하드웨어 시스템 설계 9주차 실습 보고서

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Goal: Run a given sample project in your FPGA linux and explain a brief functionality of sample project on report.

Code:

main.c

```c
#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <fcntl.h>

#include <sys/mman.h>


#define SIZE 4


int main(int argc, char** argv)

{

  int i;


  int foo = open("/dev/mem", O_RDWR);

  int *fpga_bram = mmap(NULL, SIZE * sizeof(int), PROT_READ|PROT_WRITE, MAP_SHARED, foo, 0x40000000);

  int *fpga_ip   = mmap(NULL, sizeof(int), PROT_READ|PROT_WRITE, MAP_SHARED, foo, 0x43C00000);


  // initialize memory
```

```c
  for (i = 0; i < SIZE; i++)

    *(fpga_bram + i) = (i * 2);

  for (i = SIZE; i < SIZE * 2; i++)

    *(fpga_bram + i) = 0.0f;


  printf("%-10s%-10s\n", "addr", "FPGA(hex)");

  for (i = 0; i < SIZE * 2; i++)

    printf("%-10d%-10X\n", i, *(fpga_bram + i));


  // run ip

  *(fpga_ip) = 0x5555;

  while (*fpga_ip == 0x5555);


  printf("%-10s%-10s\n", "addr", "FPGA(hex)");

  for (i = 0; i < SIZE * 2; i++)

    printf("%-10d%-10X\n", i, *(fpga_bram + i));


  return 0;

}


main_modify.c

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <fcntl.h>

#include <sys/mman.h>
```

```c
#define SIZE 6

int main(int argc, char** argv)
{
  int i;


  int foo = open("/dev/mem", O_RDWR);
  int *fpga_bram = mmap(NULL, SIZE * sizeof(int), PROT_READ|PROT_WRITE, MAP_SHARED, foo, 0x40000000);
  int *fpga_ip   = mmap(NULL, sizeof(int), PROT_READ|PROT_WRITE, MAP_SHARED, foo, 0x43C00000);


  // initialize memory
  for (i = 0; i < SIZE; i++)
    *(fpga_bram + i) = (i * 2);
  for (i = SIZE; i < SIZE * 2; i++)
    *(fpga_bram + i) = 0.0f;


  printf("%-10s%-10s\n", "addr", "FPGA(hex)");
  for (i = 0; i < SIZE * 2; i++)
    printf("%-10d%-10X\n", i, *(fpga_bram + i));


  // run ip
  *(fpga_ip) = 0x5555;
  while (*fpga_ip == 0x5555);
```

```c
    printf("%-10s%-10s\n", "addr", "FPGA(hex)");

  for (i = 0; i < SIZE * 2; i++)

    printf("%-10d%-10X\n", i, *(fpga_bram + i));



  return 0;

}
```
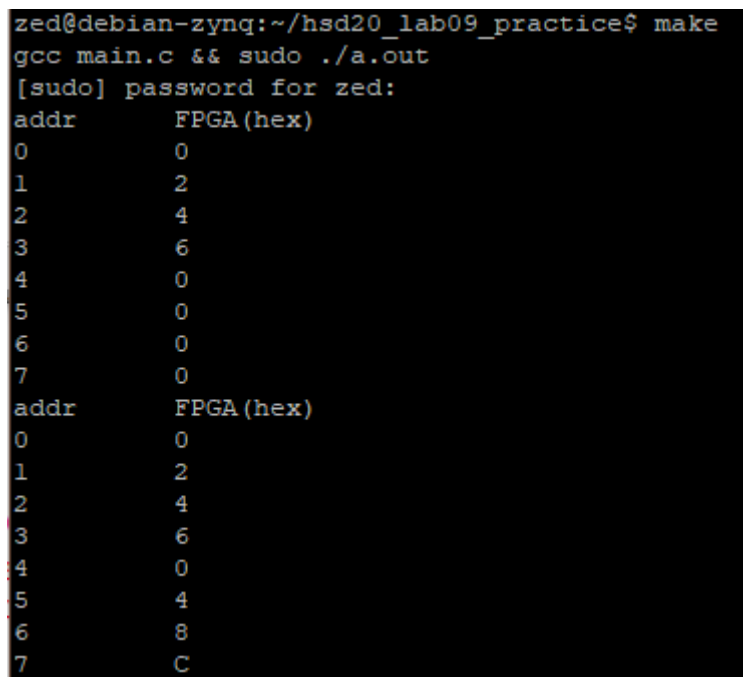
Result:

main.c


```
zed@debian-zynq:~/hsd20_lab09_practice$ make
gcc main.c && sudo ./a.out
[sudo] password for zed:
addr      FPGA(hex)
0         0
1         2
2         4
3         6
4         0
5         0
6         0
7         0
addr      FPGA(hex)
0         0
1         2
2         4
3         6
4         0
5         4
6         8
7         C
```

main_modify.c

```
zed@debian-zynq:~/hsd20_lab09_practice$ make
gcc main.c && sudo ./a.out
addr        FPGA(hex)
0           0
1           2
2           4
3           6
4           8
5           A
6           0
7           0
8           0
9           0
10          0
11          0
addr        FPGA(hex)
0           0
1           2
2           4
3           6
4           0
5           4
6           8
7           C
8           0
9           0
10          0
11          0
```

Discussion:

기존의 main.c 에서 SIZE 값만 바꿔서 실행해본 결과, MyIP 의 기능은 fpga_bram 의 addr 0~3
에서 4 개의 값을 읽은 후 2 배한 값을 fpga_bram 의 addr 4~7 에 저장하는 기능을 합니다.