

Sistem Programlama

Final Ödevi:

Character Device uygulaması-arduino ile iletişim

1.Kodlar

CharacterDev

```
#include<linux/kernel.h>
#include<linux/init.h>
#include<linux/module.h>
#include<linux/syscalls.h>
#include<linux/string.h>
#include<linux/file.h>
#include<linux/fs.h>
#include<linux/fcntl.h>
#include<asm/uaccess.h>
#include<linux/delay.h>
#define FILE_DIR "/dev/ttyUSB0" //Arduino cihazının bağlı olduğu port

//Module nitelikleri
MODULE_LICENSE("GPL");
MODULE_DESCRIPTION("Character Device Program");
MODULE_AUTHOR("ALFA");

static char msg[50]; //Argüman metnini tutar
static short readPos=0; //Okuma pozisyonu
static int times=0; //Character device erişim sayısını tutar

static int dev_open(struct inode *,struct file *);
static int dev_rls(struct inode *,struct file *);
static ssize_t dev_read(struct file *,char *,size_t,loff_t *);
static ssize_t dev_write(struct file *,const char*,size_t,loff_t *);

static void write_file(const char*,const char*);

static struct file_operations cmd_file_ops={
    .read=dev_read,
    .open=dev_open,
    .write=dev_write,
    .release=dev_rls
};

int init_module(){
    printk(KERNEL_INFO "Init module girdi\n");
    int MajorNum=register_chrdev(70,"CharacterDev",&cmd_file_ops);
    if(MajorNum<0)printk(KERN_ALERT "Yüklenirken hata oldu..\n");

    else printk(KERN_INFO "Yüklendi\n");
}
```

```

        return MajorNum;
    }

void cleanup_module(){
    unregister_chrdev(70,"CharacterDev");
    printk(KERN_INFO"Silindi\n");
}

static int dev_open(struct inode *inode,struct file *fil){
    times++;
    printk(KERN_INFO "Cihaz %d kere açıldı\n",times);
    return 0;
}

static ssize_t dev_read(struct file*filp,char *buff,size_t len,loff_t *off)
{
    printk(KERN_INFO "dev_read a girdi\n");
    short count =0; //Okunan karakter sayısını tutan değişken
    while(len && (msg[readPos]!=0))
    {
        put_user(msg[readPos],buff++);
        count++;
        len--;
        readPos++;
    }
    return count;
}

static ssize_t dev_write(struct file *filp,const char *buff,size_t len,loff_t *off)
{
    printk(KERN_INFO "dev_write a girdi\n");
    short ind =0;
    short count=0;
    memset(msg,0,50); //Metin için hafıza tahsis edilir
    readPos=0;

    while(len>0){
        msg[count++]=buff[ind++];
        len--;
    }
    write_file(FILE_DIR,msg);
    return count;
}

static int dev_rls(struct inode *inode,struct file *fil){
    printk(KERN_INFO"Cihaz kapandı\n");
    return 0;
}

```

```

static void write_file(const char*filename,const char* data){
    printk(KERN_INFO "write file a girdi");
    struct file *filp;
mm_segment_t oldfs;
    int ret;
    int count;
    filp=filp_open(filename,O_RDWR|O_APPEND,0644);

    if(IS_ERR(filp))
    {
        printk("Açılma hatası...\n");
        return;
    }
    for(count=0;data[count]!='\0';count++);

    msleep(5000);

    printk(KERN_INFO"Mesaj: %s",data);

    oldfs=get_fs();
    set_fs(get_ds());
    ret=kernel_write(filp,data,count,&filp->f_pos);

    set_fs(oldfs);
    filp_close(filp,NULL);
}

```

CKod

```

#include<stdio.h>
#include<fcntl.h>
#include<assert.h>
#include<string.h>
#include<ctype.h>
#include<stdlib.h>
#include<unistd.h>

```

```

int main(int argc,char *argv[]){

```

```

    assert(argc>1);          //Terminalden argüman girilip girilmediği kontrol edilir

```

```

    FILE *arduino;
    int index;                //Argüman indislerini tutan değişken

```

```

    char buf[20];            //Argüman olarak alınan metni tutan değişken

```

```

memset(buf,0,20);          //metin için hafıza tahsis edilir

strcpy(buf,argv[1]);

for(index=2;index<argc;index++){
    strcat(buf," ");
    strcat(buf,argv[index]);
}

int fd=open("/dev/CharacterDev",O_RDWR);

write(fd,buf,strlen(buf));

close(fd);
return 0;
}

```

Arduino Kodu

```

#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
    lcd.begin(16, 2);
    lcd.print("Grup Adi : Alfa..");
    Serial.begin(9600);
}

if(Serial.available()>0){
    lcd.setCursor(0,0);
    for (int i = 0; i < 16; ++i){
        lcd.print(' ');
    }
    lcd.setCursor(0,0);
    lcd.print("Grup uyeleri : ");
}

```

```
lcd.setCursor(0,1);

String input = Serial.readString();

Serial.println(input);

lcd.print(input);

}

}
```

Makefile

obj-m += CharacterDev.o

all:

make -C /lib/modules/\$(shell uname -r)/build M=\$(PWD) modules

clean:

make -C /lib/modules/\$(shell uname -r)/build M=\$(PWD) clean

test:

cc -o CKod CKod.c

2.Ekran Görüntüleri

- make komutu

```
fundaaysel@fundaaysel-VirtualBox:~/Masaüstü/modules$ sudo su
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# pico CharacterDev.c
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# make
make -C /lib/modules/4.18.12/build M=/home/fundaaysel/Masaüstü/modules modules
make[1]: Entering directory '/home/fundaaysel/Masaüstü/linux-4.18.12'
CC [M] /home/fundaaysel/Masaüstü/modules/CharacterDev.o
Building modules, stage 2.
MODPOST 1 modules
CC /home/fundaaysel/Masaüstü/modules/CharacterDev.mod.o
LD [M] /home/fundaaysel/Masaüstü/modules/CharacterDev.ko
make[1]: Leaving directory '/home/fundaaysel/Masaüstü/linux-4.18.12'
```

- insmod komutu

```
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# insmod CharacterDev.ko
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# mknod /dev/CharacterDev c 70 0
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# chmod a+rw /dev/CharacterDev
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules# gcc -o CKod CKod.c
root@fundaaysel-VirtualBox:/home/fundaaysel/Masaüstü/modules#
```

• dmesg

```
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules

Dosya Düzenle Görünüm Ara Uçbirim Yardım

[ 39.714576] RAPL PMU: hw unit of domain pp0-core 2^0 Joules
[ 39.714577] RAPL PMU: hw unit of domain package 2^0 Joules
[ 39.714577] RAPL PMU: hw unit of domain dram 2^0 Joules
[ 39.714578] RAPL PMU: hw unit of domain pp1-gpu 2^0 Joules
[ 39.714578] RAPL PMU: hw unit of domain pssys 2^0 Joules
[ 39.929318] cryptd: max_cpu_qlen set to 1000
[ 40.405316] AVX2 version of gcm enc/dec engaged.
[ 40.405317] AES CTR mode by8 optimization enabled
[ 41.855803] vboxvideo: module is from the staging directory, the quality is unknown, you have been warned.
[ 41.858001] [drm] VRAM 01000000
[ 41.858143] [TTM] Zone kernel: Available graphics memory: 2019774 KiB
[ 41.858144] [TTM] Initializing pool allocator
[ 41.858147] [TTM] Initializing DMA pool allocator
[ 41.860523] fbcon: vboxdrmfb (fb0) is primary device
[ 41.862663] Console: switching to colour frame buffer device 100x37
[ 41.863820] vboxvideo 0000:00:02.0: fb0: vboxdrmfb frame buffer device
[ 41.863860] [drm] Initialized vboxvideo 1.0.0 20130823 for 0000:00:02.0 on minor 0
[ 43.500189] audit: type=1400 audit(1546790971.428:2): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/sbin/dhclient" pid=438 comm="apparmor_parser"
[ 43.500500] audit: type=1400 audit(1546790971.432:3): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/lib/NetworkManager/nm-dhcp-client.action" pid=438 comm="apparmor_parser"
[ 43.508777] audit: type=1400 audit(1546790971.432:4): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/lib/NetworkManager/nm-dhcp-helper" pid=438 comm="apparmor_parser"
[ 43.508988] audit: type=1400 audit(1546790971.432:5): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/lib/connman/scripts/dhclient-script" pid=438 comm="apparmor_parser"
[ 44.885609] snd_intel8x0 0000:00:05.0: white list rate for 1028:0177 is 48000
[ 44.929225] audit: type=1400 audit(1546790972.852:6): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince" pid=495 comm="apparmor_parser"
[ 44.929460] audit: type=1400 audit(1546790972.852:7): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince//sanitized_helper" pid=495 comm="apparmor_parser"
[ 44.930347] audit: type=1400 audit(1546790972.852:8): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince-previewer" pid=495 comm="apparmor_parser"
[ 44.930522] audit: type=1400 audit(1546790972.852:9): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince-previewer//sanitized_helper" pid=495 comm="apparmor_parser"
[ 44.931311] audit: type=1400 audit(1546790972.852:10): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince-thumbnailer" pid=495 comm="apparmor_parser"
[ 44.931477] audit: type=1400 audit(1546790972.852:11): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince-thumbnailer//sanitized_helper" pid=495 comm="apparmor_parser"
[ 53.880100] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready
[ 53.880120] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready
[ 53.892329] e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
[ 53.892329] IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready
[ 81.200804] rfkill: input handler disabled
[ 210.055407] CharacterDev: loading out-of-tree module taints kernel.
[ 210.055440] CharacterDev: module verification failed: signature and/or required key missing - tainting kernel
[ 210.055505] Yüklendi
[ 235.068023] usb 1-2: new full-speed USB device number 3 using ohci-pci
[ 236.179786] usb 1-2: New USB device found, idVendor=1a86, idProduct=7523, bcdDevice= 2.54
[ 236.179788] usb 1-2: New USB device strings: Mfr=0, Product=2, SerialNumber=0
[ 236.179790] usb 1-2: Product: USB2.0-Serial
[ 236.410281] usbcore: registered new interface driver usbserial_generic
[ 236.410561] usbserial: USB Serial support registered for generic
[ 236.435004] usbcore: registered new interface driver ch341
[ 236.435741] usbserial: USB Serial support registered for ch341-uart
[ 236.435826] ch341 1-2:1.0: ch341-uart converter detected
[ 236.477567] usb 1-2: ch341-uart converter now attached to ttyUSB0
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules
```

• Arduino'ya veri gönderme

```
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules

Dosya Düzenle Görünüm Ara Uçbirim Yardım

root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules# ./CKod Funda
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules# ./CKod Gokhan
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules# ./CKod Omer
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules# ./CKod Unal
root@fundaaysel-VirtualBox: /home/fundaaysel/Masaüstü/modules#
```