SoC Robot Brain Board – uClinux

System Design Innovation & Application Research Center

I. SoC Brain Board **개발환경**
II. **개발환경 세팅**
III. **개발** Tools **설치**
IV. OS Porting
V. Device drivers
VI. Application SW

Intelligent SoC Robot Algorithm

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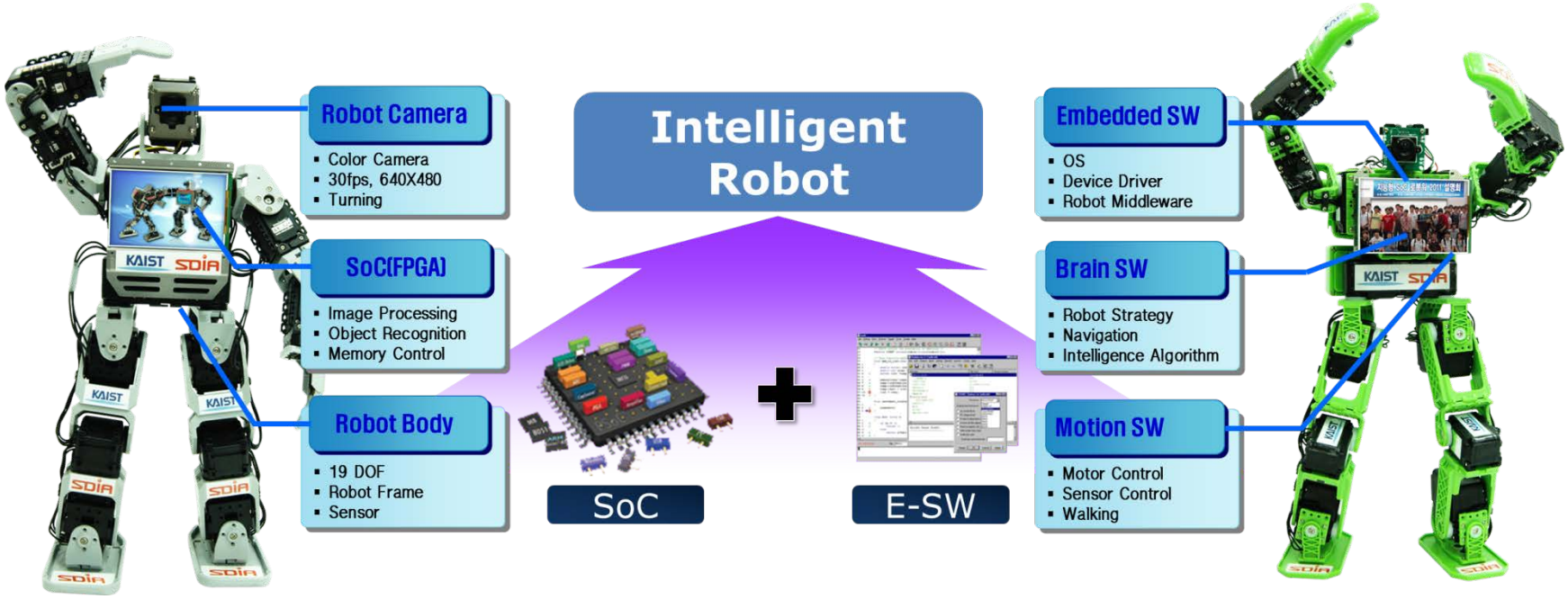

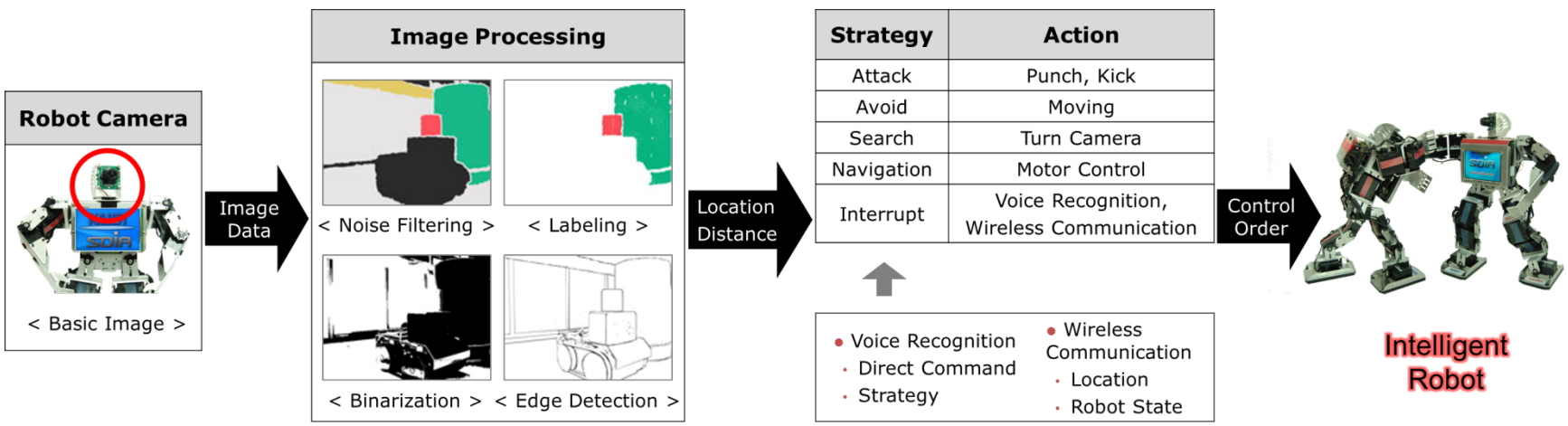

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DST Robot 디에스티로봇

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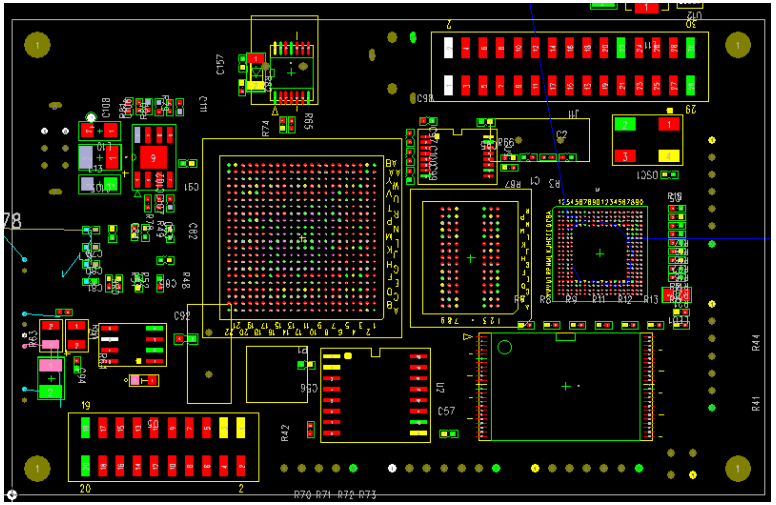
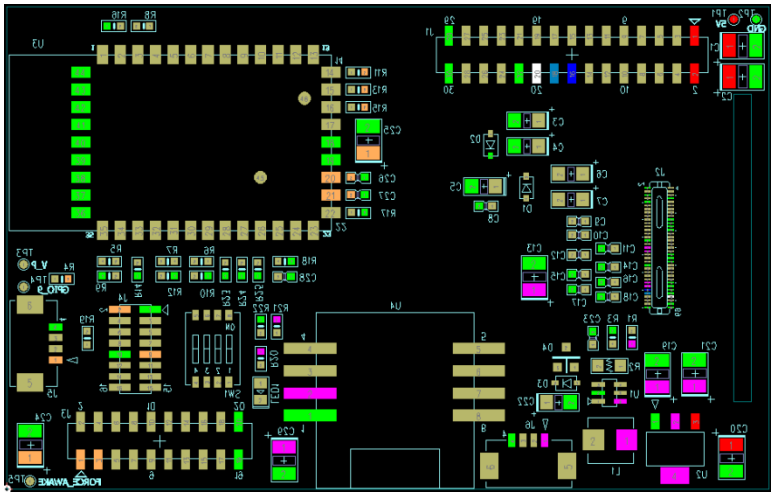
Main Board



LCD/RF Module



Item	Specification
MCU	ADChips Eagle (EISC CPU)
Memory	SDRAM - 64MB NAND Flash - 64MB
FPGA	Altera Cyclone□ – EP4CE75 Altera EPCS64
Video Decoder	SAA7111A
UART	1 Port RS232C – PC 1 Port TTL Level – Robot
USB	1 Port – Mini USB
Camera Input	1 Port – 3Pins
Display	3.5Inch TFT- LCD (320 X 480)
WIFI	G2 microsystems
Bluetooth	Option
GPIO	10Pins (Sensor Interface)
Size	87mm X 55mm

Brain Board (Main Board)

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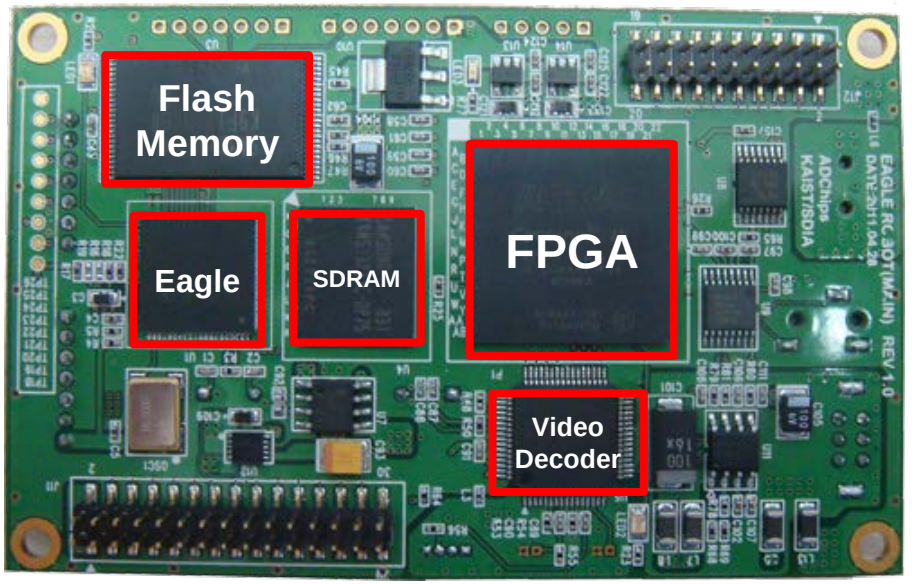
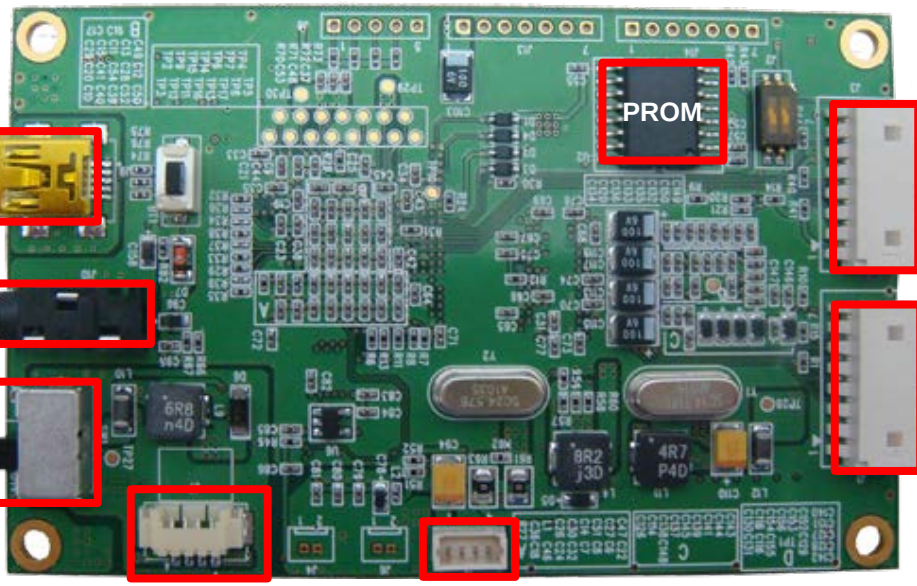
Top



Bottom



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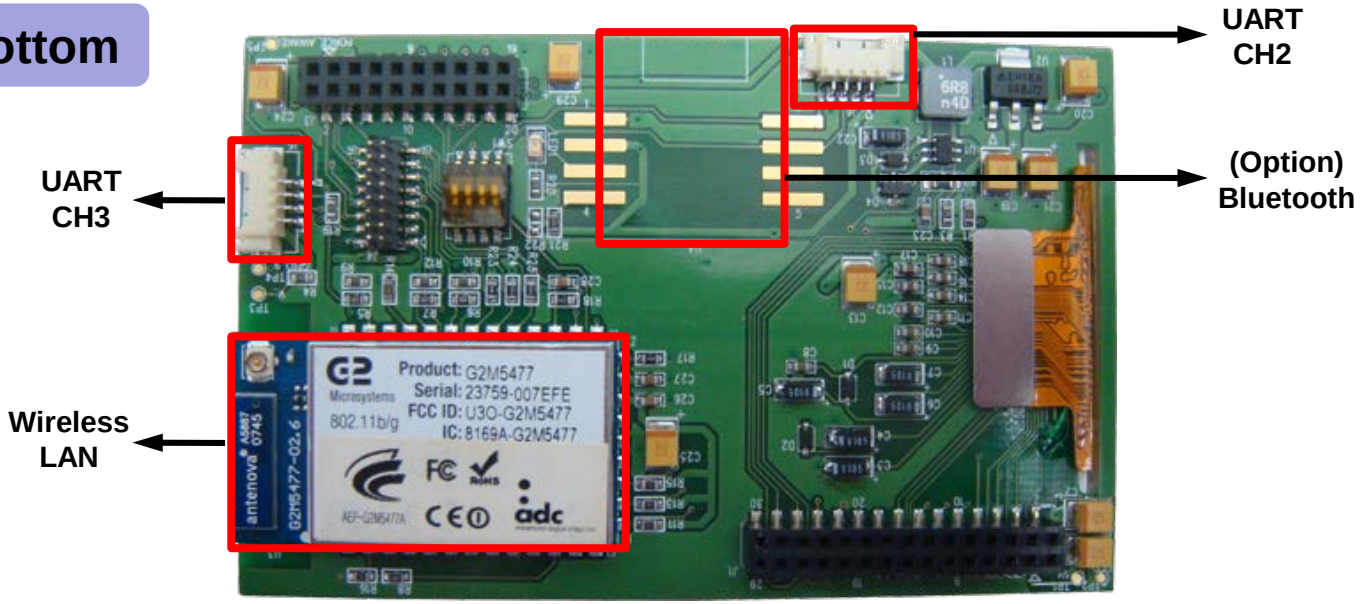
Top

Bottom



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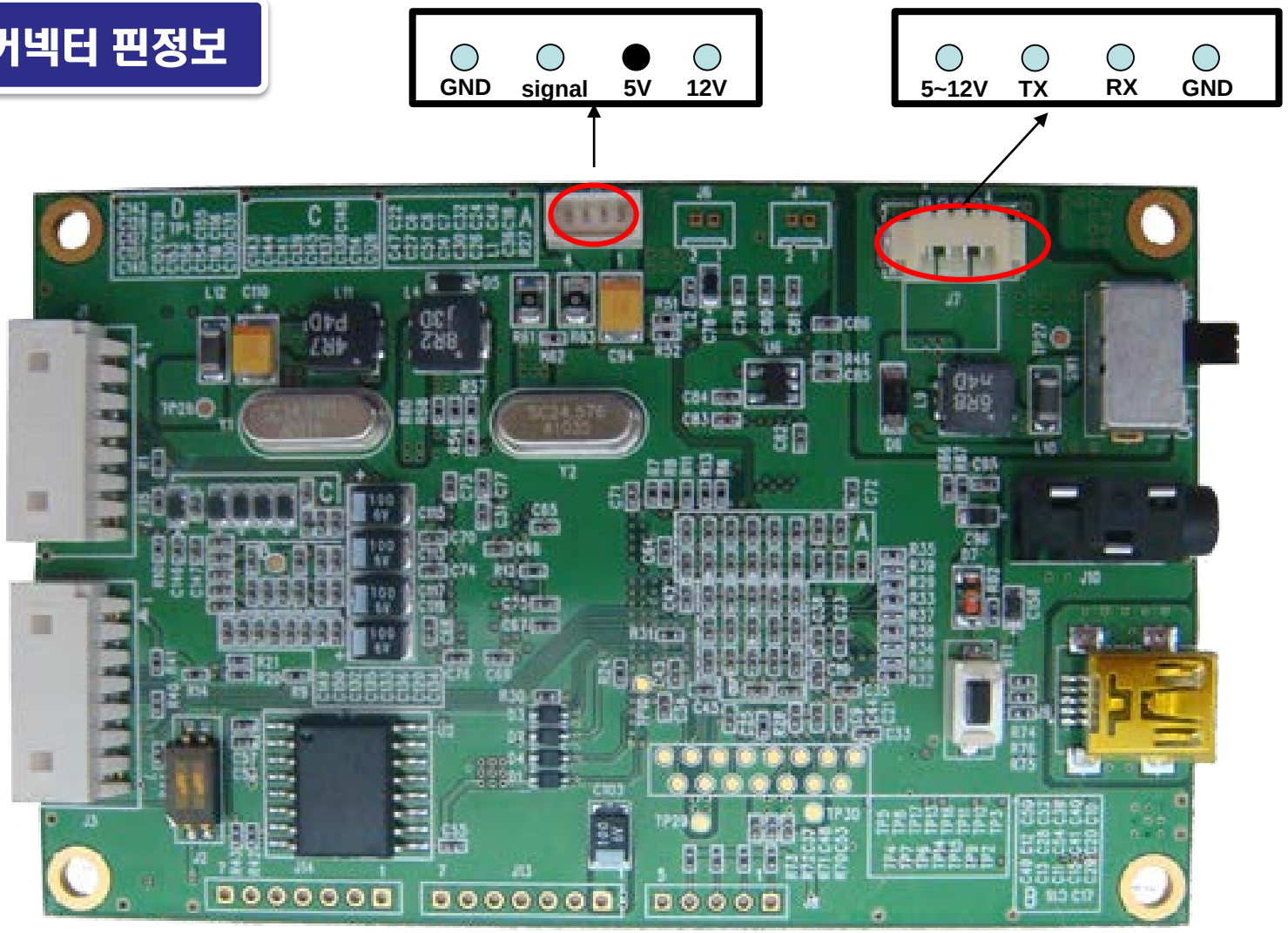
커넥터 핀정보



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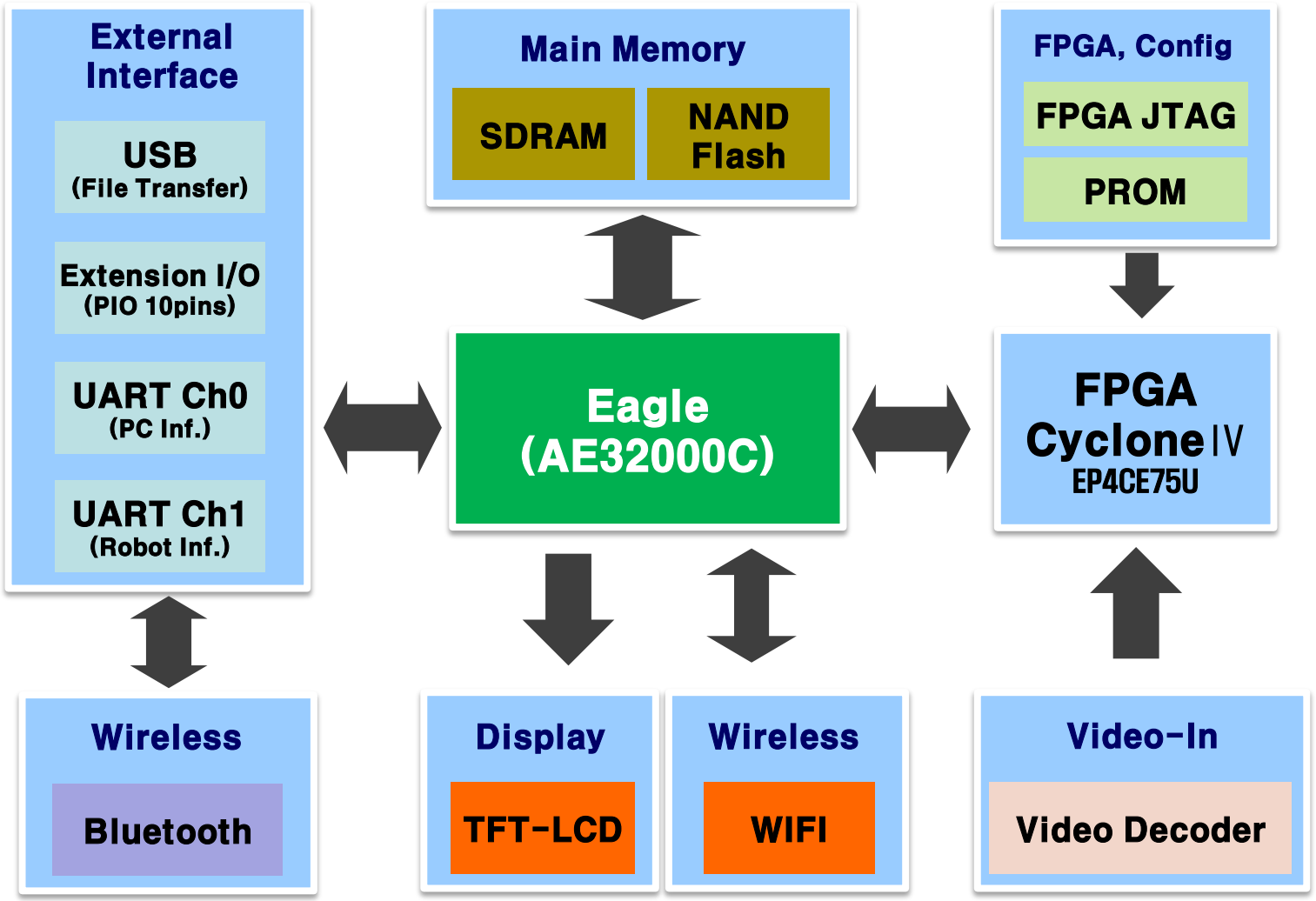

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Hardware

- PC
- SoC Brain Board
- RS-232C Cable(Serial Cable)
- USB Cable
- DC 5V Power Adapter (2A)
- NTSC 출력 Camera (12V)

Software

- OS: Windows XP, 7, 8
- Cygwin (gcc operation environment)
- ECOMI (AE32000 Compiler)
- USB Download Program, USB Driver
- Hyper Terminal

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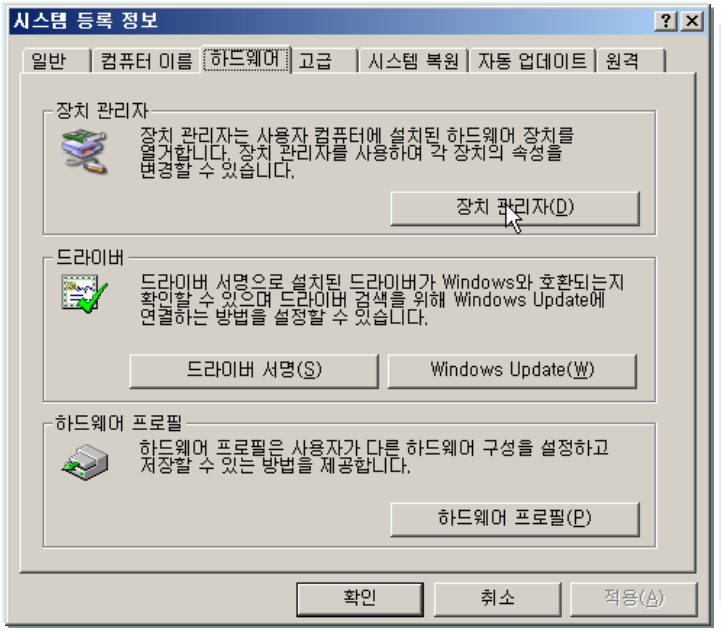
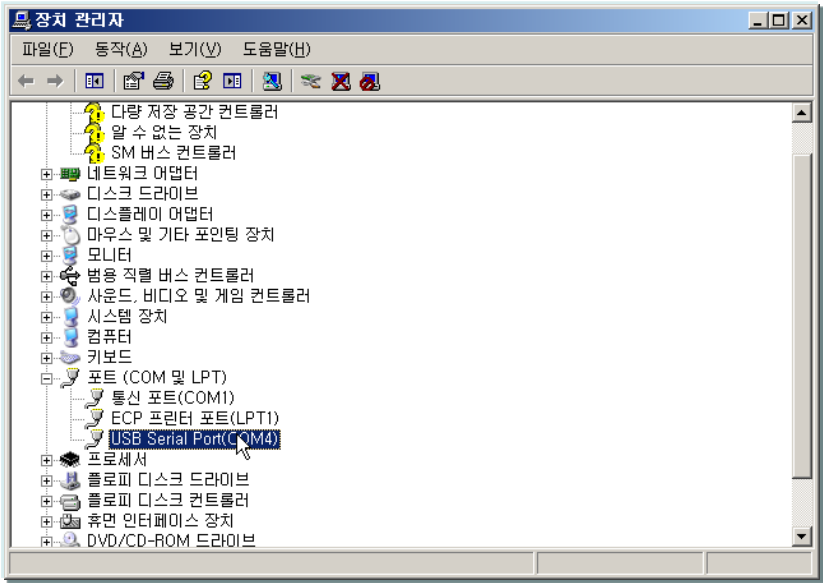
Port 설정

- USB-to-Serial Cable PC 연결 (Drive 설치)
- USB-to-Serial 포트 설정
  내컴퓨터 -> 등록정보 -> 하드웨어 -> 장치관리자 -> 포트





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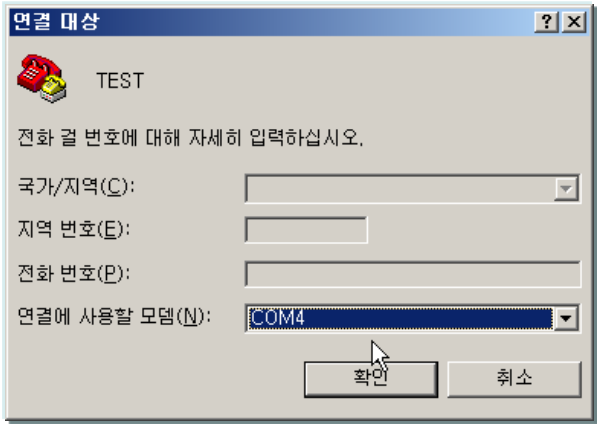
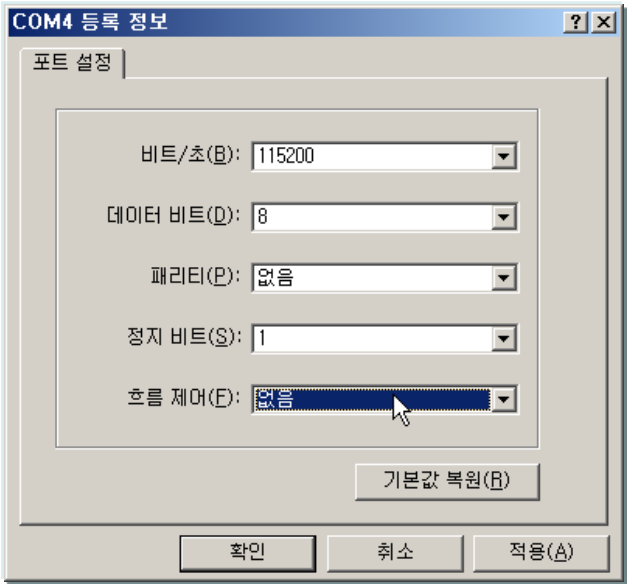
Port 설정

- 비트/초: 115200
- 데이터 비트: 8
- 패리티: 없음
- 정지 비트: 1
- 흐름 제어: 없음





Cygwin download

- ADChips 홈페이지 자료실 접속
  http://www.adc.co.kr/support/data.asp
- Cygwin 설치파일 저장

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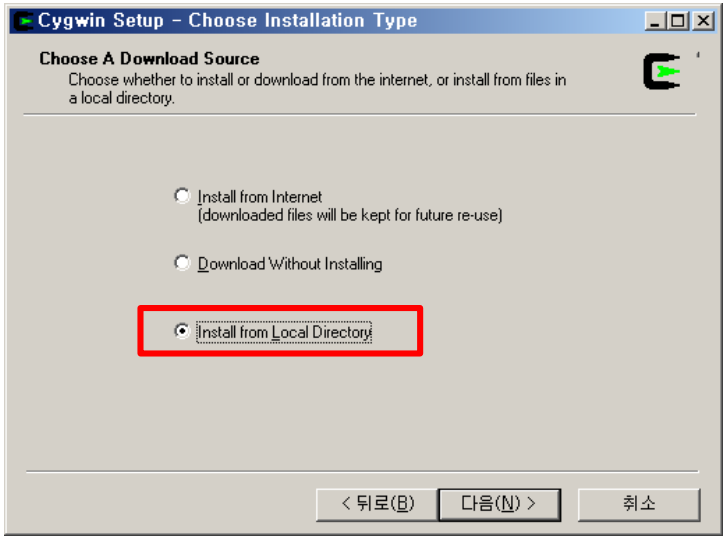
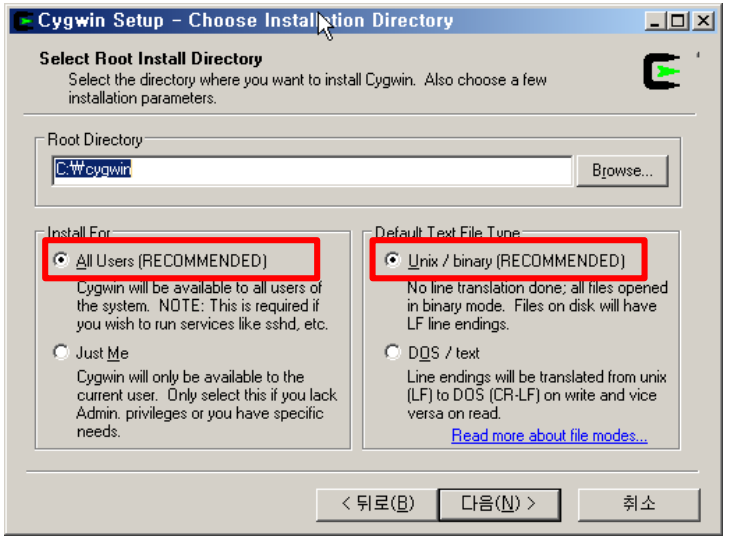
Cygwin 설치

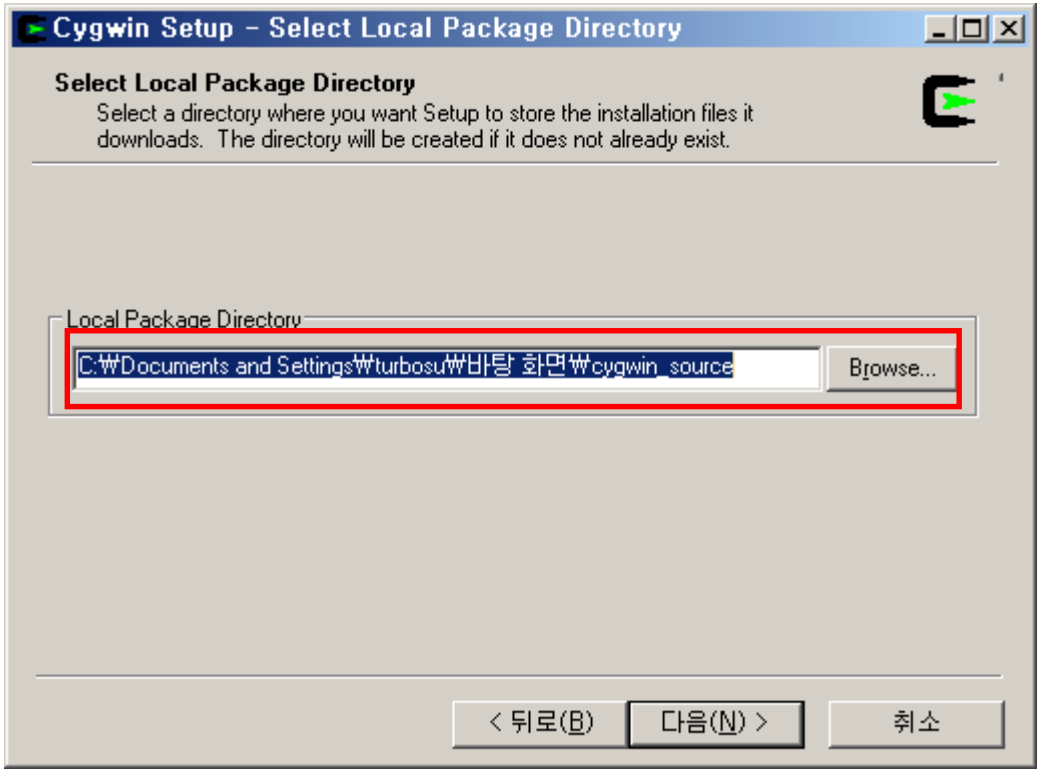
- 압축풀기 => cygwin_source 폴더 setup.exe 실행
- Install from Local Directory Check => 다음
- Root Directory: C:₩cygwin
- Install For: All Users
- Default Text File Type: Unix / binary Check => 다음





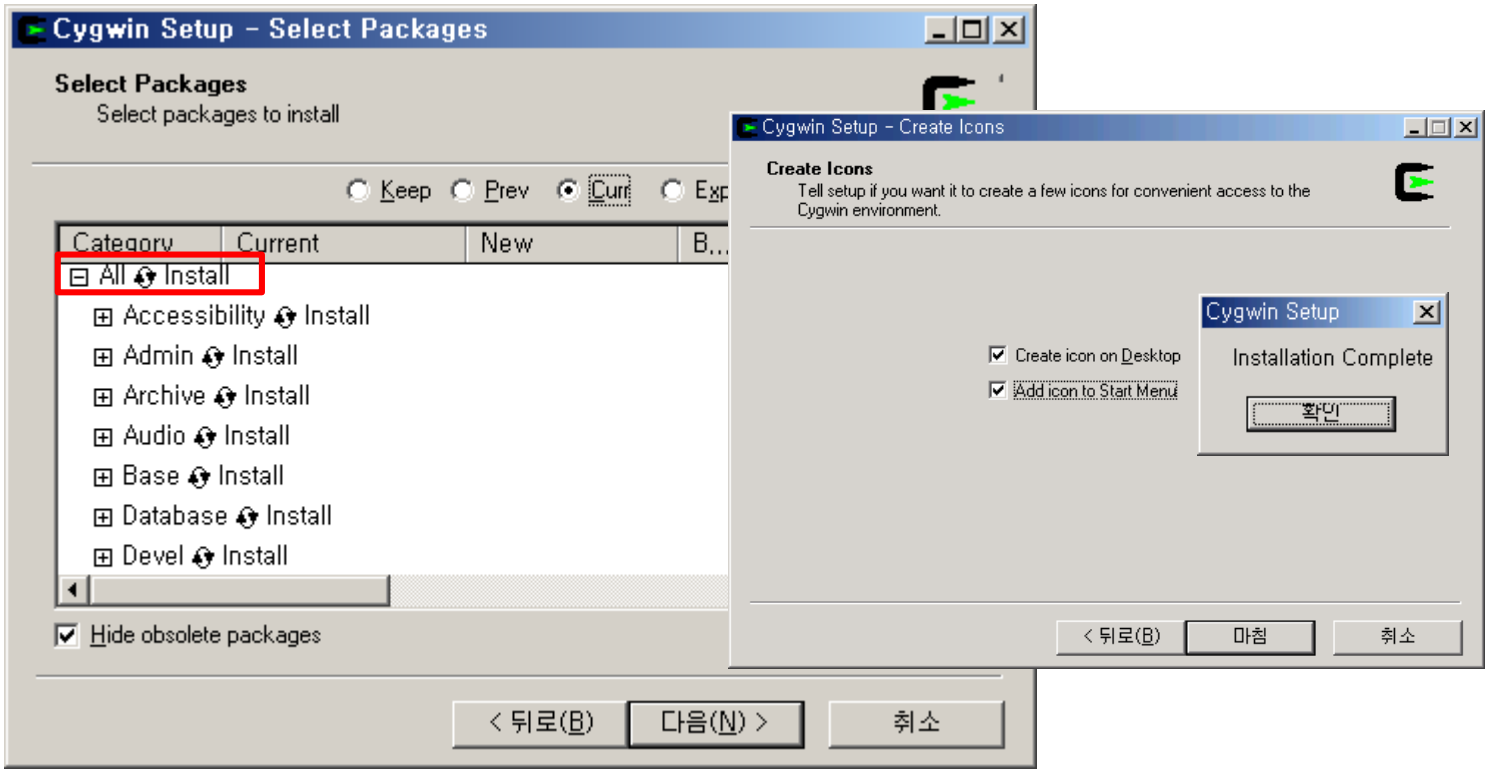
Cygwin 설치

- Local Package Directory: cygwin_source 폴더 => 다음



Cygwin 설치

- Select Package: All Install 선택 => 다음
- Installation Complete, 설치완료



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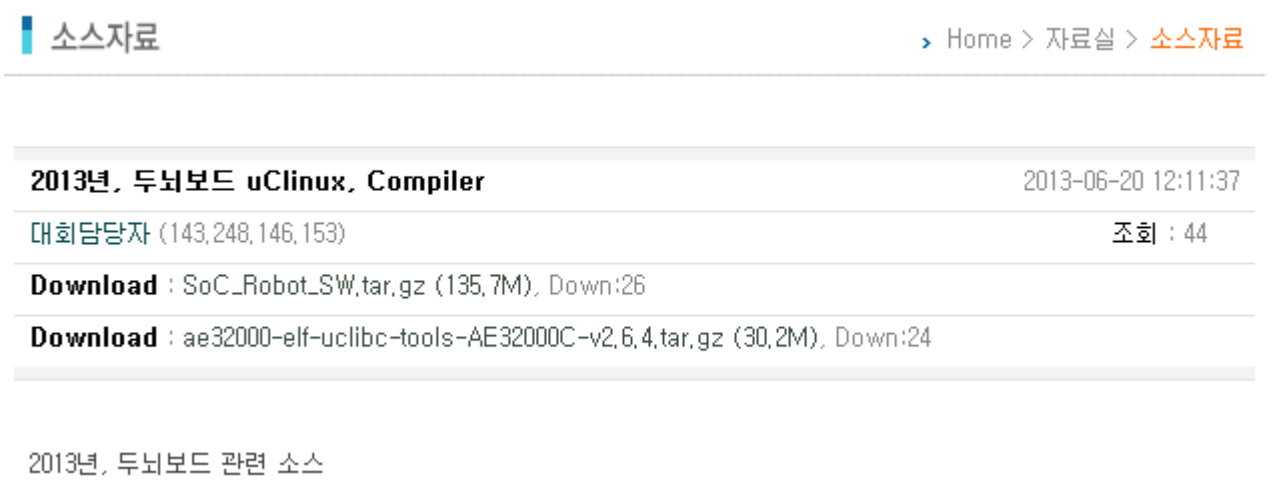
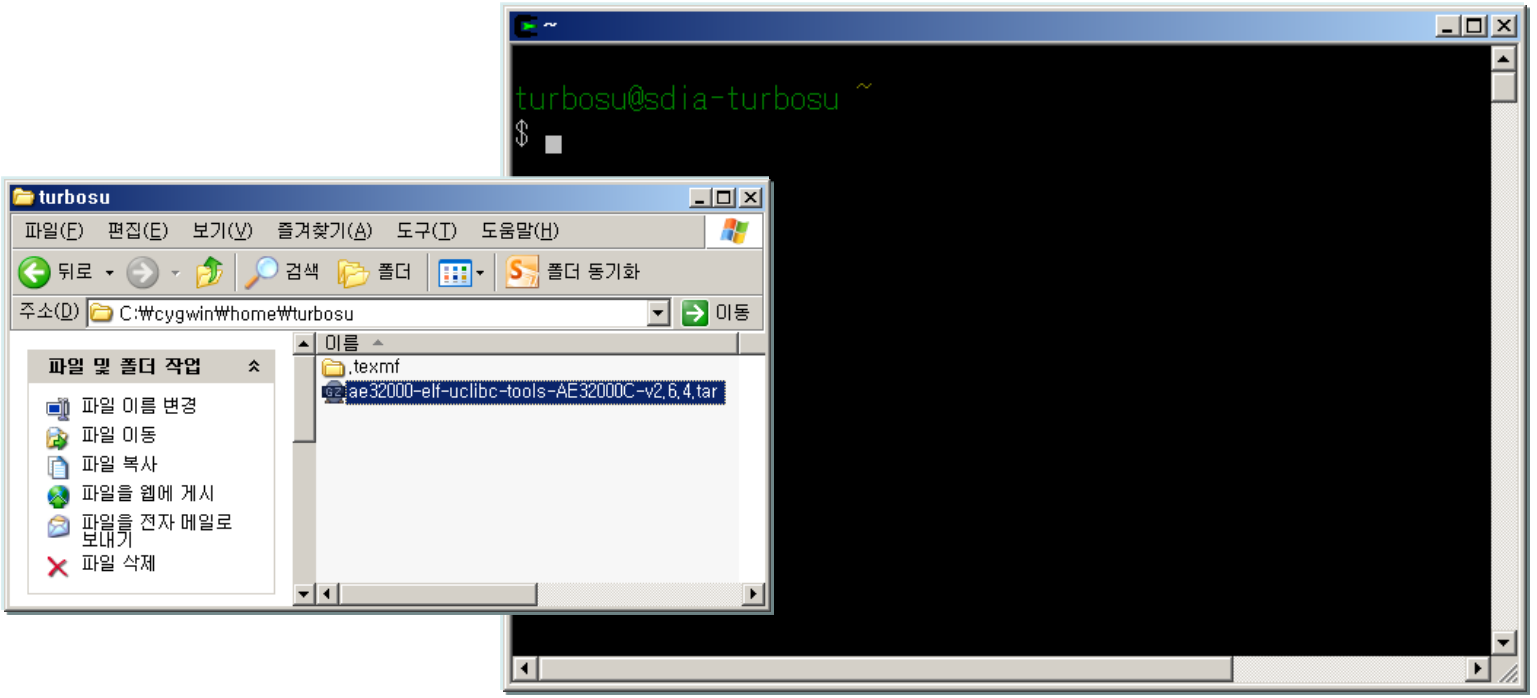
Source download

- 로봇워 대회 홈페이지 접속 => 소스자료, 2013, 두뇌보드 uClinux, Compiler
- SoC_Robot_SW.tar.gz
- ae32000-elf-uclibc-tools-AE32000C-v2.6.4.tar.gz



Compiler 설치

- Ae32000-elf-uclibc-tools-AE32000C-v2.6.4.tar.gz
- Directory 복사: C:₩cygwin₩home₩<user ID>

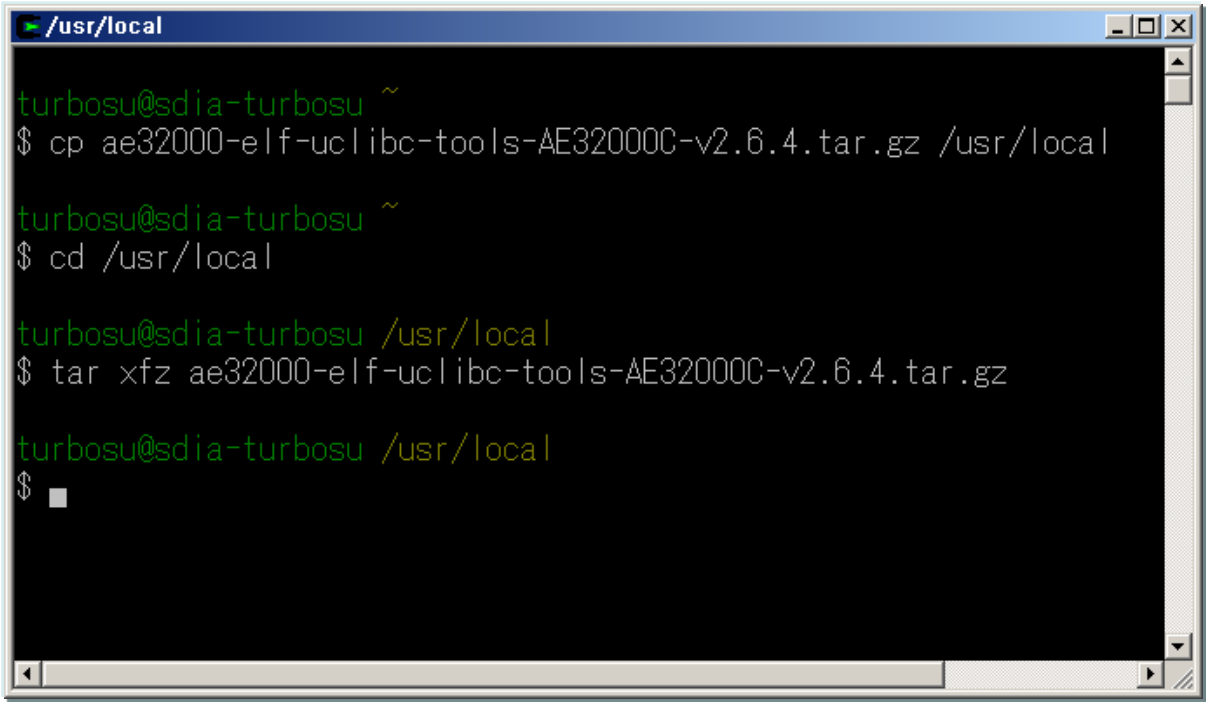


Linux 명령어

명령어	의미
ls	파일과 디렉토리의 목록을 출력
cd	디렉토리 이동
cp	파일이나 디렉토리를 복사
mv	파일이나 디렉토리 이름을 변경하거나 다른 디렉토리로 이동
mkdir	디렉토리 생성
cat	텍스트 파일의 내용을 출력
tar	파일 묶기, 풀기
pwd	현재 작업중인 디렉토리를 확인
chmod	파일에 대한 허가권을 변경
clear	화면지우기
date	현재시간 보기

Compiler 설치

- Cygwin 실행
  - $ cp ae32000-elf-uclibc-tools-AE32000C-v2.6.4.tar.gz /usr/local
  - $ cd /usr/local
  - $tar xfz ae32000-elf-uclibc-tools-AE32000C-v2.6.4.tar.gz



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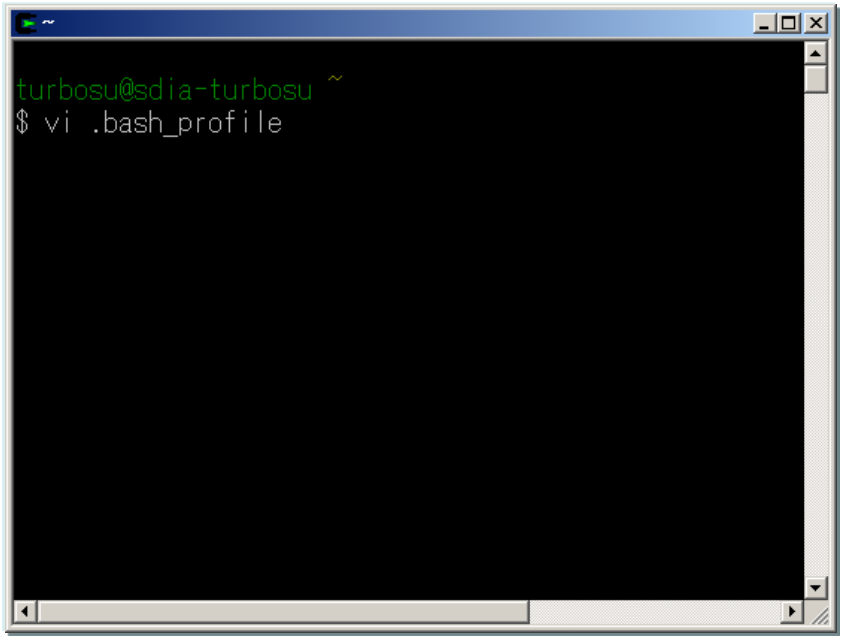
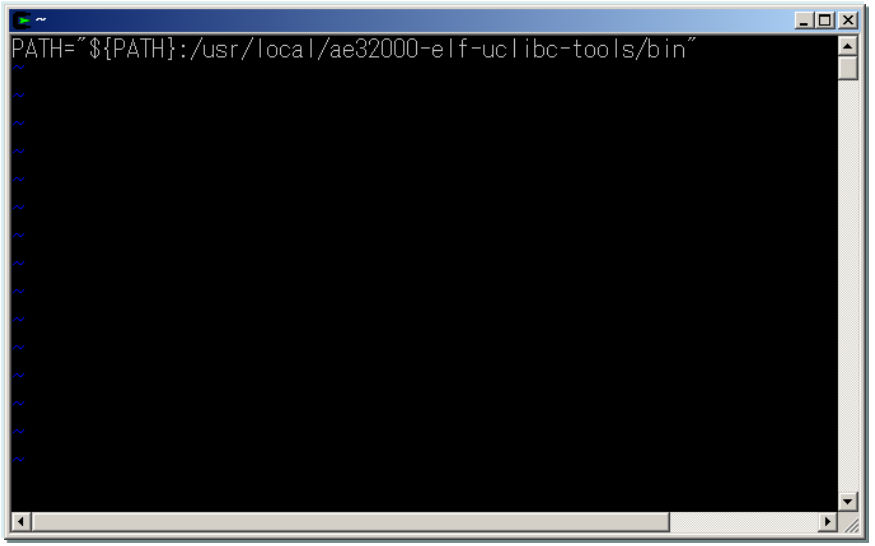
Compiler 설치

- Shell 파일 만들기
  - $ vi .bash_profile
- vi 편집기에 다음의 PATH 추가 후 저장

  PATH="${PATH}:/usr/local/ae32000-elf-uclibc-tools/bin"





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Compiler 설치

- Shell 적용 및 설치 확인
  - $ source .bash_profile
  - $ ae32000-elf-uclibc-gcc -v

```
turbosu@sdia-turbosu ~
$ source .bash_profile

turbosu@sdia-turbosu ~
$ ae32000-elf-uclibc-gcc -v
Reading specs from /usr/local/ae32000-elf-uclibc-tools/lib/gcc/ae3
c/3.4.5/specs
Configured with: /d/AE32000-uClinux/AE32000-uClibc/uClinux_Compile
6.4/toolchain_build_ae32000/gcc-3.4.5-ae32000c-uclibc-v080829/conf
=/usr/local/ae32000-elf-uclibc-tools --build=i686-pc-cygwin32 --ho
win32 --target=ae32000-elf-uclibc --enable-languages=c,c++ --with-
r=/usr/local/ae32000-elf-uclibc-tools/ae32000-elf-uclibc/include/c
hared --disable-__cxa_atexit --enable-target-optspace --with-gnu-l
c --disable-nls --enable-sjlj-exceptions
Thread model: single
gcc version 3.4.5 (AE32000 Compiler v2.6.4 | binutils-2.14 | gdb_i
(LDI Code motion / Seperated GCCLIB / mulsi3 / Mem index
$

turbosu@sdia-turbosu ~
```

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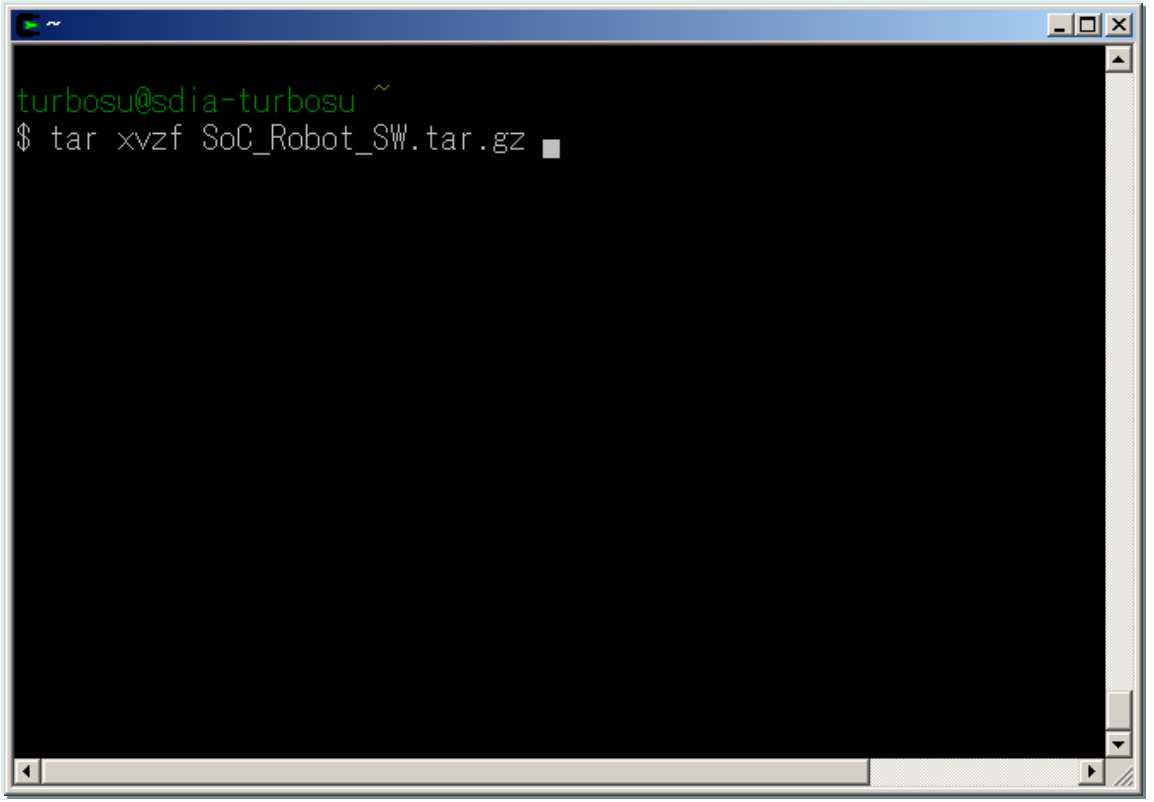
SoC Robot SW 복사

- 대회 홈페이지 소스자료 게시판: SoC_Robot_SW.tar.gz Download
- C:₩cygwin/home/<User_ID>에 파일 복사 후 압축풀기
  - $ tar xvzf SoC_Robot_eagle.tar.gz



Boot loader 컴파일

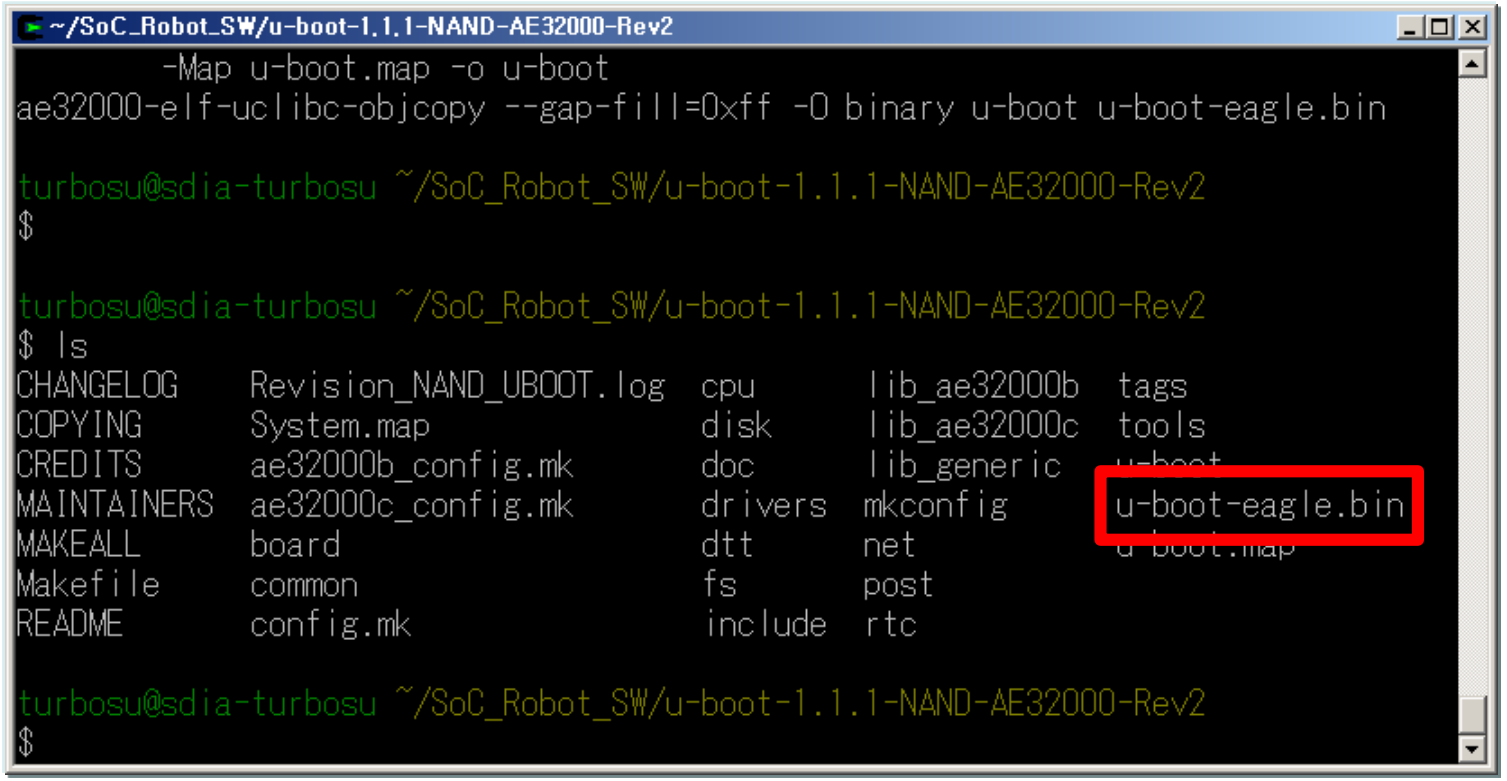
- Bootloader 폴더로 이동
  - $ cd SoC_Robot_SW/bootloader

~/SoC_Robot_SW/bootloader

```
$ cd SoC_Robot_SW

turbosu@turbosu-PC ~/SoC_Robot_SW
$ ls
Eagle_Downloader  bootloader  kernel     nand_boot  user_app
USB_Driver        dev_module  logo_make  ramdisk

turbosu@turbosu-PC ~/SoC_Robot_SW
$ cd bootloader/

turbosu@turbosu-PC ~/SoC_Robot_SW/bootloader
$ ls
CHANGELOG                   SI-Eagle_Robot      drivers        rtc
COPYING                     System.map          dtt            tags
CREDITS                     ae32000b_config.mk  fs             tools
EConMan_jtagspeed-800K.exe  ae32000c_config.mk  include        u-boot
FTCJTAG.dll                 board               lib_ae32000b   u-boot-eagle.bin
MAINTAINERS                 common              lib_ae32000c   u-boot.map
MAKEALL                     config.mk           lib_generic    u-boot_down.bat
Makefile                    cpu                 mkconfig
README                      disk                net
Revision_NAND_UBOOT.log     doc                 post

turbosu@turbosu-PC ~/SoC_Robot_SW/bootloader
$
```

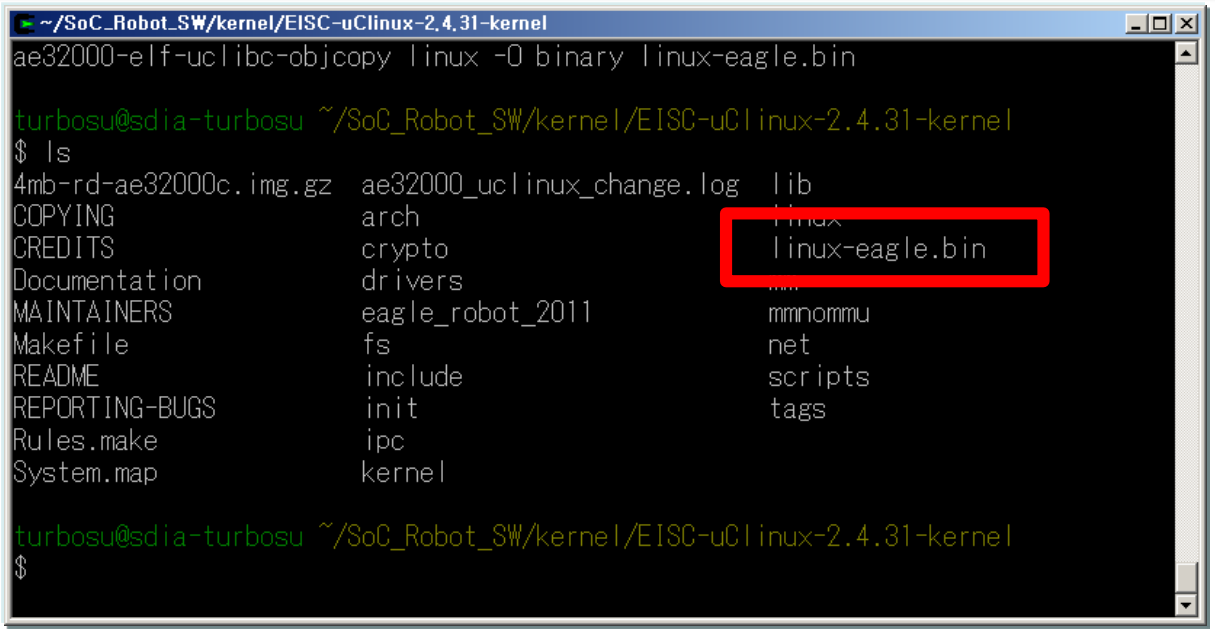
Boot loader 컴파일

- Bootloader 컴파일
  - $ make mrproper //Linux의 make clean 과 동일 기능
  - $ make eagle_config //eagle MCU에 맞게 구성
  - $ make // 컴파일 (Build)



Kernel 컴파일

- Kernel 컴파일
  - $ cd
  - $ cd SoC_Robot_SW/kernel/EISC-uClinux-2.4.31-kernel
  - $ cp eagle-robot_config .config
  - $ make oldconfig
  - $ make dep
  - $ make



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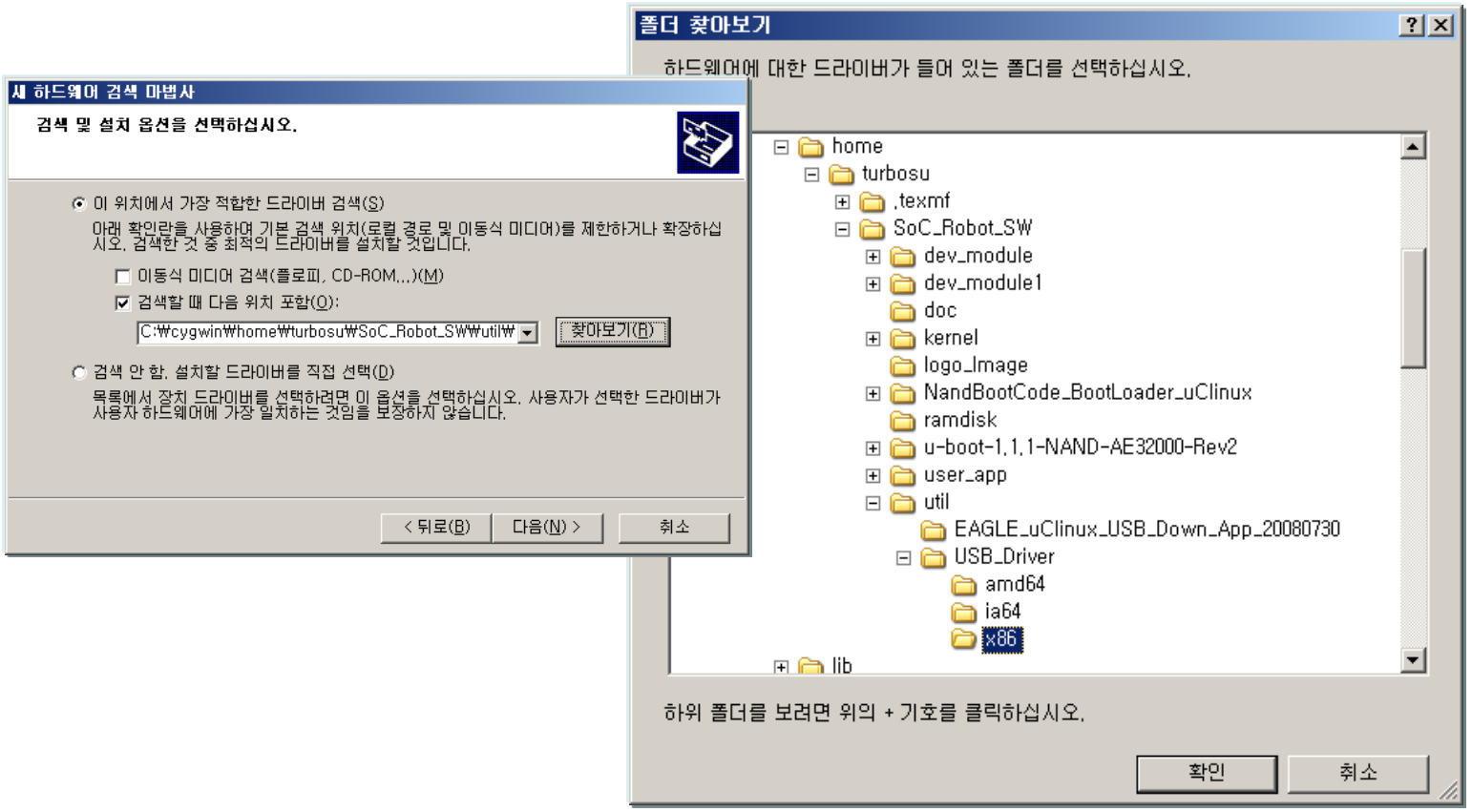
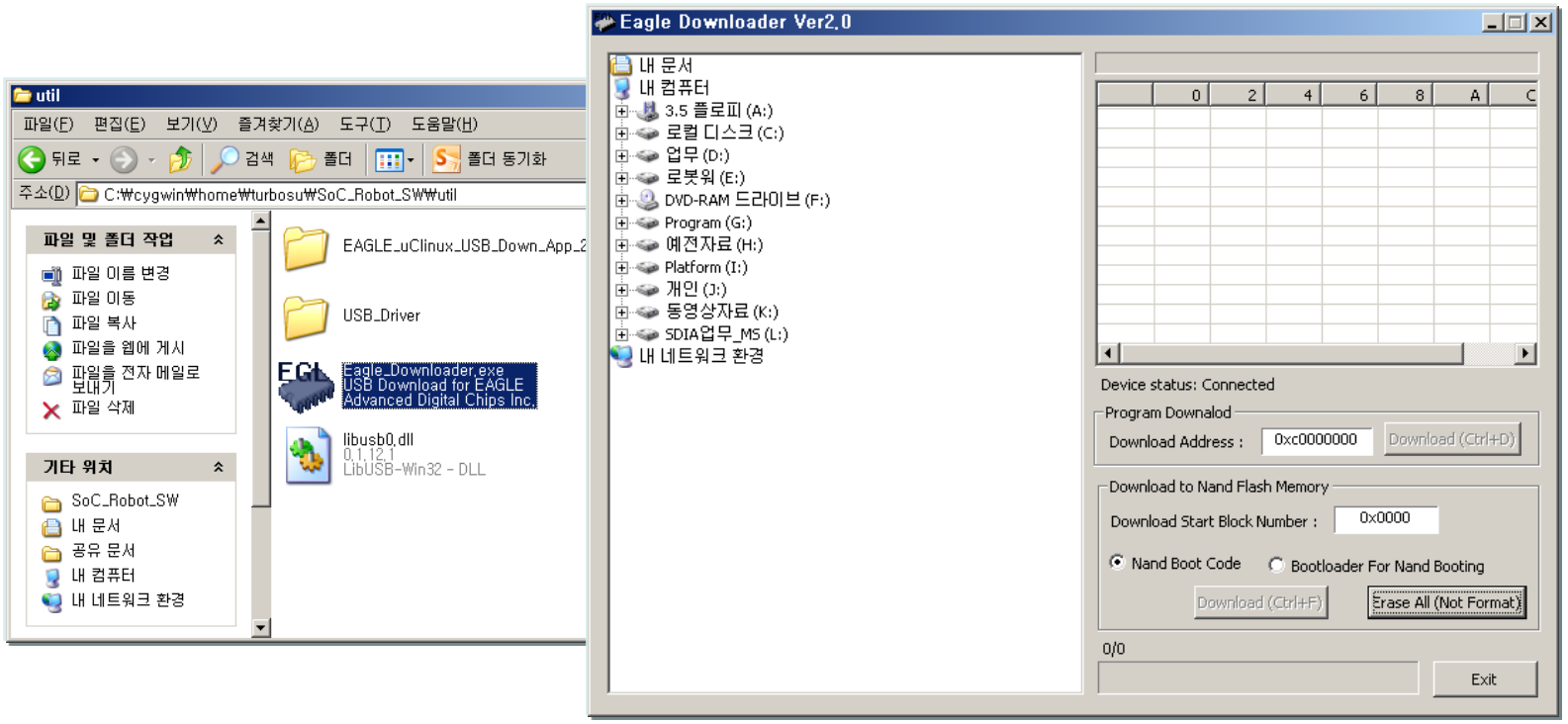
usb driver 설치

- SoC 두뇌보드 mini USB Cable 연결 => 보드 전원 ON
- 새하드웨어 검색마법사 (목록 또는 특정 위치에서 설치)
- SoC_Robot_SW₩util₩USB_Driver₩x86 폴더 선택 후 확인



Eagle Downloader 2.0

- SoC_Robot_SW₩util 폴더에 Eagle_Downloader.exe 실행



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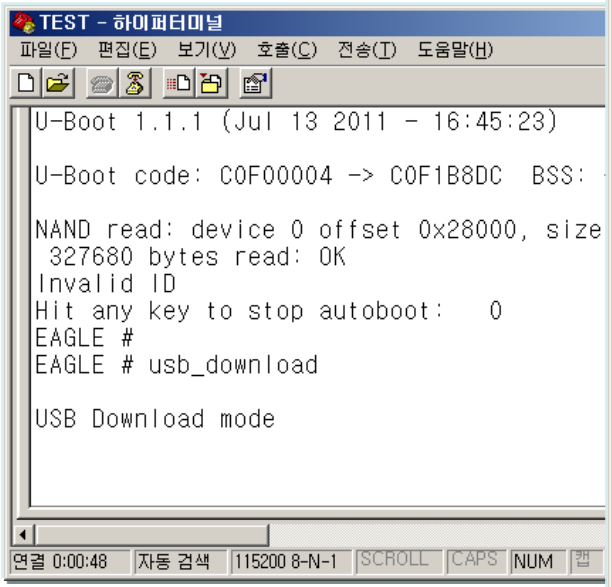
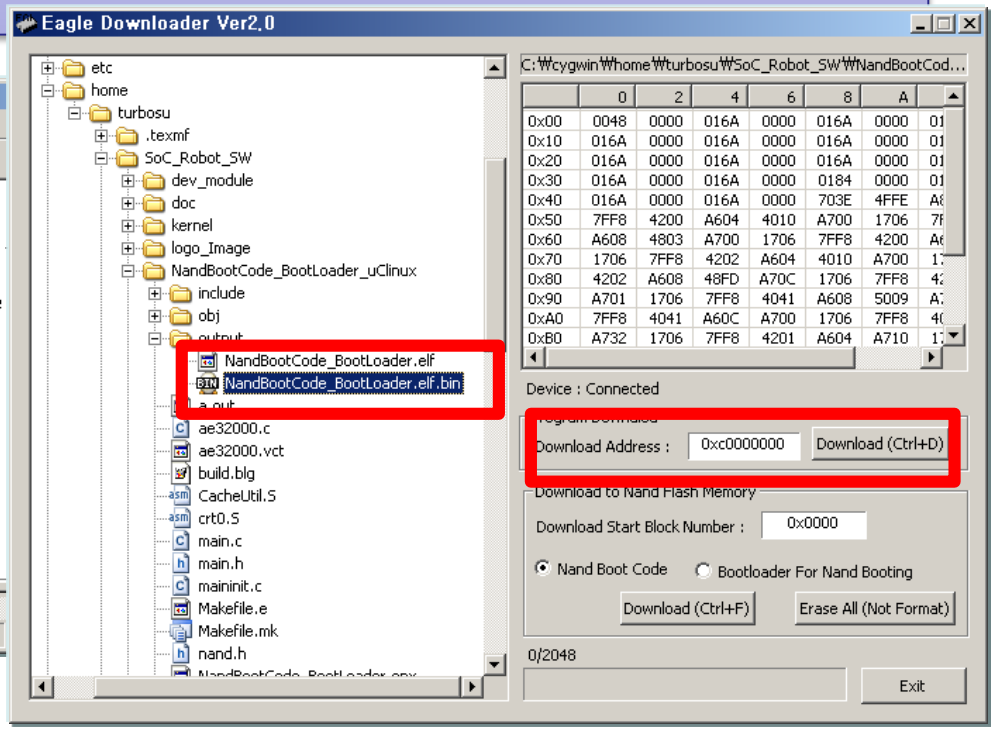
nand Boot Code download

- 두뇌보드 전원 ON
- 하이퍼터미널 => 엔터
  # usb_download
- Eagle Downloader Ver2.0
- NandBootCode_BootLoader.elf.bin 선택
- Program Download [Download Address 0xc0000000] Download

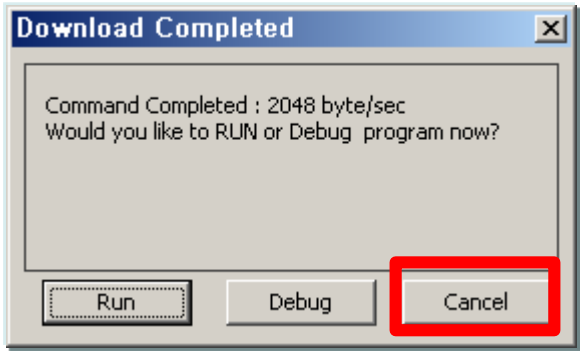




nand Boot Code download

- Download Completed => Cancel
- 하이퍼터미널

  #nand write.jffs2 0xc0000000 0x0 0x800



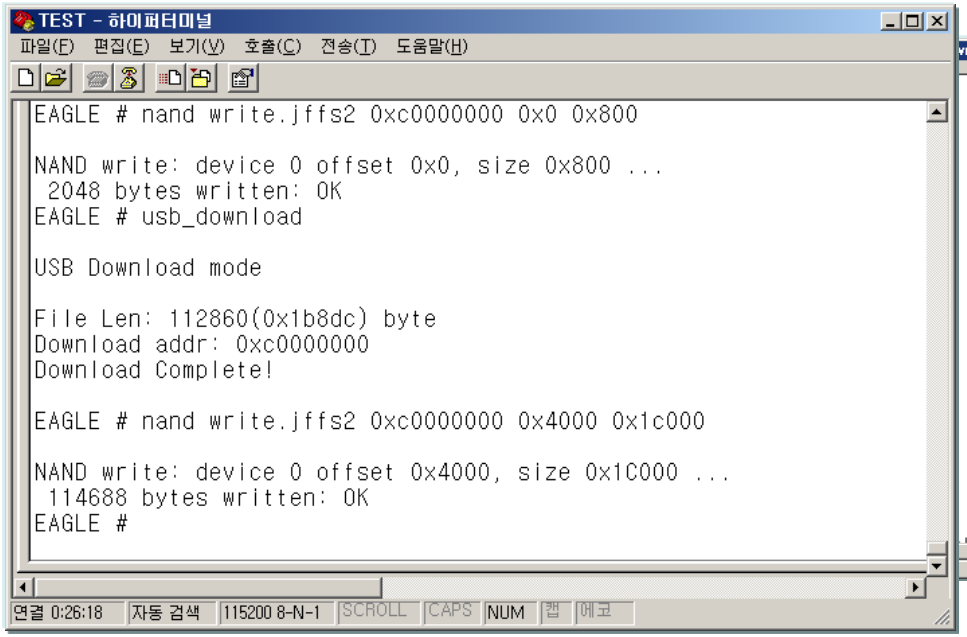
Boot Loader download

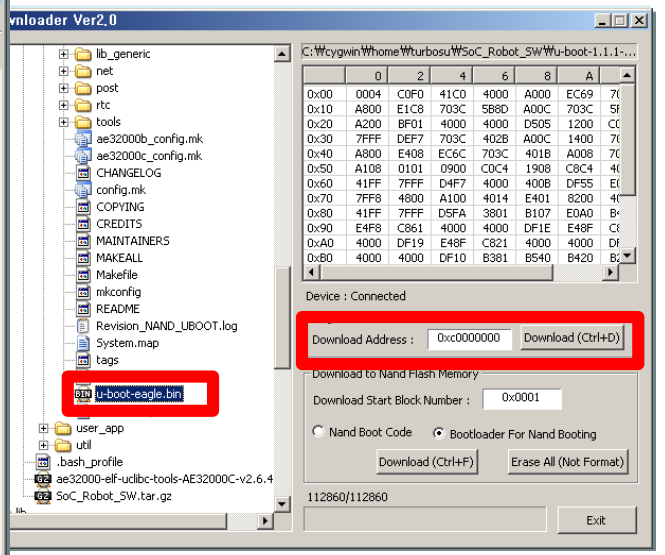
#usb_download

- Eagle Downloader Ver2.0
- u-boot-eagle.bin 선택
- Program Download [Download Address 0xc0000000] Download

#nand write.jffs2 0xc0000000 0x4000 0x1c000

- 두뇌보드 전원 OFF => ON





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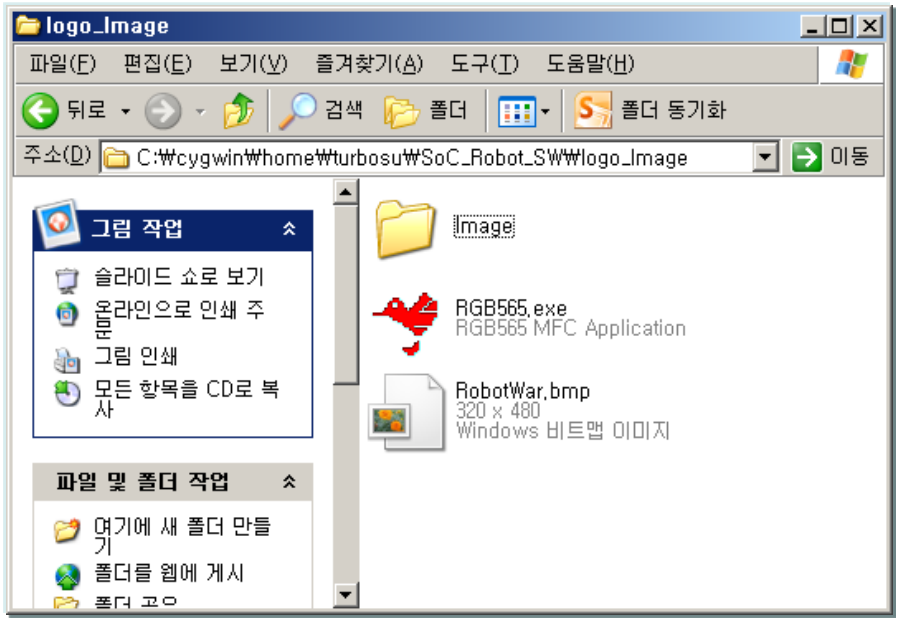
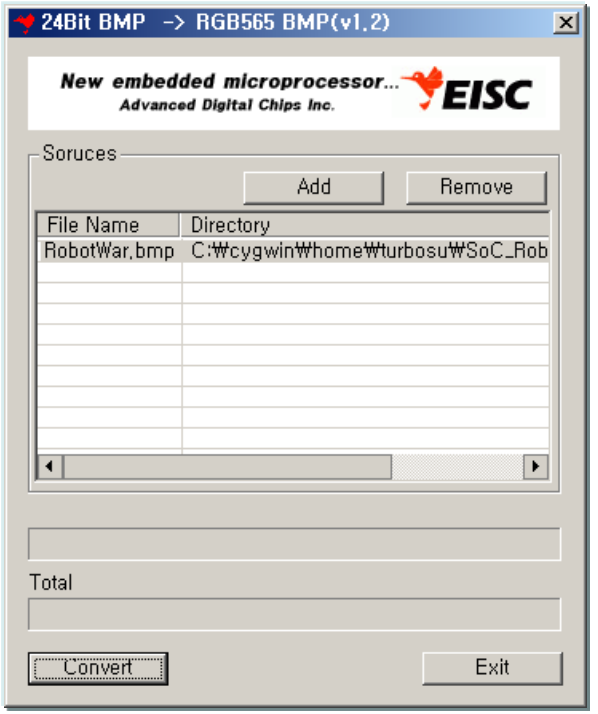
LOGO Image 포맷 변환

- SoC_Robot_SW₩logo_Image 폴더 =>
- RGB565.exe 실행
- Convert





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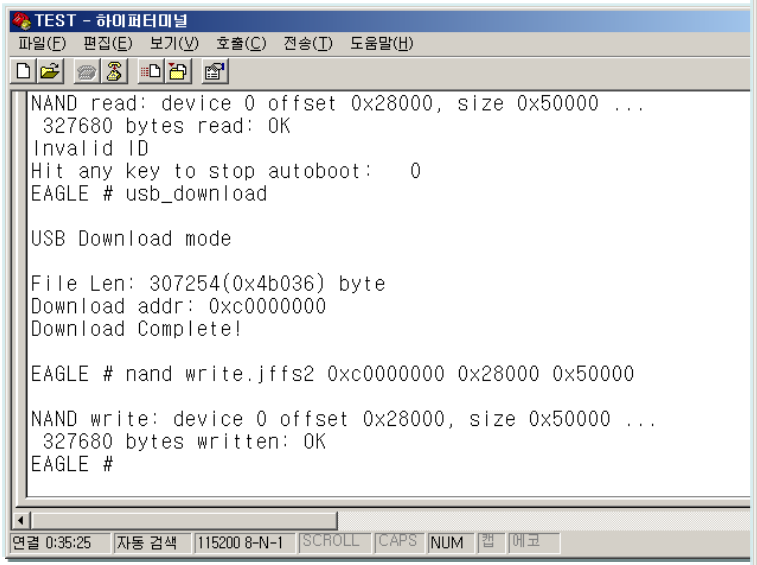
LOGO Image Download

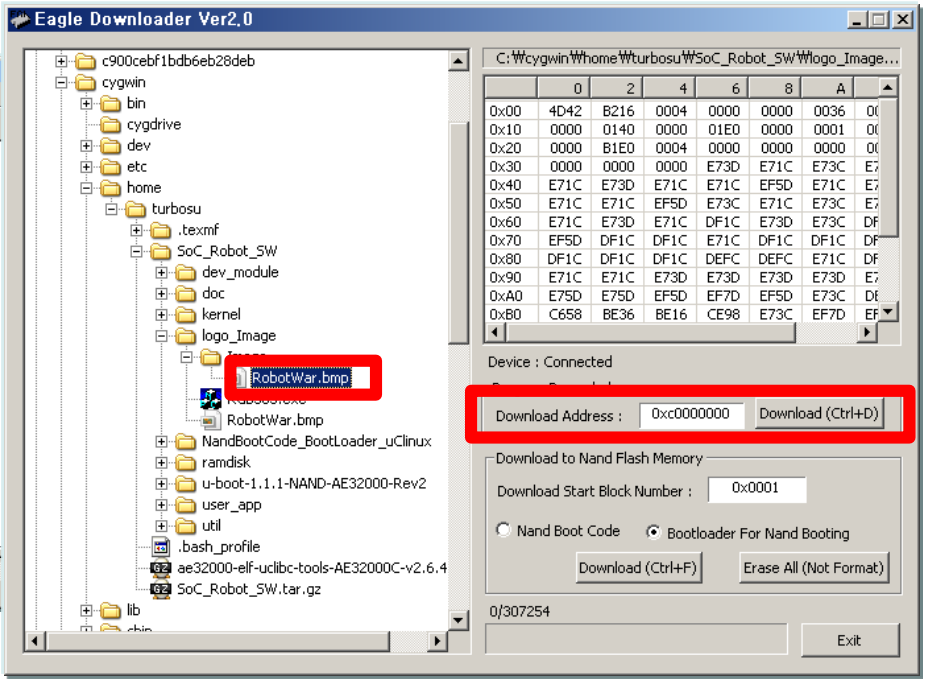
#usb_download

- Eagle Downloader Ver2.0
- RobotWar.bmp 선택
- Program Download [Download Address 0xc0000000] Download

#nand write.jffs2 0xc0000000 0x28000 0x50000

- 두뇌보드 전원 OFF => ON



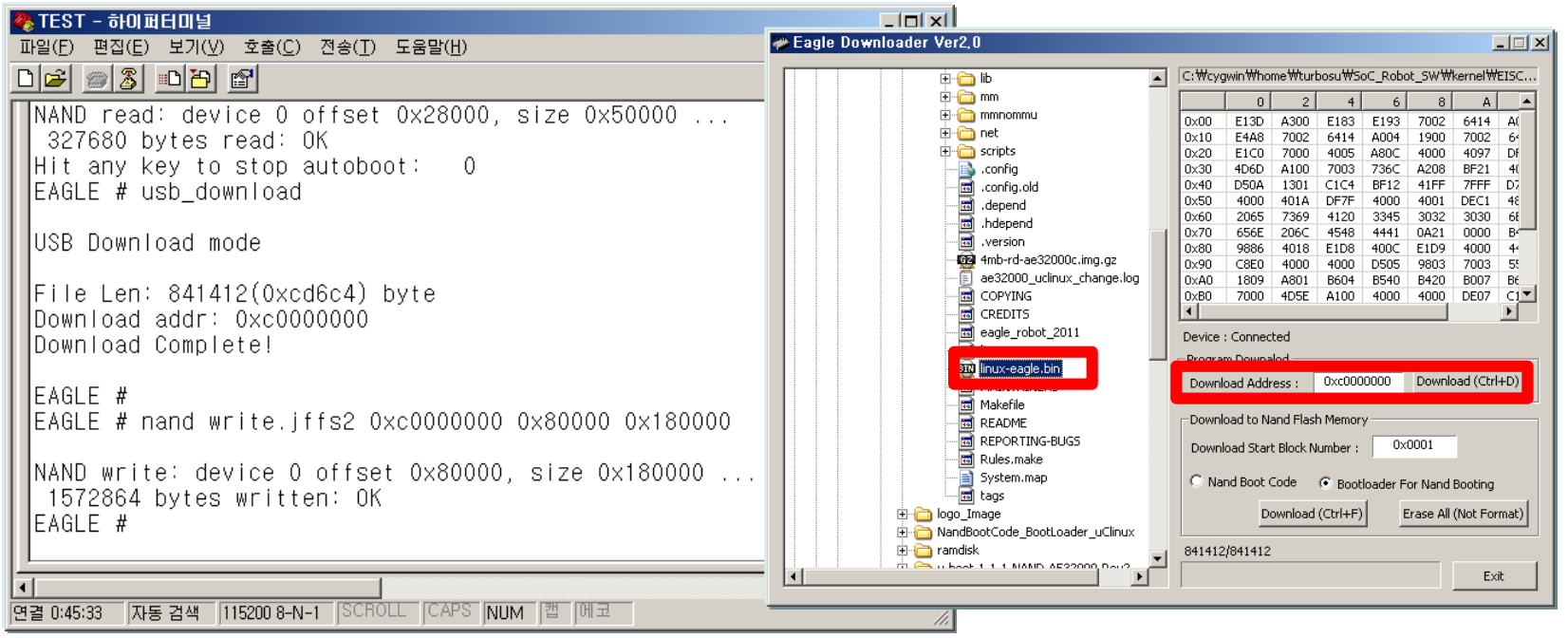


Kernel download

usb_download

- Eagle Downloader Ver2.0
- linux-eagle.bin 선택
- Program Download [Download Address 0xc0000000] Download

#nand write.jffs2 0xc0000000 0x80000 0x180000

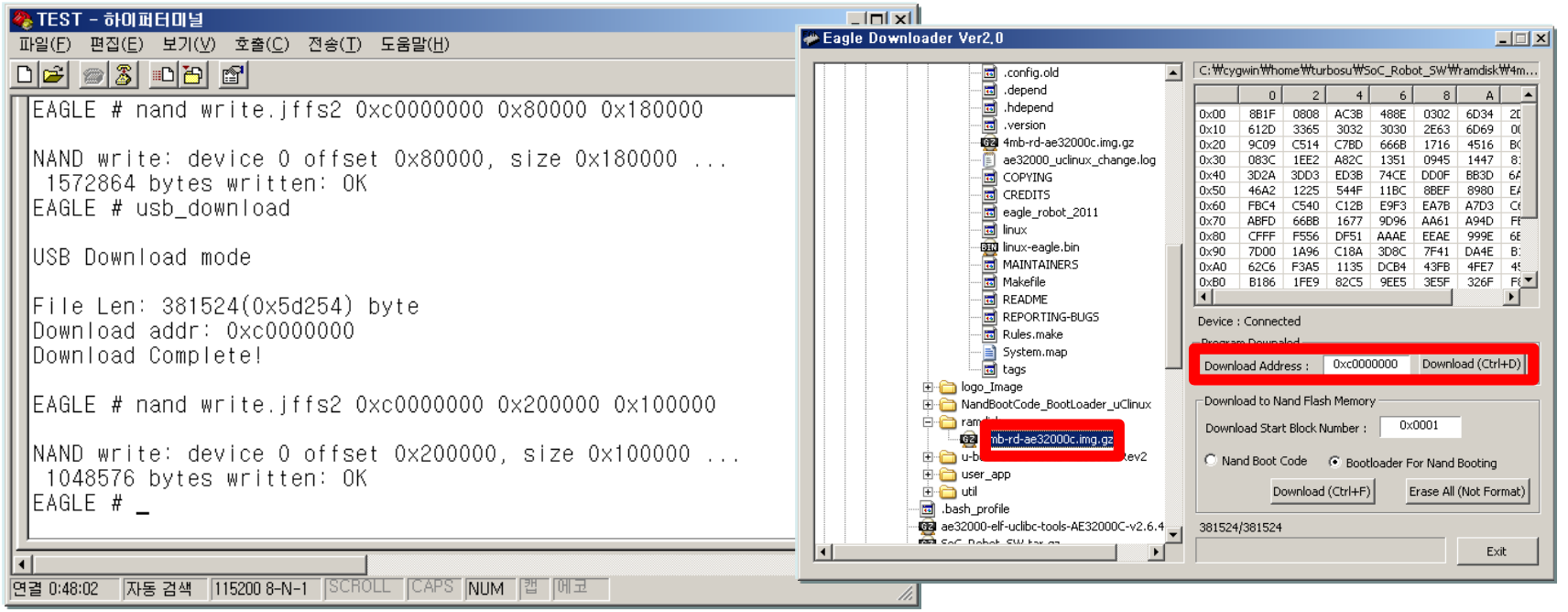


Ramdisk download

usb_download

- Eagle Downloader Ver2.0
- 4mb-rd-ae323000c.img.gz 선택
- Program Download [Download Address 0xc0000000] Download

#nand write.jffs2 0xc0000000 0x200000 0x100000



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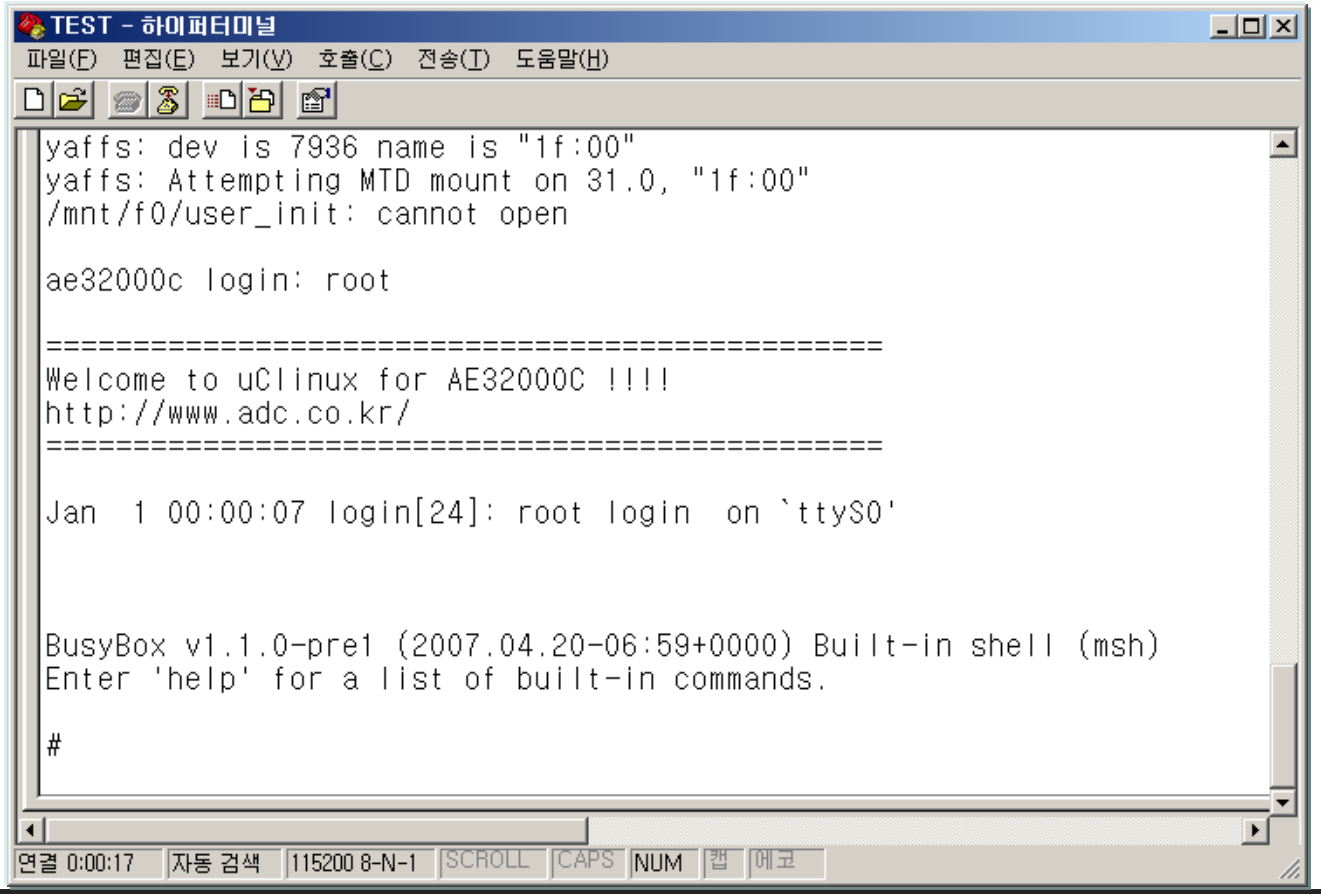
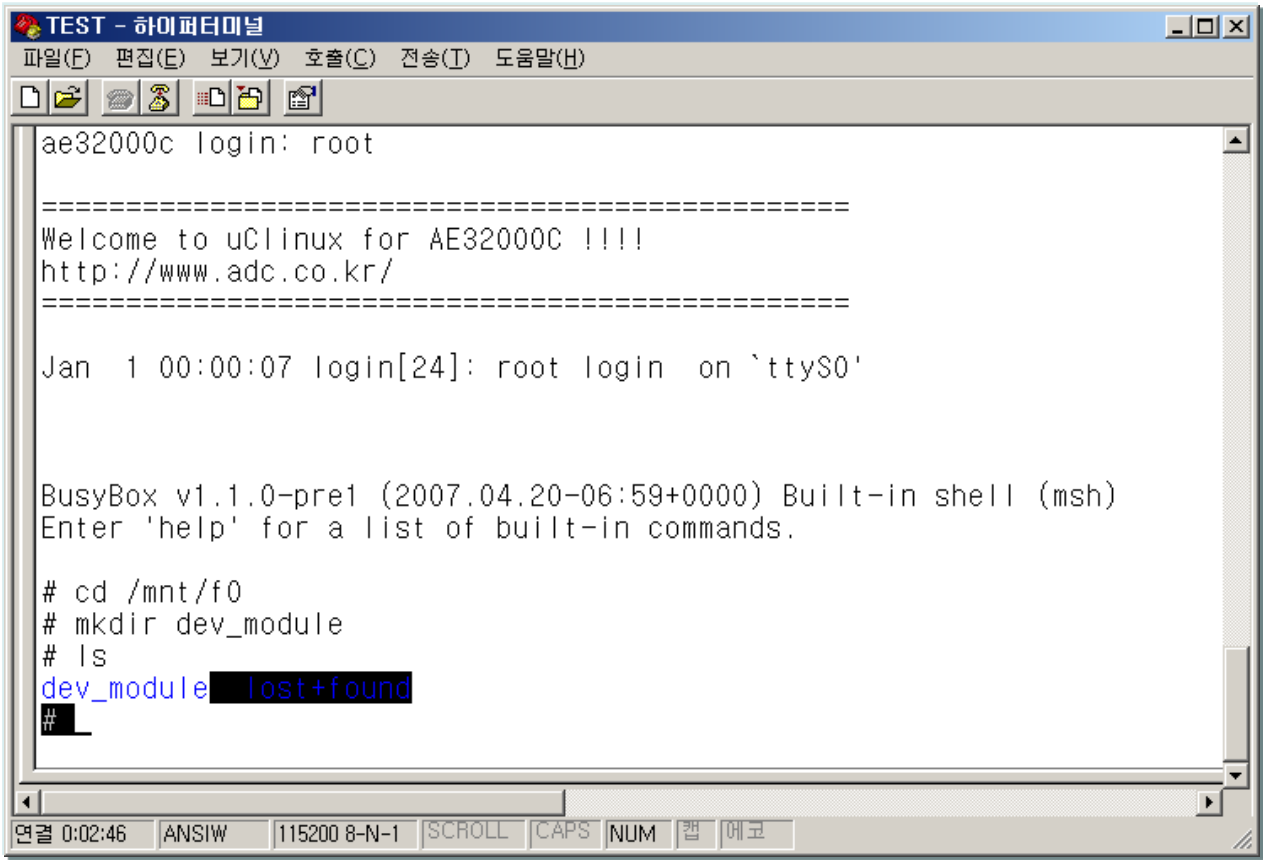
OS Booting

- 두뇌보드 전원 OFF => ON
- Login
  ae32000c login: root



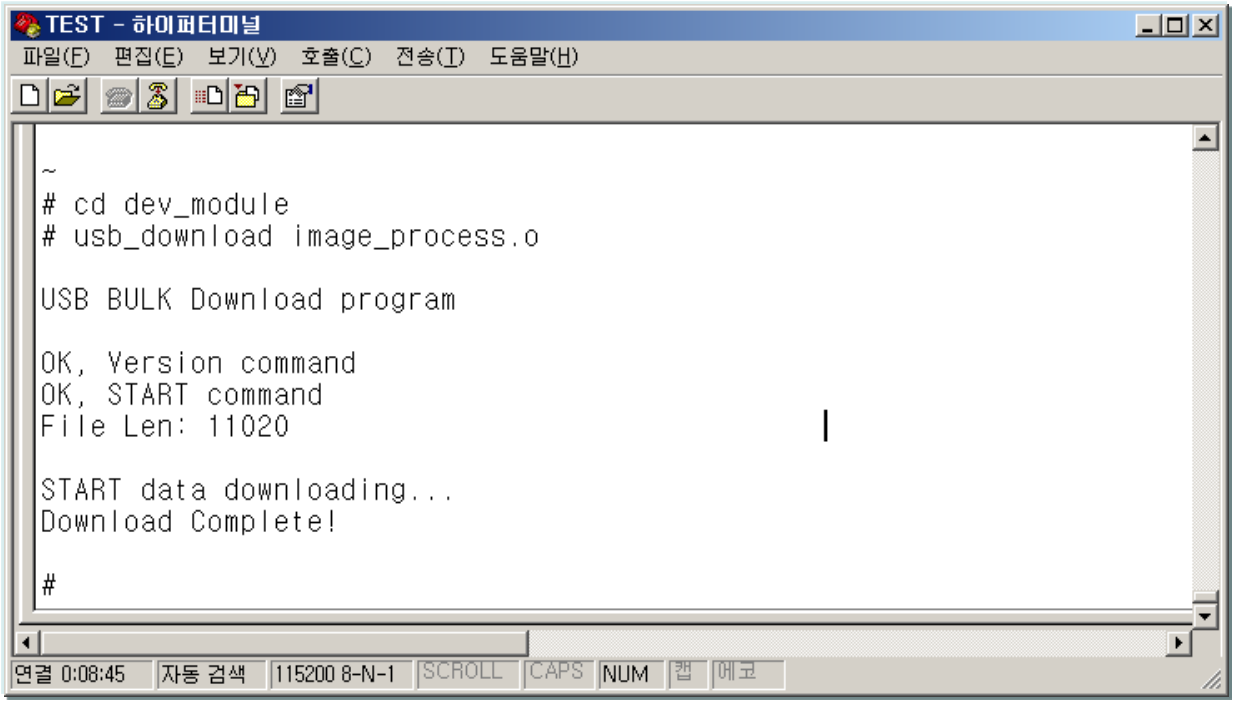
Driver 설치 및 세팅

```
#cd /mnt/f0
#mkdir dev_module  // dev_module 디렉토리 생성 명령
#ls //현재 위치에서의 폴더 및 파일 List 보기
```



Driver 설치 및 세팅

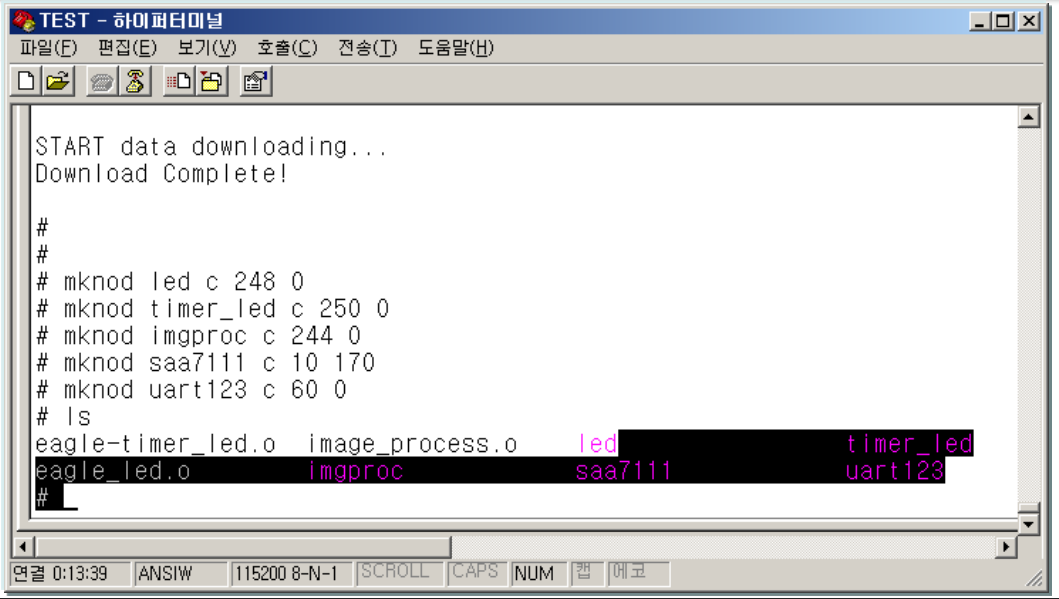
- Module File Download
  #cd dev_module
  #usb_download image_process.o
- Eagle Downloader에서
- SoC_Robot_SW₩dev_module₩Image_Process_Module 폴더
- image_process.o 파일 선택 => Download



Driver 설치 및 세팅

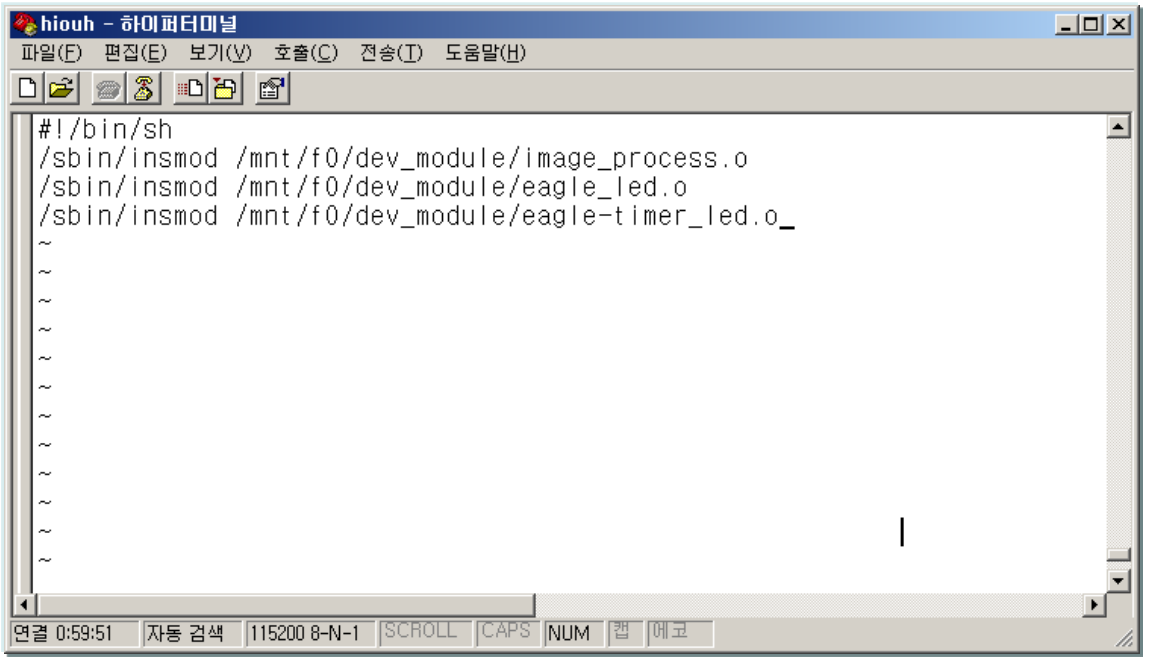
- Module File Download
- 동일한 방식으로 eagle-timer_led.o, eagle_led.o Download
- Module 추가

```
#mknod led c 248 0
#mknod timer_led c 250 0
#mknod imgproc c 244 0
#mknod saa7111 c 10 170
#mknod uart123 c 60 0
```



Driver 설치 및 세팅

- 상위 디렉토리 이동
  #cd ..
- user_init 파일 생성 및 생성 (user_init 파일: 부팅되면서 바로 실행)
  #vi user_init
- 아래 그림과 같이 입력
- 저장방법: Esc 선택후 :wq! 엔터



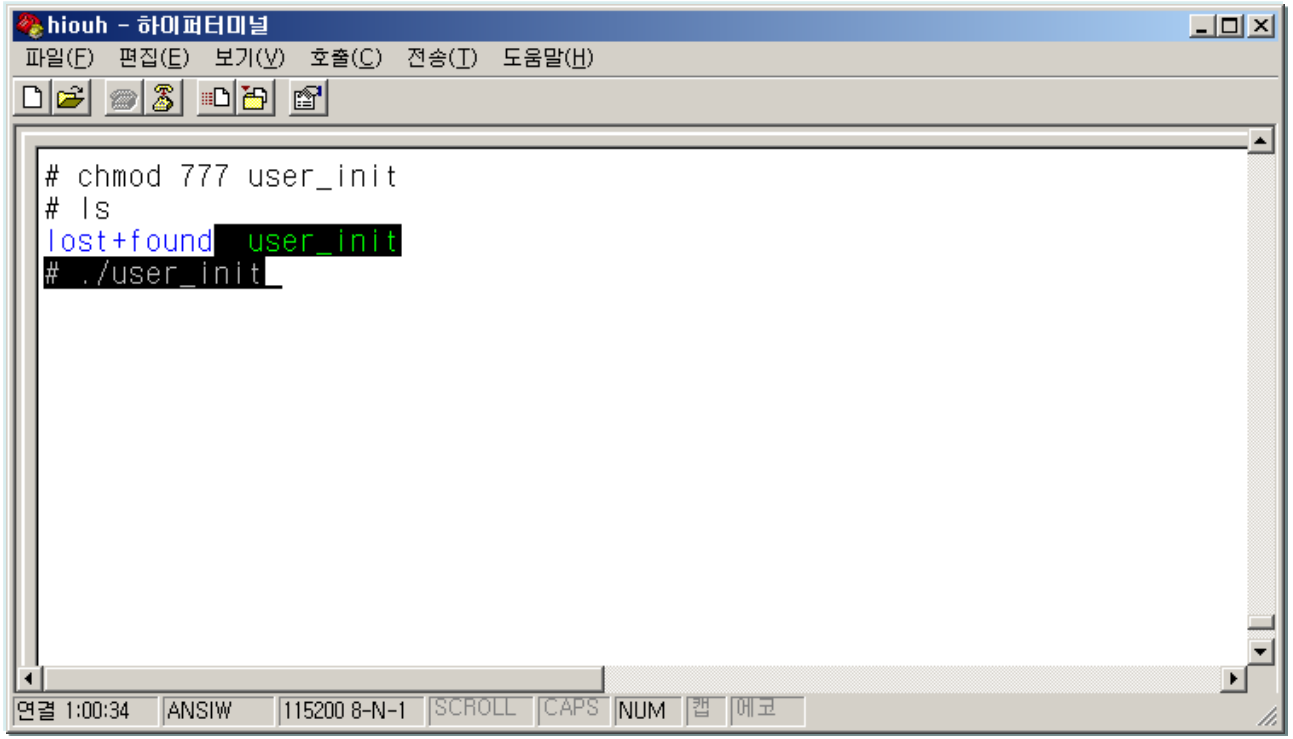
Driver 설치 및 세팅

- user_init 파일 권한 변경

  #chmod 777 user_init

  #ls
- user_init 파일 실행

  #./user_init



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Application SW-led test

- cygwin에서 SoC_Robot_SW₩user_app₩led_test 폴더로 이동

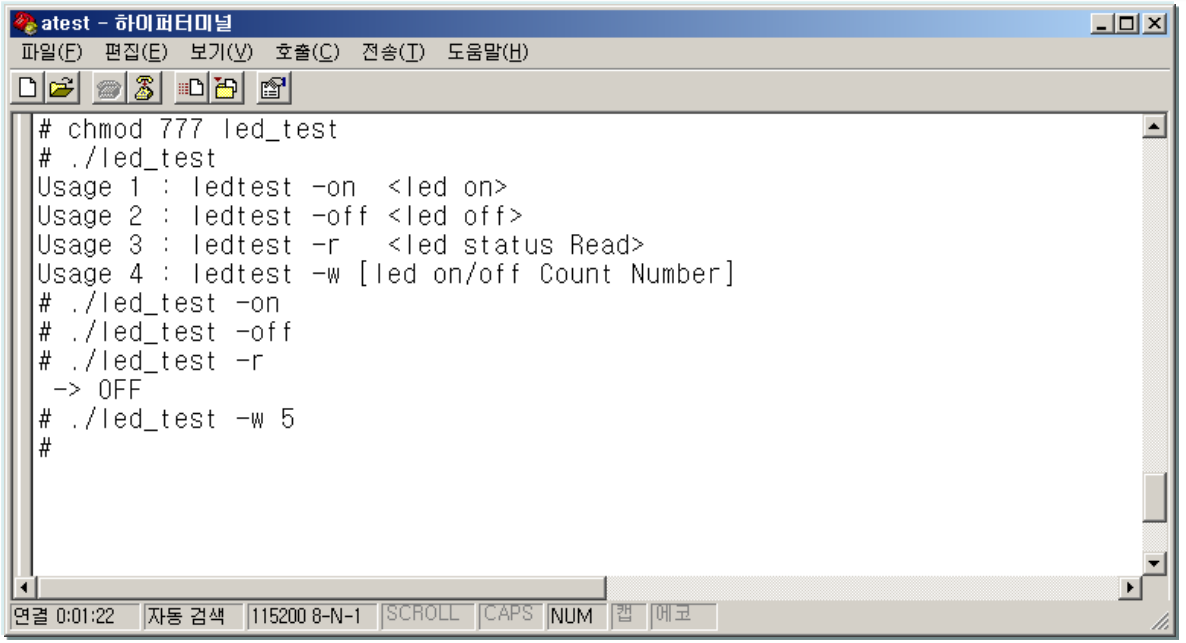
  $make clean; make
- 하이퍼터미널

  #cd /mnt/f0

  #usb_download led_test

  #chmod 777 led_test

  #./led_test



Application SW-Image Load

- cygwin에서 SoC_Robot_SW₩user_app₩ImageLoad 폴더로 이동

  $make clean; make
- 하이퍼터미널

  #cd /mnt/f0

  #usb_download ImageLoad_Test

  #chmod 777 ImageLoad_Test

  #./ImageLoad_Test