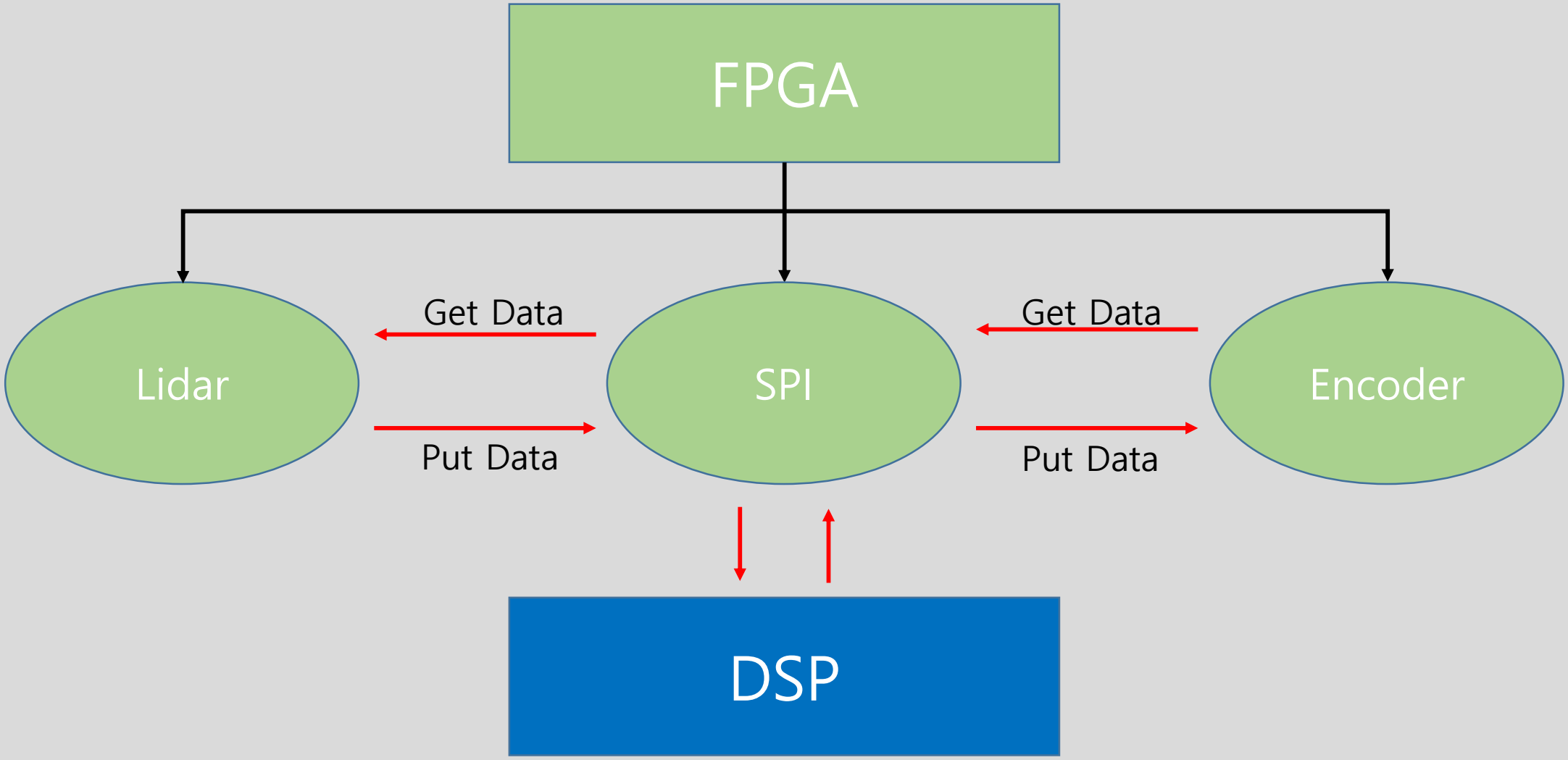
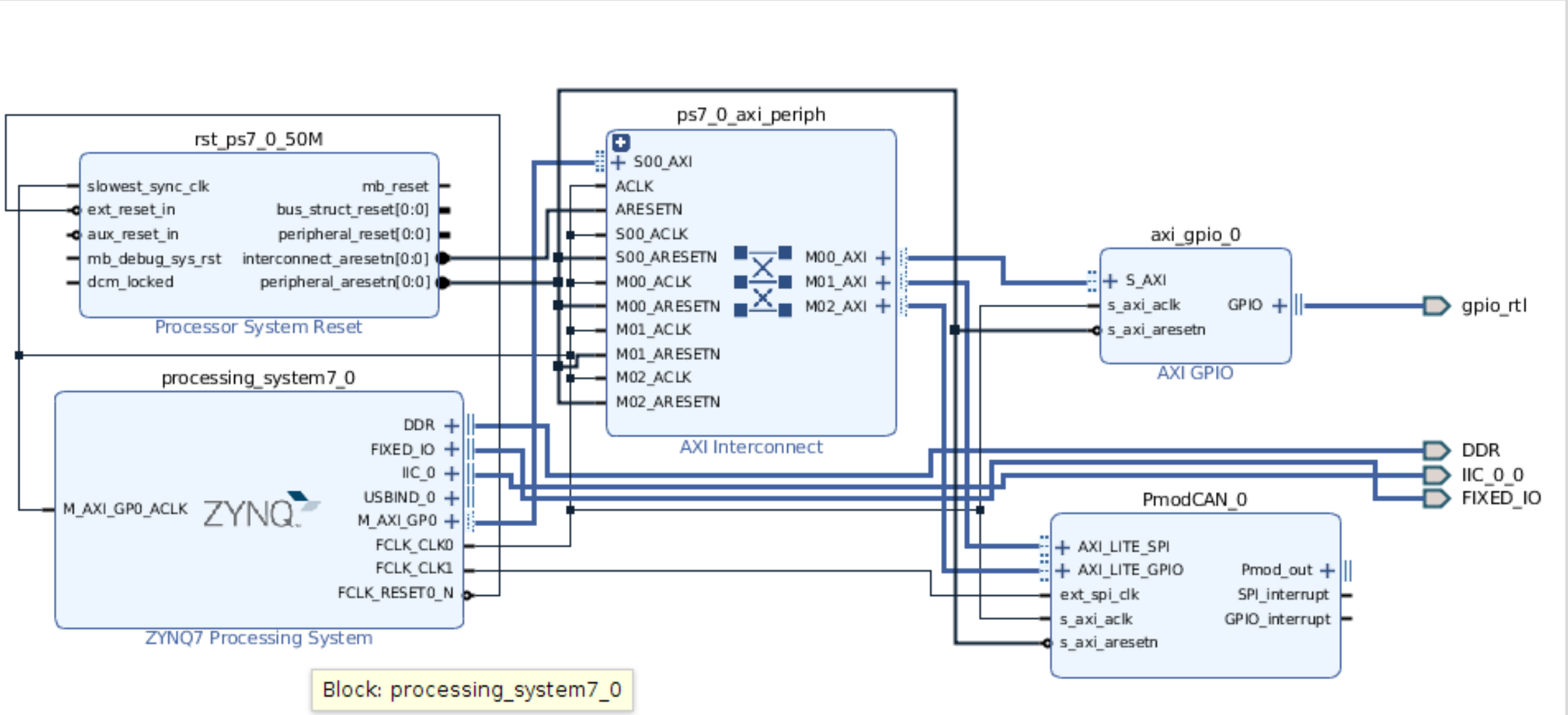
FPGA

시스템 아키텍처

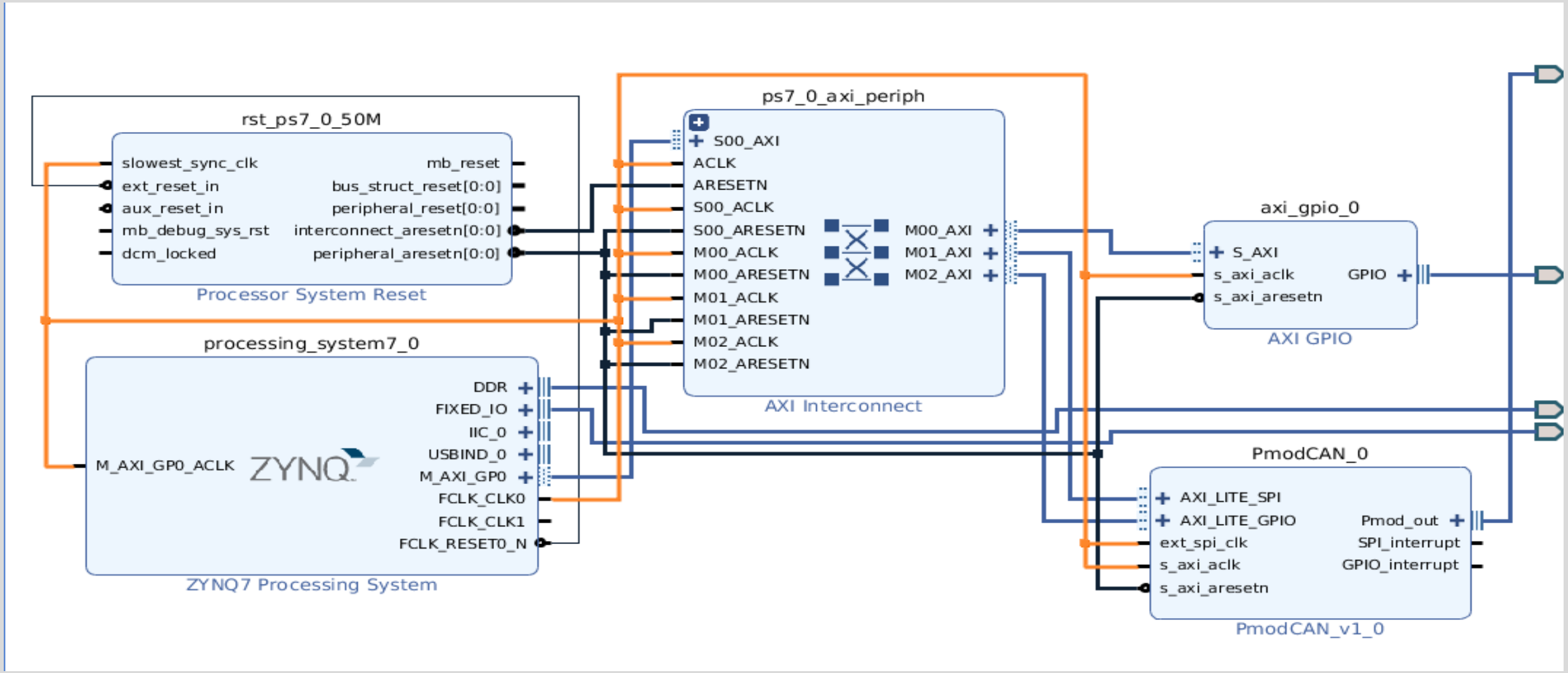

FPGA
Lidar
Get Data
Put Data
SPI
Get Data
Put Data
Encoder
DSP

진행 상황

FPGA IP


rst_ps7_0_50M
slowest_sync_clk
ext_reset_in
aux_reset_in
mb_debug_sys_rst
dcm_locked
mb_reset
bus_struct_reset[0:0]
peripheral_reset[0:0]
interconnect_aresetn[0:0]
peripheral_aresetn[0:0]
Processor System Reset
ps7_0_axi_periph
S00_AXI
ACLK
ARESETN
S00_ACLK
S00_ARESETN
M00_ACLK
M00_ARESETN
M01_ACLK
M01_ARESETN
M02_ACLK
M02_ARESETN
M00_AXI
M01_AXI
M02_AXI
AXI Interconnect
axi_gpio_0
S_AXI
s_axi_aclk
s_axi_aresetn
GPIO
AXI GPIO
gpio_rtl
processing_system7_0
M_AXI_GP0_ACLK
ZYNQ
DDR
FIXED_IO
IIC_0
USBIND_0
M_AXI_GP0
FCLK_CLK0
FCLK_CLK1
FCLK_RESET0_N
ZYNQ7 Processing System
DDR
IIC_0_0
FIXED_IO
PmodCAN_0
AXI_LITE_SPI
AXI_LITE_GPIO
ext_spi_clk
s_axi_aclk
s_axi_aresetn
Pmod_out
SPI_interrupt
GPIO_interrupt
Block: processing_system7_0

FPGA IP


rst_ps7_0_50M
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ps7_0_axi_periph
S00_AXI
ACLK
ARESETN
S00_ACLK
S00_ARESETN
M00_ACLK
M00_ARESETN
M01_ACLK
M01_ARESETN
M02_ACLK
M02_ARESETN
M00_AXI
M01_AXI
M02_AXI
AXI Interconnect
axi_gpio_0
S_AXI
s_axi_aclk
s_axi_aresetn
GPIO
AXI GPIO
PmodCAN_0
AXI_LITE_SPI
AXI_LITE_GPIO
ext_spi_clk
s_axi_aclk
s_axi_aresetn
Pmod_out
SPI_interrupt
GPIO_interrupt
PmodCAN_v1_0

PIN Config

gpio_rtl_tri_io (10)	INOUT				
gpio_rtl_tri_io[9]	INOUT				Y17
gpio_rtl_tri_io[8]	INOUT				H15
gpio_rtl_tri_io[7]	INOUT				V18
gpio_rtl_tri_io[6]	INOUT				V17
gpio_rtl_tri_io[5]	INOUT				U15
gpio_rtl_tri_io[4]	INOUT				U14
gpio_rtl_tri_io[3]	INOUT				R14
gpio_rtl_tri_io[2]	INOUT				P14
gpio_rtl_tri_io[1]	INOUT				T15
gpio_rtl_tri_io[0]	INOUT				T14

IIC_0_0_scl_io	INOUT				V13
IIC_0_0_sda_io	INOUT				V12
jc_pin1_io	INOUT	JC1			V15
jc_pin2_io	INOUT	JC2			W15
jc_pin3_io	INOUT	JC3			T11
jc_pin4_io	INOUT	JC4			T10
jc_pin7_io	INOUT	JC7			W14
jc_pin8_io	INOUT	JC8			Y14
jc_pin9_io	INOUT	JC9			T12
jc_pin10_io	INOUT	JC10			U12

PIN Config

```
INPUT : JD(1~8) JE(4,10)

LIDAR : JE(1,7)  1: BLUE /  7:GREEN

SPI : JC
1번 CS V15
2번 MOSI W15
3번 MISO T11
4번 SCK T10
```

SW

●shmget() - 공유 메모리 생성 or 접근

```
int shmget(key_t key, int size, int shmflg);
```

```
shm_id = shmget( (key_t)KEY_NUM, MEM_SIZE, IPC_CREAT | 0666
```

●shmat() - 공유 메모리를 프로세스에 첨부

```
void *shmat(int shmid, const void* shmaddr, int shmflg);
```

shmaddr이 NULL이라면 시스템은 사용하지 않는 적당한 메모리 영역을 붙임.

```
void *shmat(int shmid, const void* shmaddr, int shmflg);
```

```
shm_addr = shmat(shm_id, (void *)0 , 0)
```

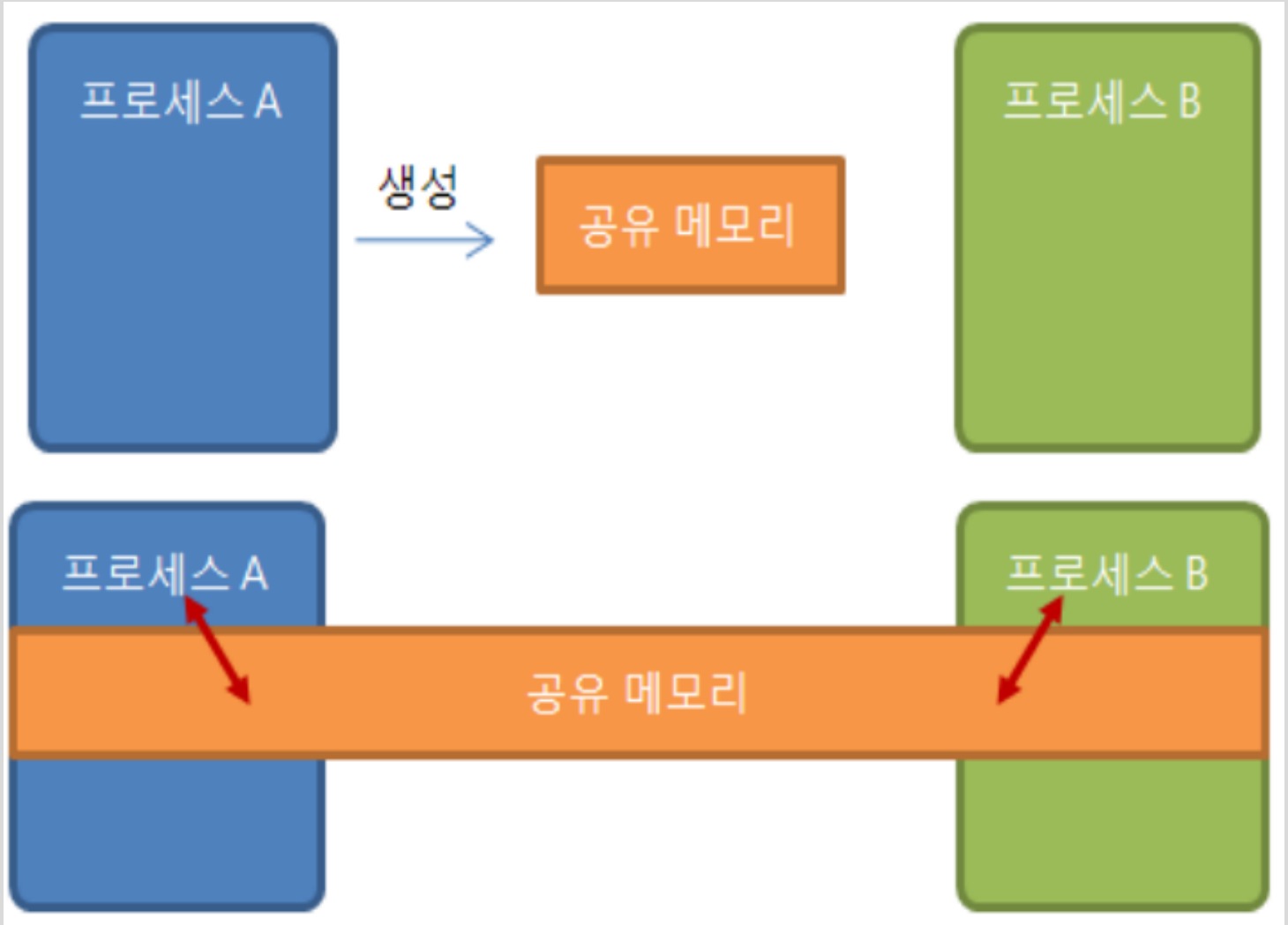
SW

```
/* SHM DATA */
    char *flag_PmodToLidar;
    char *flag_PmodToInput;
    char *flag_LidarToPmod;
    char *flag_InputToPmod;
    int *InputValue;
    int *LidarValue;

    int shmid_PmodToLidar;
    int shmid_PmodToInput;
    int shmid_LidarToPmod;
    int shmid_InputToPmod;
    int shmid_InputValue;
    int shmid_LidarValue;

    void *shared_memory_PmodToLidar = (void *)0;
    void *shared_memory_PmodToInput = (void *)0;
    void *shared_memory_LidarToPmod = (void *)0;
    void *shared_memory_InputToPmod = (void *)0;
    void *shared_memory_InputValue = (void *)0;
    void *shared_memory_LidarValue = (void *)0;
```

SW



SW

```
sem_wait(lidarToPmodFlag);
if(*flag_LidarToPmod)
{
    printf("######## PMOD  LIDAR VALUE : %d\n\n",*LidarValue);

    *flag_LidarToPmod = 0;
}
sem_post(lidarToPmodFlag);

sem_wait(inputToPmodFlag);
if(*flag_InputToPmod)
{
    *flag_InputToPmod = 0;
    *InputValue = 0;
}
sem_post(inputToPmodFlag);
```

```
sem_wait(pmodToInputFlag);
*flag_PmodToInput = 1;
sem_post(pmodToInputFlag);

sleepCount++;
if(sleepCount == 5)
{
    sleepCount = 0;

    sem_wait(pmodToLidarFlag);
    *flag_PmodToLidar = 1;
    sem_post(pmodToLidarFlag);
}

sem_wait(lidarToPmodFlag);
```

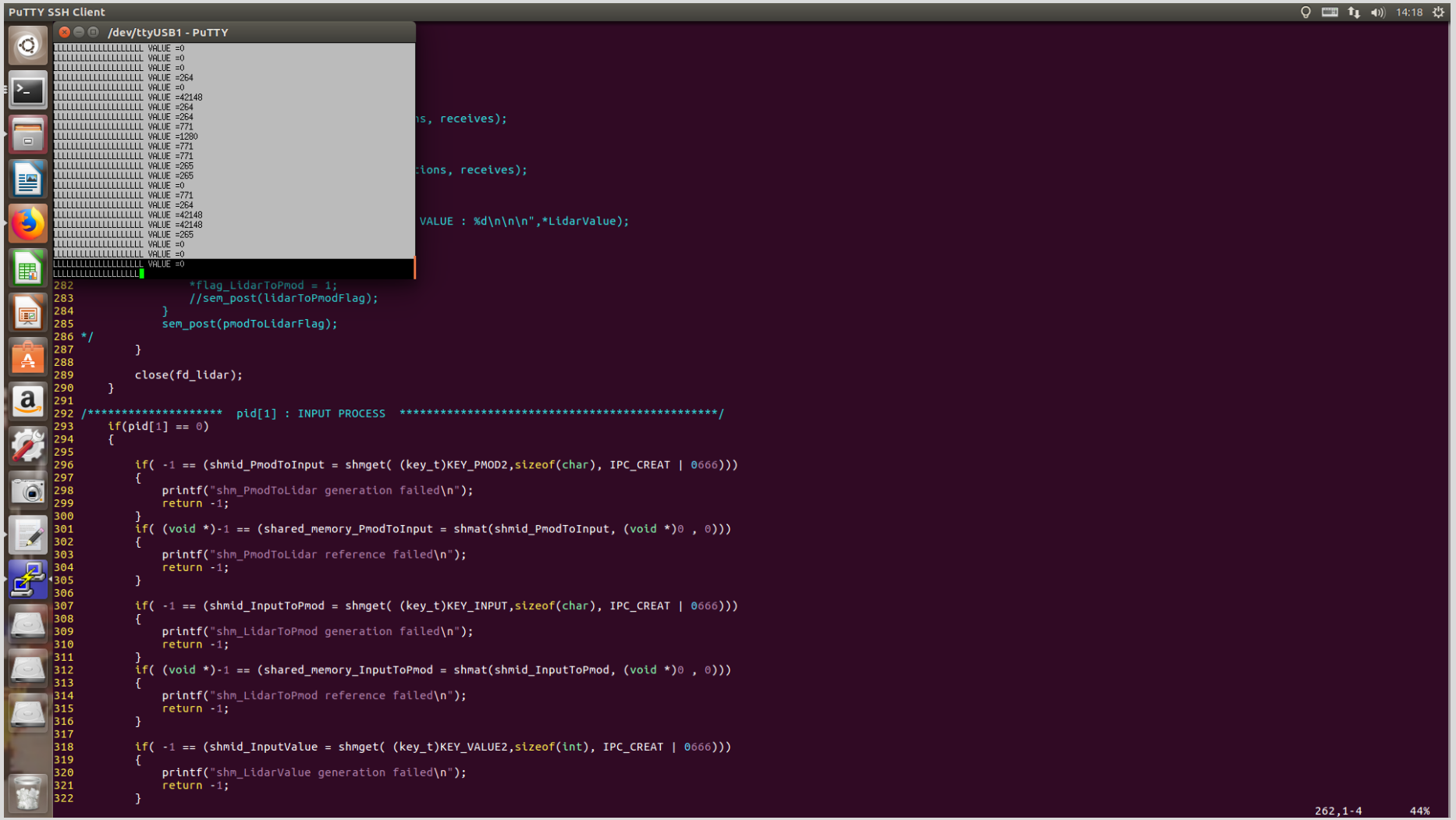
문제점 및 해결방안

문제점1)　Thread Error

```
NOTE: Executing RunQueue Tasks
ERROR: test-app-1.0-r0 do_compile: oe_runmake failed
ERROR: test-app-1.0-r0 do_compile: Function failed: do_compile (log file is located at /home/jbs/FPGA/PTC/test_sw/build/tmp/work/cortexa9hf-neon-xilinx-linux-gnueabi/test-app/1.0-r0/temp/log.do_compile.26147)
ERROR: Logfile of failure stored in: /home/jbs/FPGA/PTC/test_sw/build/tmp/work/cortexa9hf-neon-xilinx-linux-gnueabi/test-app/1.0-r0/temp/log.do_compile.26147
Log data follows:
| DEBUG: Executing shell function do_compile
| NOTE: make -j 4
| ERROR: oe_runmake failed
| arm-xilinx-linux-gnueabi-gcc  -march=armv7-a -marm -mfpu=neon  -mfloat-abi=hard -mcpu=cortex-a9 --sysroot=/home/jbs/FPGA/PTC/test_sw/build/tmp/sysroots/plnx_arm  -O2 -pipe -g -feliminate-unused-debug-types -fdebug-prefix-map=/home/jbs/FPGA/PTC/test_sw/build/tmp/work/cortexa9hf-neon-xilinx-linux-gnueabi/test-app/1.0-r0=/usr/src/debug/test-app/1.0-r0 -fdebug-prefix-map=/home/jbs/FPGA/PTC/test_sw/build/tmp/sysroots/x86_64-linux= -fdebug-prefix-map=/home/jbs/FPGA/PTC/test_sw/build/tmp/sysroots/plnx_arm=    -c -o test-app.o test-app.c
| test-app.c: In function 'main':
| test-app.c:613:1: error: expected declaration or statement at end of input
|  }
|  ^
| make: *** [<builtin>: test-app.o] Error 1
| WARNING: exit code 1 from a shell command.
| ERROR: Function failed: do_compile (log file is located at /home/jbs/FPGA/PTC/test_sw/build/tmp/work/cortexa9hf-neon-xilinx-linux-gnueabi/test-app/1.0-r0/temp/log.do_compile.26147)
ERROR: Task (/home/jbs/FPGA/PTC/test_sw/project-spec/meta-user/recipes-apps/test-app/test-app.bb:do_compile) failed with exit code '1'
NOTE: Tasks Summary: Attempted 2044 tasks of which 1662 didn't need to be rerun and 1 failed.

Summary: 1 task failed:
  /home/jbs/FPGA/PTC/test_sw/project-spec/meta-user/recipes-apps/test-app/test-app.bb:do_compile
Summary: There were 2 ERROR messages shown, returning a non-zero exit code.
ERROR: Failed to build project
```

문제점2)　Lidar Value Error



해결방법

```
if(LidarCount == 99)
{
    LidarCount = 0;
    measurement(CORRECTION, options, receives);
    *LidarValue = Lidar_Value;
    usleep(3700);
}
else
{
    measurement(NO_CORRECTION, options, receives);
    *LidarValue = Lidar_Value;
    usleep(3700);
}

printf("****  LIDAR PROCESS VALUE : %d",*LidarValue);
```

감사합니다.