW & WHEEL CHAIR FINAL PRODUCT

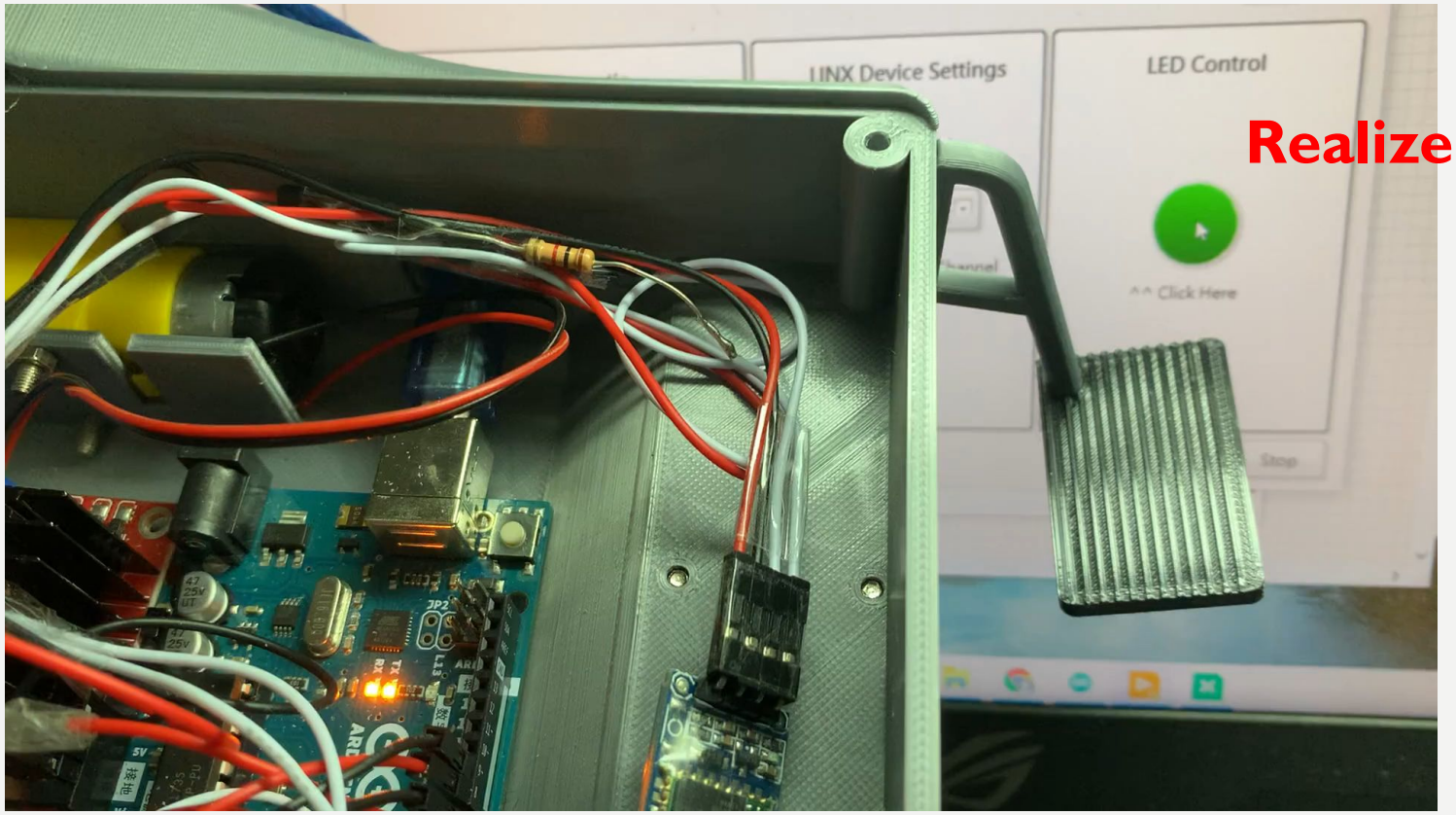
LABVIEW INTERFACE FOR ARDUINO

First method to connect labview failed!!!

Compile Error:
No longer supported new version of labview

LABVIEW CONTROL ARDUINO BY DIGILENT LINX

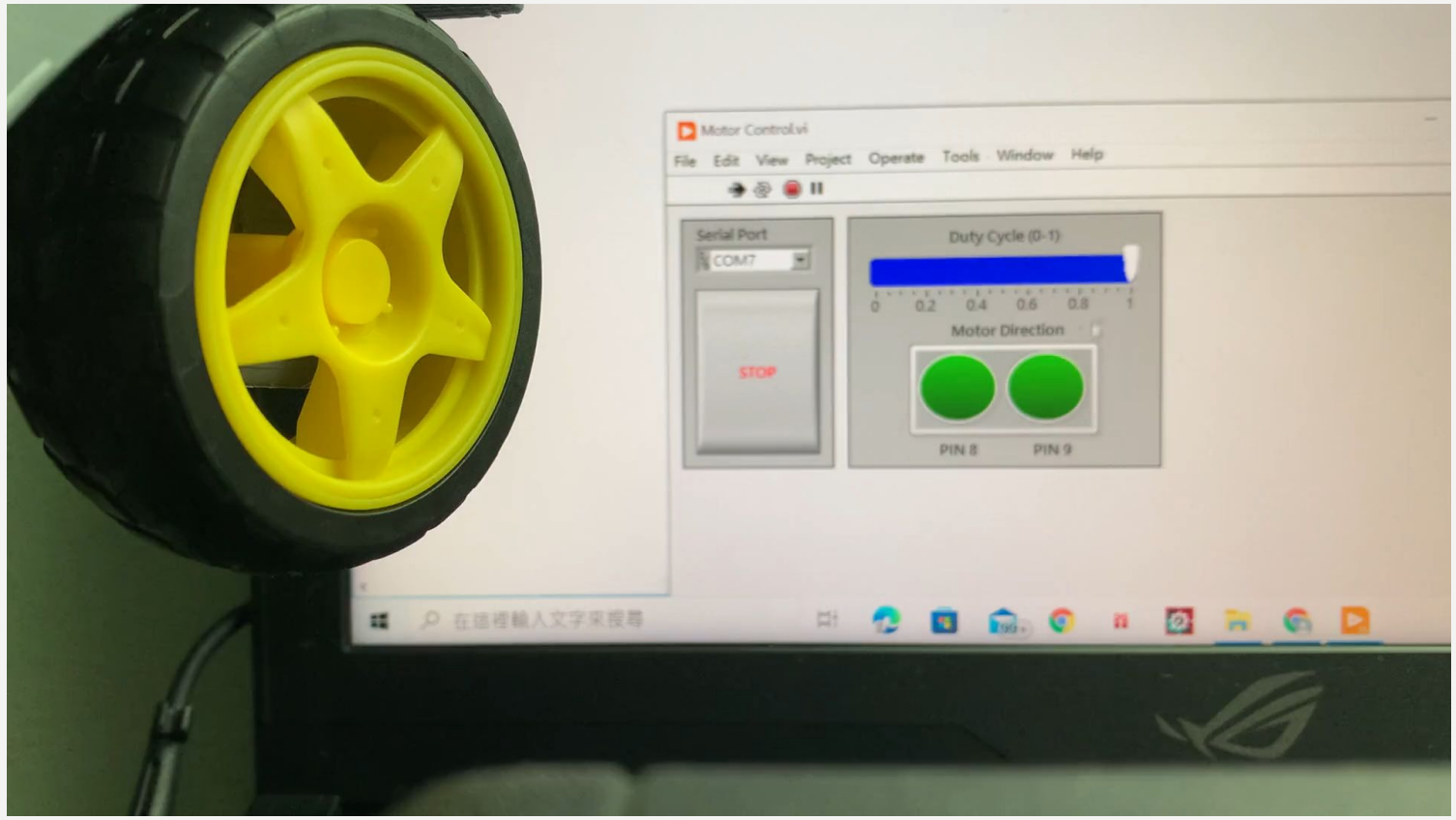
TEST WITH LED BLINK FIRST



Realize real-time control

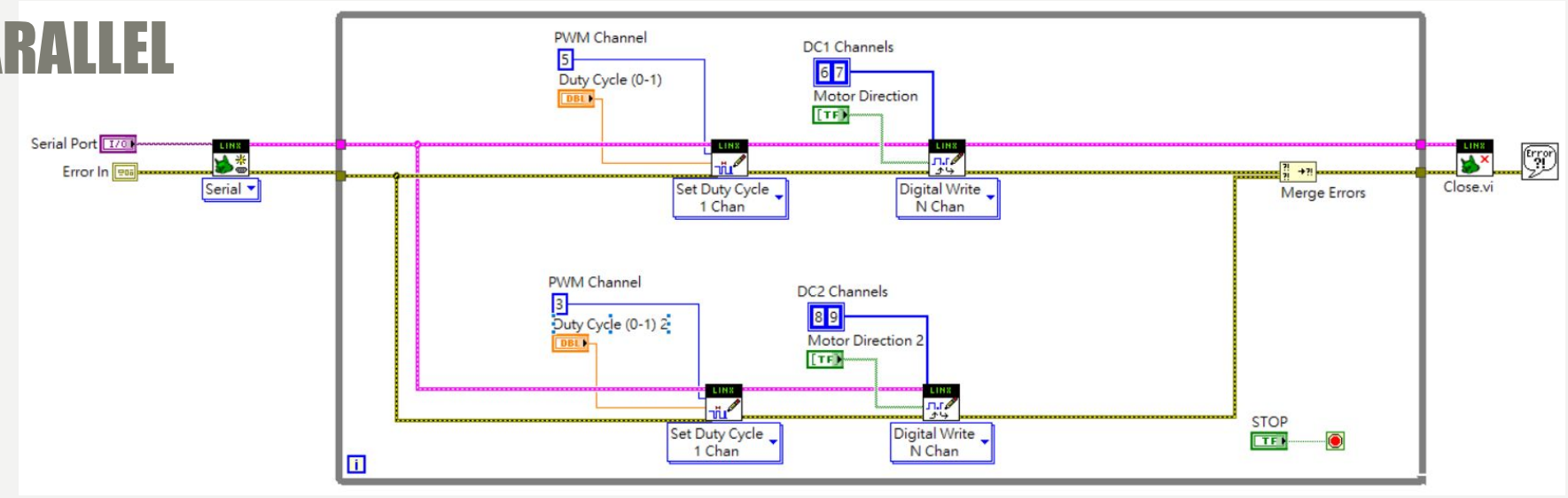
LABVIEW CONTROL ARDUINO BY DIGILENT LINX

TEST VIDEO

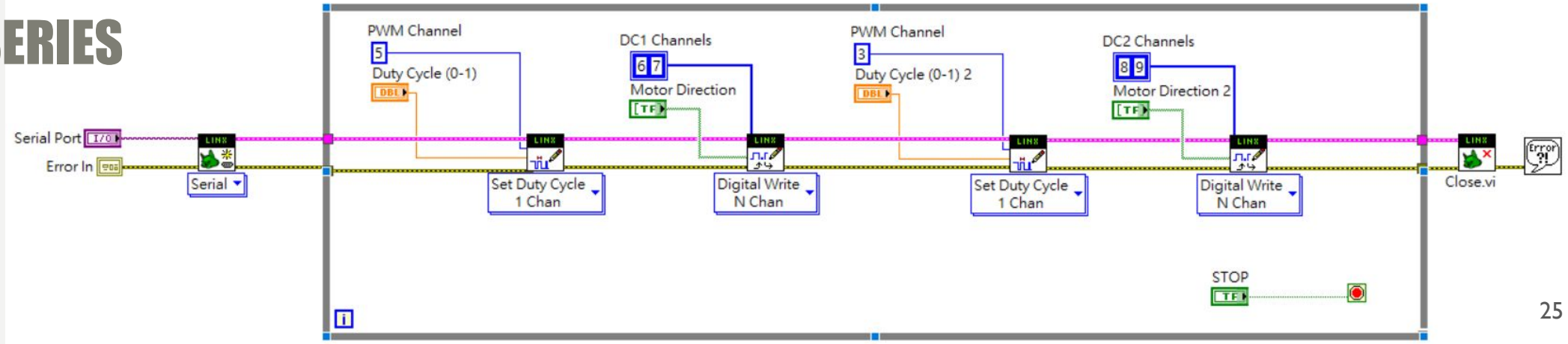


TWO WAYS TO CONTROL 2 DC MOTORS

PARALLEL

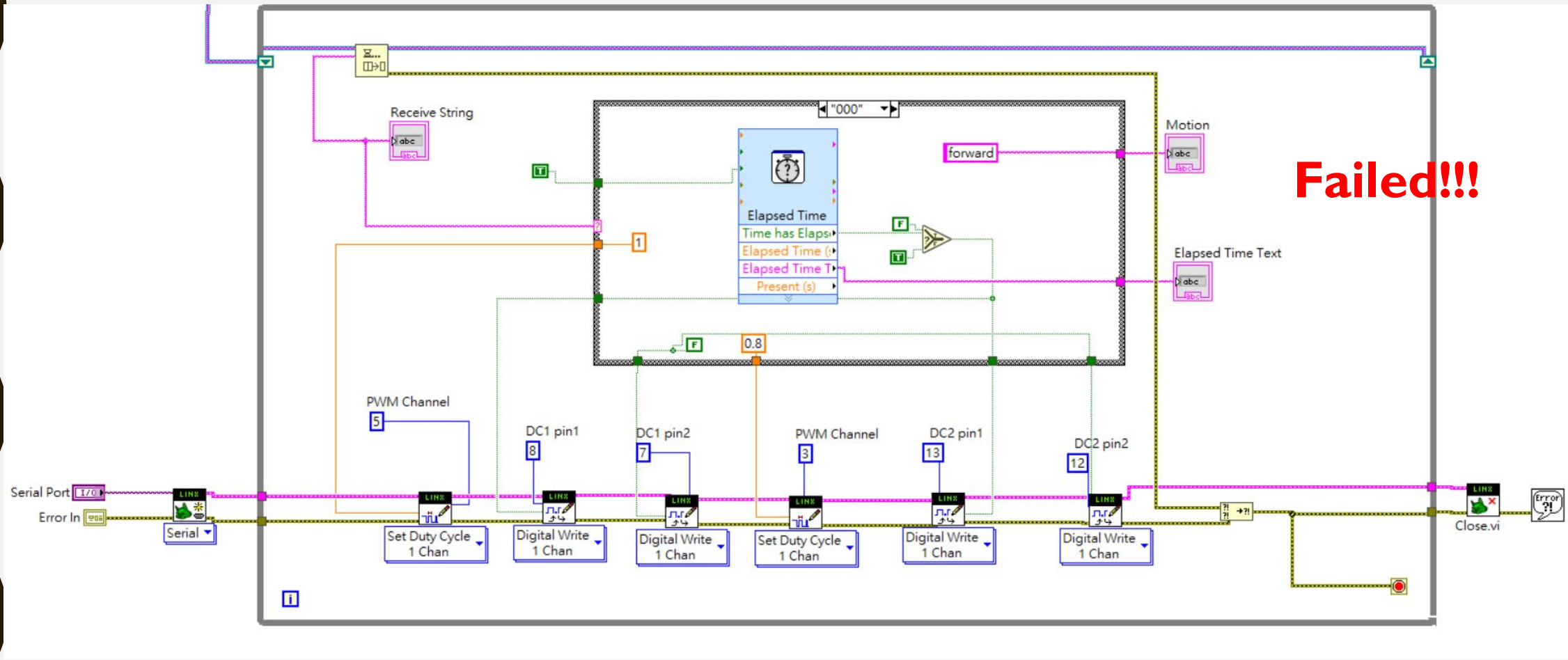


SERIES



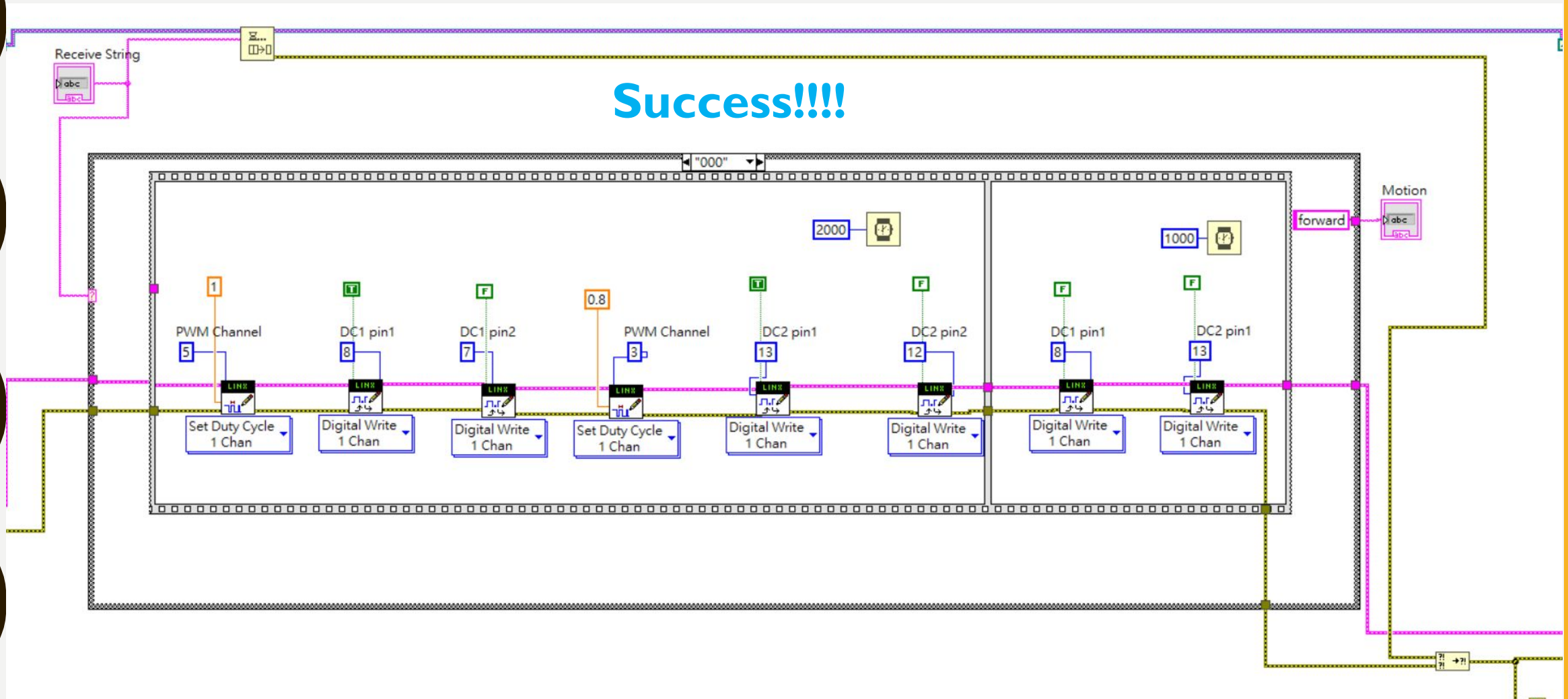
WAYS TO LET MOTORS RUN A PERIOD OF TIME

Works in general loop but not work in producer and consumer structure



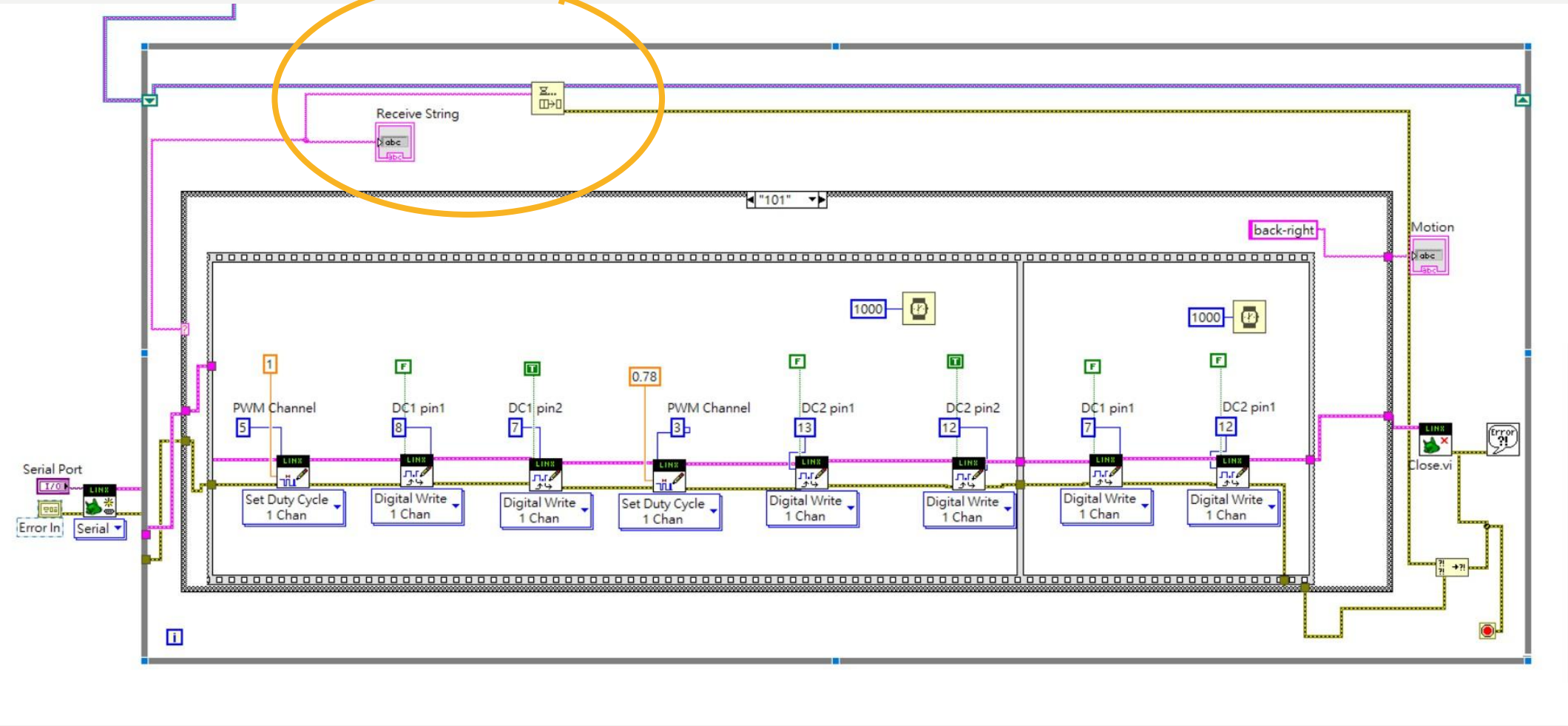
WAYS TO LET MOTORS RUN A PERIOD OF TIME

Use flat structure to force motors to stop after motor running



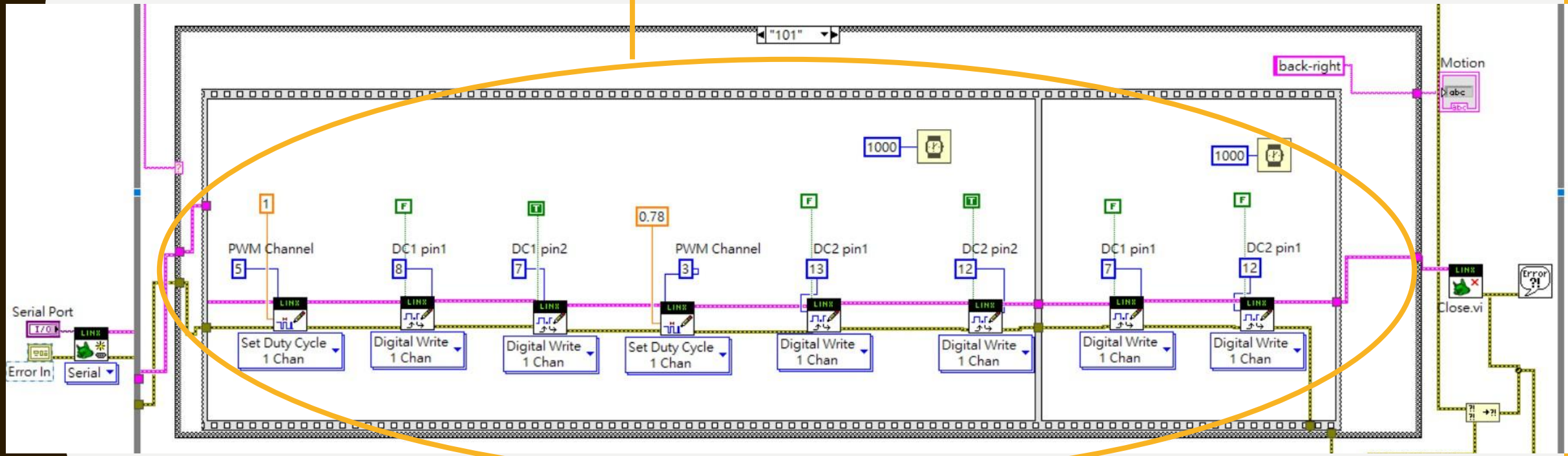
CONSUMER – MOTOR CASES

Take out (Dequeue) string – input sting into case structure



CONSUMER – MOTOR CASES

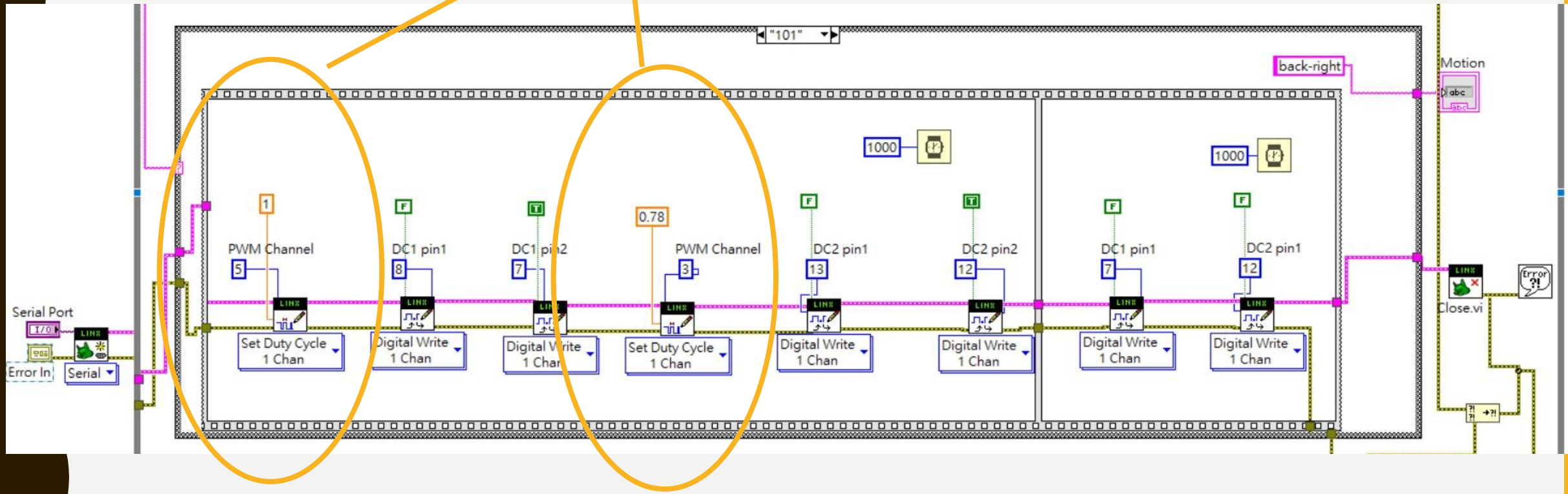
Use LabView LINX as our medium to drive ardunio



CONSUMER – MOTOR CASES

The parameter used to determine which direction to go through motor different speed

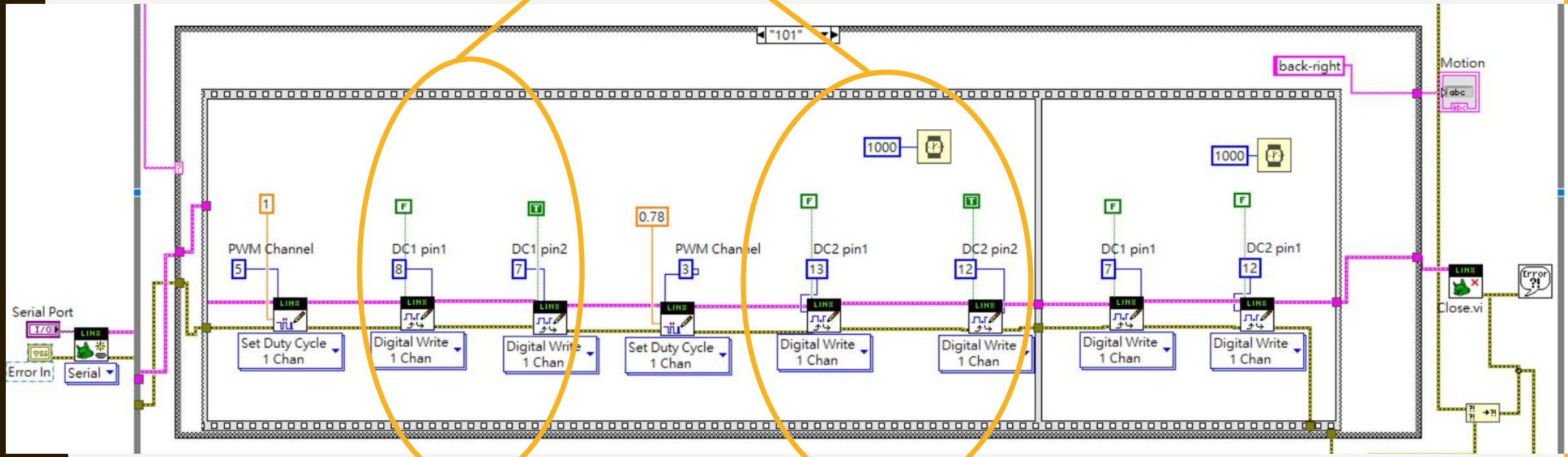
101 back-right



CONSUMER – MOTOR CASES

The parameter used to determine motor run or not

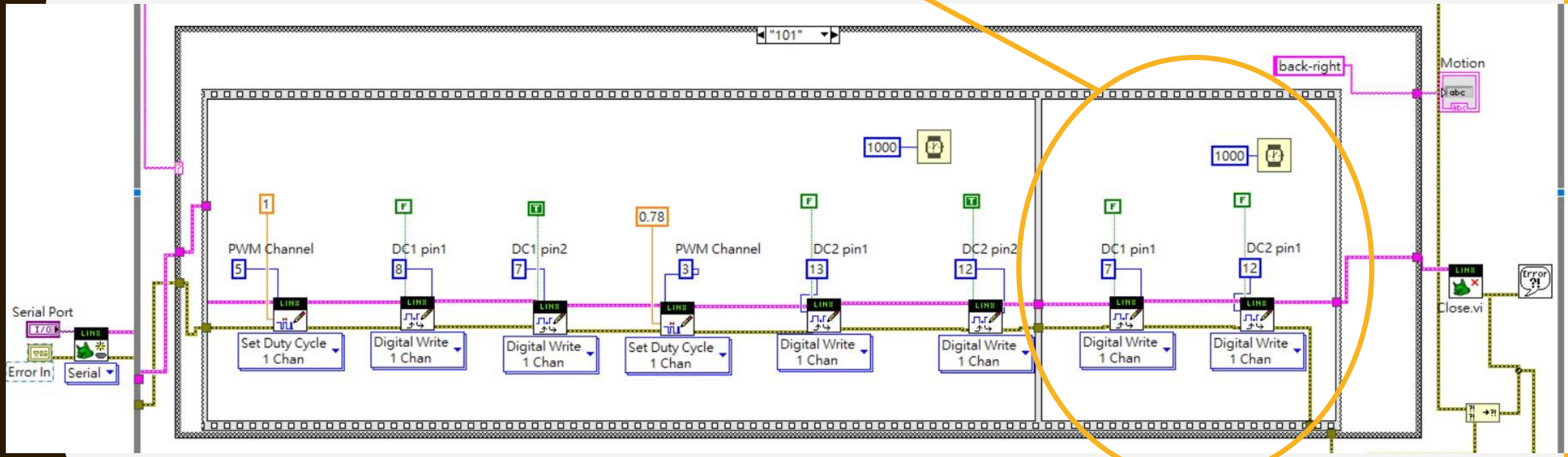
101 back-right



CONSUMER – MOTOR CASES

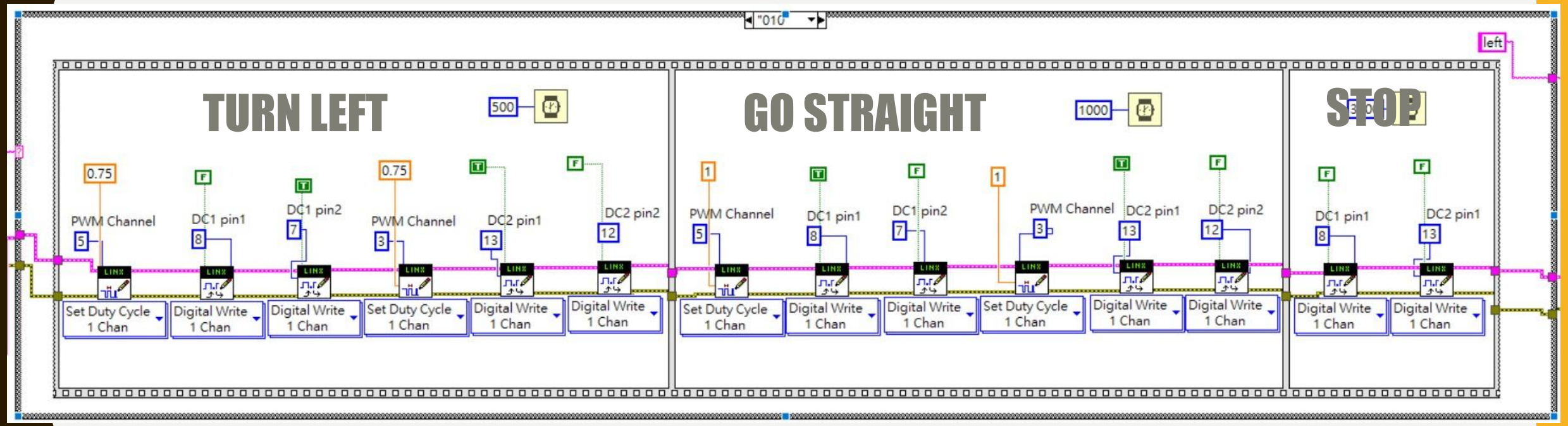
The parameter used to stop motor in each case

101 back-right



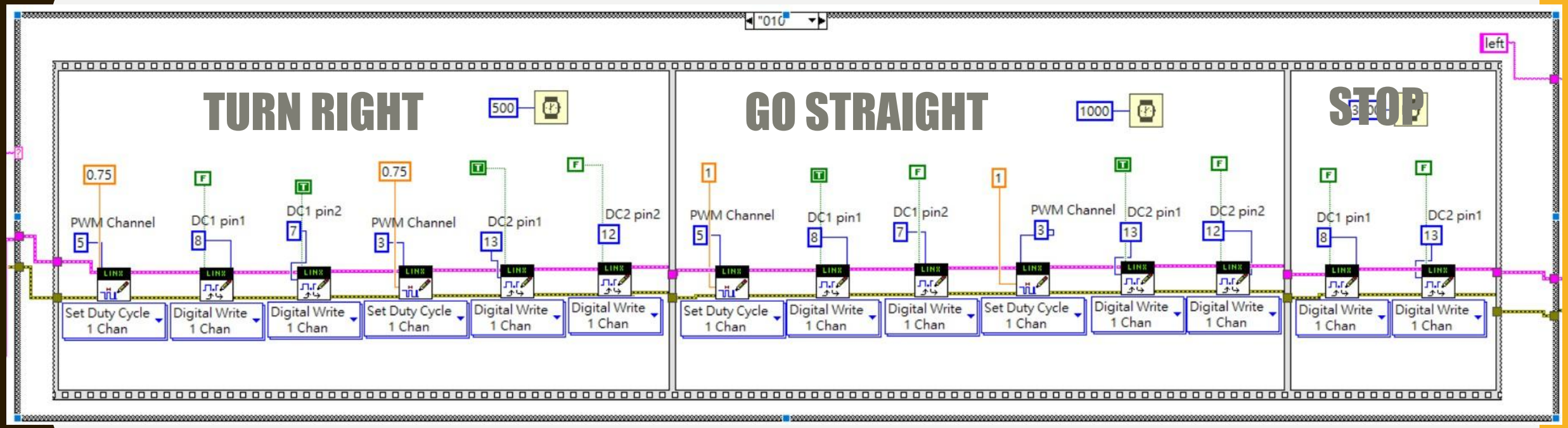
CONSUMER – MOTOR CASES

Specific case in out cases - left

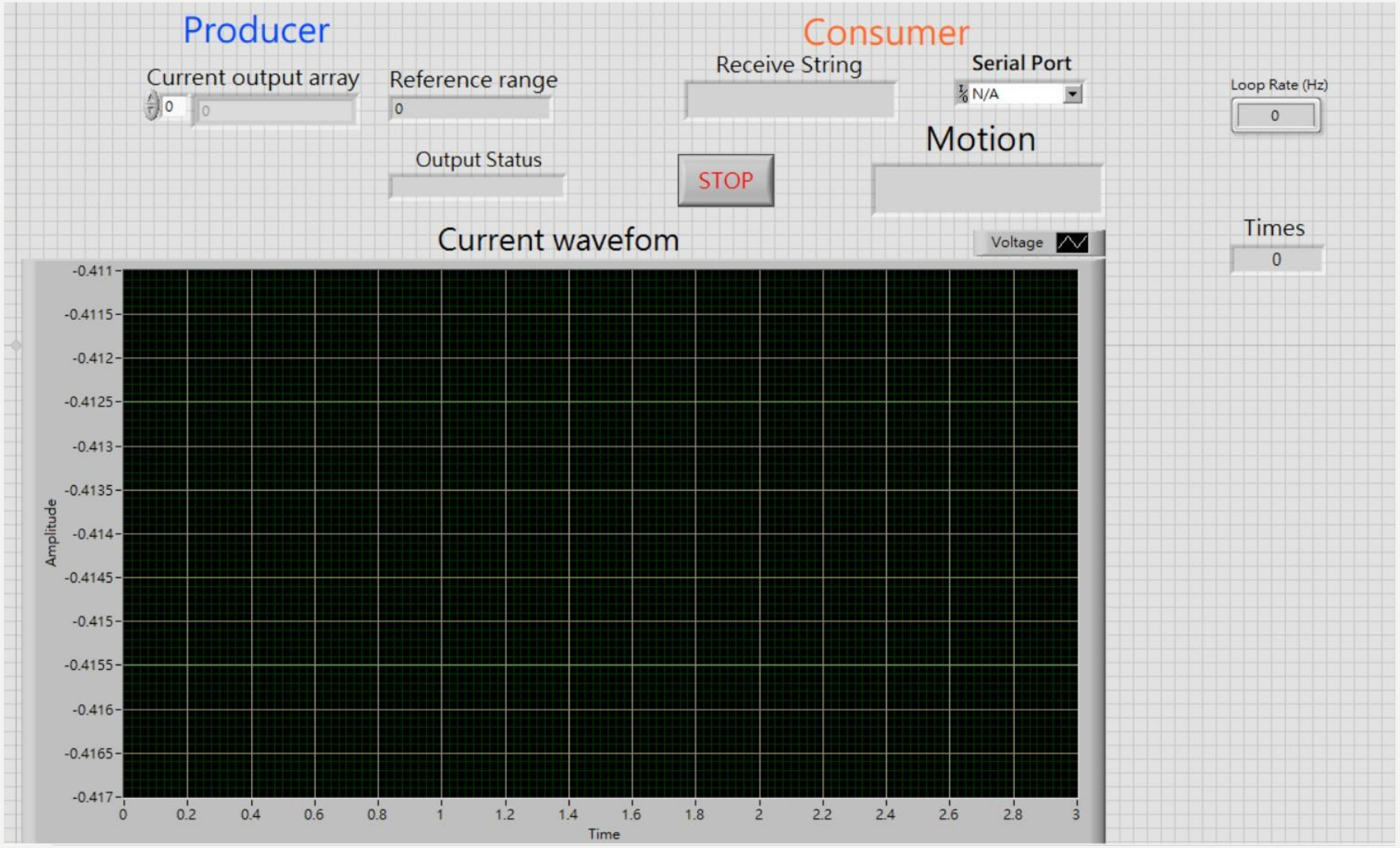


CONSUMER – MOTOR CASES

Specific case in out cases - right



USER PANEL


Producer
Current output array
0
0
Reference range
0
Output Status
Consumer
Receive String
Serial Port
N/A
STOP
Motion
Loop Rate (Hz)
0
Times
0
Current wavefom
Voltage
Amplitude
-0.411
-0.4115
-0.412
-0.4125
-0.413
-0.4135
-0.414
-0.4145
-0.415
-0.4155
-0.416
-0.4165
-0.417
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
Time

HARDWARE - WHEELCHAIR

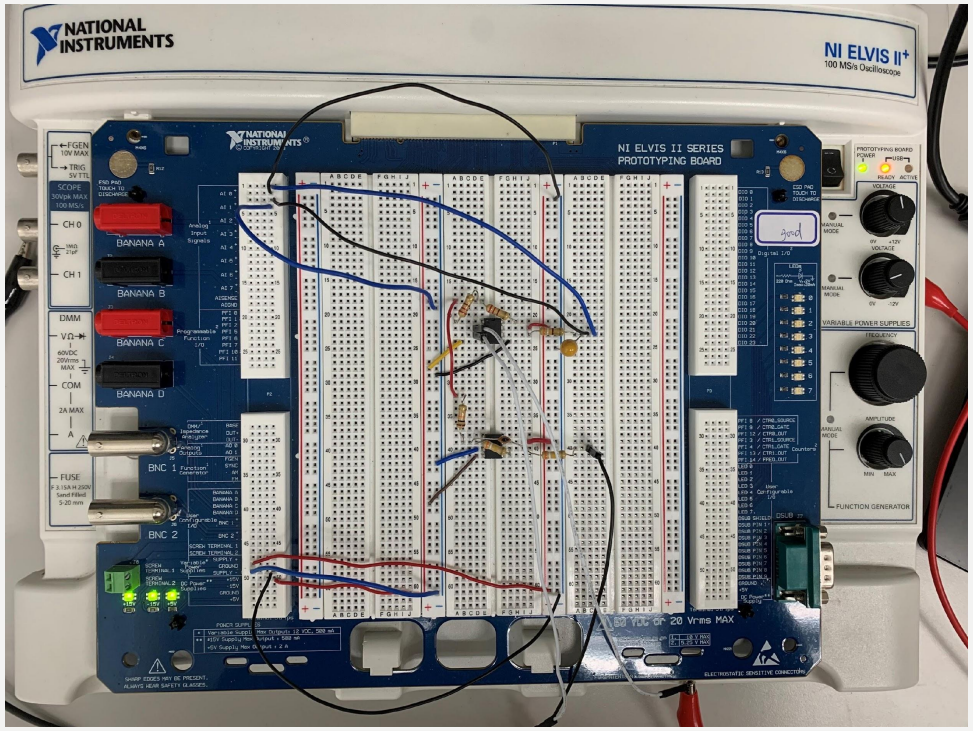
This is also completed in this project!!!

Solidworks

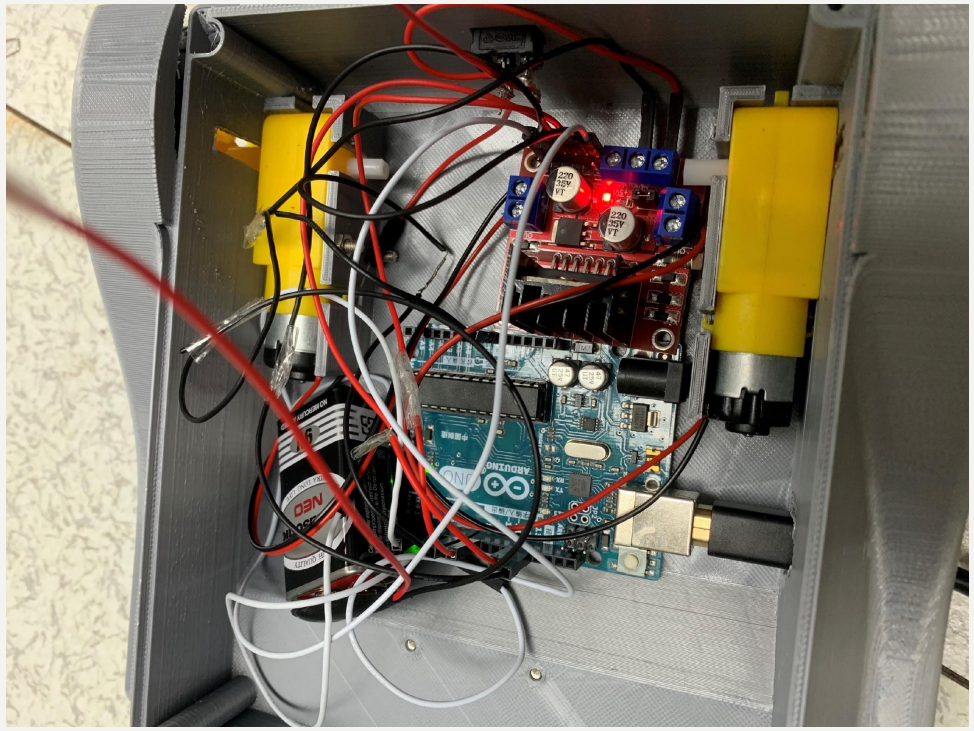
From 3D printer

HARDWARE - CIRCUIT

Elvis board

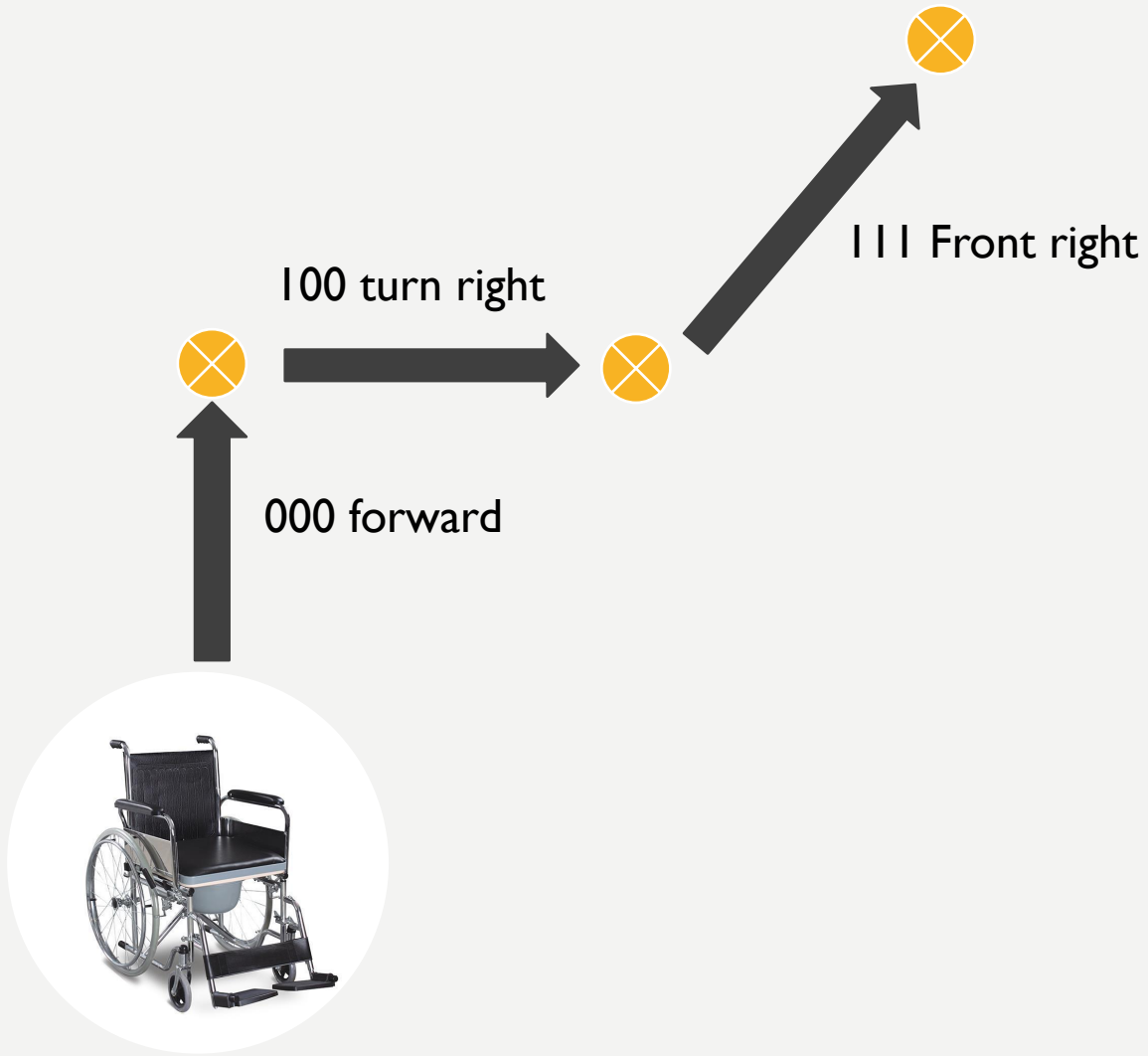


Circuit in wheel chair



DEMO

THIS IS OUR DEMO ROUTE SHOWING THAT IT CAN WORK.



RESULT

ARDUINO

NATIONAL INSTRUMENTS
LabVIEW™

THE OUTPUT COMMAND IS NOT CORRECT OCCASIONALLY

- Signal precision is 89%, command precision is 66%
- The method we used cannot provide high accuracy detect the impulse from the signal
- This signal require quite high standard signal acquisition, if our signal producer have some small move, it may influence the consequence
- Related to whether producer can provide blink signal with high(enough) voltage deviation

TRUE SIGNAL BUT WRONG DIRECTION

- Idler may influence wheelchair direction
- The battery cannot provide stable voltage
- We do not install encoder on the motor, so actually it cannot be asked to turn accurate turns for constant distance

CONCLUSION – SOME REVISION

- Signal deriving should be faster, it is impossible for producer to wait 10-18 seconds to motion.
- Signal processing can be more accurate. Maybe we could use numerical analysis to derive some equation to get 0 and 1.
- We can add some sensor or encoder on our wheelchair than it could be control more precisely.

REFERENCE

NOTION

- https://www.researchgate.net/publication/338657993_Speed_Control_of_a_Wheelchair_Prototype_Driven_by_a_DC_Motor_Through_Real_EEG_Brain_Signals

ARDUINO CONNECT WITH LABVIEW THE SAMPLE CODE OF DRIVING A DC MOTOR

- https://www.youtube.com/watch?v=11hi7lGEdyU
- https://www.ni.com/zh-tw/support/documentation/supplemental/21/producer-consumer-architecture-in-labview0.html
- https://www.youtube.com/watch?v=Cq4JM00BrA4
- https://www.youtube.com/watch?v=67n2iC12tYc

THANK YOU FOR YOUR ATTENTION