Mango-IMX6Q 감압식 TSC2007 터치 인터럽트 Disable 하기

http://www.mangoboard.com/
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Document History

Revision	Date	Change note
Init	2016-05-12	전종인

1. Mango-IMX6 감압식 TSC2007 터치 인터럽트 Disable하기

TSC2007 datasheet를 보면,

COMMAND BYTE

Table 2. Command Byte Definition (Excluding the Setup Command)[1]

BIT	NAME	DESCRIPTION
D7-D4	C3-C0	All Converter Function Select bits as detailed in Table 3, except for the setup command ('1011').
D3-D2	PD1-PD0	00: Power down between cycles. PENIRQ enabled. 01: A/D converter on. PENIRQ disabled. 10: A/D converter off. PENIRQ enabled. 11: A/D converter on. PENIRQ disabled.
D1	M	0: 12-bit (Lower speed referred to as the 2MHz clock). 1: 8-bit (Higher speed referred to as the 4MHz clock).
D0	X	Don't care.

(1) The command byte definition for the setup command is shown in Table 4.

Bits D7-D4: C3-C0—Converter function select bits. These bits select the input to be converted and the converter function to be executed, activate the drivers, and configure the PENIRQ pull-up resistor (R_{IRQ}). Table 3 lists the possible converter functions.

Bits D3-D2: PD1-PD0—Power-down bits. These two bits select the power-down mode that the TSC2007 will be in after the current command completes, as shown in Table 2.

It is recommended to set PD0 = 0 in each command byte to get the lowest power consumption possible. If multiple X-, Y-, and Z-position measurements will be done one right after another (such as when averaging), PD0 =1 will leave the touch screen drivers on at the end of each conversion cycle.

Bit D1: M—Mode bit. If M = 0, the TSC2007 is in 12-bit mode. If M = 1, 8-bit mode is selected.

Bit D0: X—Don't care.

PD1-PD0 제어를 합니다.

```
static int tsc2007_open(struct input_dev *input_dev)
{
        struct tsc2007 *ts = input_get_drvdata(input_dev);
        int err;

        ts->stopped = false;
        mb();

        enable_irq(ts->irq);

        /* Prepare for touch readings - power down ADC and enable PENIRQ */
        err = tsc2007_xfer(ts, PWRDOWN);
        if (err < 0) {
                tsc2007_stop(ts);
                return err;
        }
```

```
        return 0;

}
```

#define PWRDOWN   (TSC2007_12BIT | TSC2007_POWER_OFF_IRQ_EN)

4개의 조건이 있다.

#define TSC2007_POWER_OFF_IRQ_EN   (0x0 << 2)
#define TSC2007_ADC_ON_IRQ_DIS0   (0x1 << 2)
#define TSC2007_ADC_OFF_IRQ_EN   (0x2 << 2)
#define TSC2007_ADC_ON_IRQ_DIS1   (0x3 << 2)

1) Git 설정을 해줍니다.

$ mkdir fsl-release-bsp
$ cd fsl-release-bsp
$ git config --global user.name "이름"
$ git config --global user.email "이메일"

$ repo init -u git://git.freescale.com/imx/fsl-arm-yocto-bsp.git -b imx-3.10.17-1.0.0_ga
Get https://gerrit.googlesource.com/git-repo
remote: Counting objects: 117, done
remote: Finding sources: 100% (117/117)
remote: Total 2920 (delta 1538), reused 2920 (delta 1538)
Receiving objects: 100% (2920/2920), 2.47 MiB | 3.48 MiB/s, done.
Resolving deltas: 100% (1538/1538), done.
From https://gerrit.googlesource.com/git-repo
* [new branch]   maint   -> origin/maint
* [new branch]   master   -> origin/master
* [new branch]   stable   -> origin/stable
* [new tag]   v1.0   -> v1.0
* [new tag]   v1.0.1   -> v1.0.1
* [new tag]   v1.0.2   -> v1.0.2
* [new tag]   v1.0.3   -> v1.0.3
* [new tag]   v1.0.4   -> v1.0.4
* [new tag]   v1.0.5   -> v1.0.5
* [new tag]   v1.0.6   -> v1.0.6
* [new tag]   v1.0.7   -> v1.0.7
* [new tag]   v1.0.8   -> v1.0.8

```
 * [new tag]          v1.0.9      -> v1.0.9
 * [new tag]          v1.1        -> v1.1
                ...  생   략 ....
  * [new tag]          v1.8.2      -> v1.8.2
 * [new tag]          v1.9.0      -> v1.9.0
 * [new tag]          v1.9.1      -> v1.9.1
 * [new tag]          v1.9.2      -> v1.9.2
 * [new tag]          v1.9.3      -> v1.9.3
 * [new tag]          v1.9.4      -> v1.9.4
 * [new tag]          v1.9.5      -> v1.9.5
 * [new tag]          v1.9.6      -> v1.9.6
Get git://git.freescale.com/imx/fsl-arm-yocto-bsp.git
remote: Counting objects: 104, done.
remote: Compressing objects: 100% (103/103), done.
remote: Total 104 (delta 33), reused 0 (delta 0)
Receiving objects: 100% (104/104), 14.83 KiB, done.
Resolving deltas: 100% (33/33), done.
From git://git.freescale.com/imx/fsl-arm-yocto-bsp
 * [new branch]        imx-3.10.17-1.0.0_ga -> origin/imx-3.10.17-1.0.0_ga
 * [new branch]        imx-3.10.17-1.0.1_ga -> origin/imx-3.10.17-1.0.1_ga
 * [new branch]        imx-3.10.31-1.1.0_alpha -> origin/imx-3.10.31-1.1.0_alpha
 * [new branch]        imx-3.10.31-1.1.0_beta -> origin/imx-3.10.31-1.1.0_beta


Your identity is: treego <treego@crz-tech.com>
If you want to change this, please re-run 'repo init' with --config-name


Testing colorized output (for 'repo diff', 'repo status'):
  black    red     green    yellow   blue     magenta   cyan     white
  bold     dim     ul       reverse
Enable color display in this user account (y/N)?
```

2) 해당 소스를 다운 받습니다. 시간이 오래 걸립니다.

```
$ repo sync
Fetching project meta-browser
Fetching project meta-openembedded
remote: Counting objects: 1324, done.
remote: Counting objects: 41552, done.
```

```
remote: Compressing objects: 100% (15835/15835), done.
remote: Total 1324 (delta 0), reused 0 (delta 0)
Receiving objects: 100% (1324/1324), 358.69 KiB | 142 KiB/s, done.
Resolving deltas: 100% (790/790), done.
From git://github.com/OSSystems/meta-browseriB | 159 KiB/s
                    ...   생   략 ....
 * [new tag]          yocto-1.5  -> yocto-1.5
 * [new tag]          yocto-1.5.1 -> yocto-1.5.1
 * [new tag]          yocto-1.5.1.final -> yocto-1.5.1.final
 * [new tag]          yocto-1.5.2 -> yocto-1.5.2
 * [new tag]          yocto-1.5.3 -> yocto-1.5.3
 * [new tag]          yocto-1.5.final -> yocto-1.5.final
 * [new tag]          yocto-1.5_M5.rc2 -> yocto-1.5_M5.rc2
 * [new tag]          yocto-1.6  -> yocto-1.6
 * [new tag]          yocto-1.6.1 -> yocto-1.6.1
 * [new tag]          yocto_1.5_M5.rc8 -> yocto_1.5_M5.rc8
Fetching projects: 100% (8/8), done.
Checking out files: 100% (4486/4486), done. files:   10% (466/4486)
Syncing work tree: 100% (8/8), done.
```

3) 완료 되면, 아래와 같이 소스가 다운 받아 집니다.

```
$ ls
README    downloads    fsl-setup-release.sh    imx6q-yocto    setup-environment
sources
```

4) "fsl-setup-release.sh" 스크립트 파일을 이용해서, 컴파일 설정을 해줍니다.

```
$ MACHINE=imx6qsabresd source fsl-setup-release.sh -b imx6q-yocto -e fb
Build directory is   imx6q-yocto

  Using FB backend with FB DIST_FEATURES to override poky X11 DIST FEATURES
Configuring for imx6qsabresd


Some SoC depends on libraries and packages that are covered by
Freescale EULA. To have the right to use those binaries in your images
```

you need to read and accept the EULA that will be displayed.

LA_OPT27 v4 June 2013

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Welcome to Freescale Community BSP

The Yocto Project has extensive documentation about OE including a
reference manual which can be found at:
    http://yoctoproject.org/documentation

For more information about OpenEmbedded see their website:
    http://www.openembedded.org/

You can now run 'bitbake <target>'

Common targets are:
    core-image-minimal
    meta-toolchain
    meta-toolchain-sdk
    adt-installer
    meta-ide-support

Your build environemnt has been configured with:

    MACHINE=imx6qsabresd
    SDKMACHINE=i686
    DISTRO=poky
    EULA=1
```

5) "bitbake" 명령으로 컴파일을 진행하게 되는데, 아래와 같이 에러가 발생 됩니다.

```
$ bitbake fsl-image-fb
```

```
ERROR: Fetcher failure for URL: 'http://cgit.freedesktop.org/~whot/evtest/snapshot/evtest-
1.25.tar.bz2;name=archive'. Checksum mismatch!
File: '/home/treego/PROJECT/temp2/wisol/freescale-imx6/work/Yocto/fsl-release-
bsp/downloads/evtest-1.25.tar.bz2' has md5 checksum 0ef3fe5e20fa2dee8994827d48482902 when
770d6af03affe976bdbe3ad1a922c973 was expected
File: '/home/treego/PROJECT/temp2/wisol/freescale-imx6/work/Yocto/fsl-release-
bsp/downloads/evtest-1.25.tar.bz2' has sha256 checksum
6e93ef54f0aa7d263f5486ce4a14cac53cf50036bfd20cf045fef2b27ee6664b when
3d34123c68014dae6f7c19144ef79ea2915fa7a2f89ea35ca375a9cf9e191473 was expected
If this change is expected (e.g. you have upgraded to a new version without updating the
checksums) then you can use these lines within the recipe:
SRC_URI[archive.md5sum] = "0ef3fe5e20fa2dee8994827d48482902"
SRC_URI[archive.sha256sum] =
"6e93ef54f0aa7d263f5486ce4a14cac53cf50036bfd20cf045fef2b27ee6664b"
Otherwise you should retry the download and/or check with upstream to determine if the file has
become corrupted or otherwise unexpectedly modified.

ERROR: Function failed: Fetcher failure for URL:
'http://cgit.freedesktop.org/~whot/evtest/snapshot/evtest-1.25.tar.bz2;name=archive'. Unable to fetch
URL from any source.
ERROR: Logfile of failure stored in: /home/treego/PROJECT/temp2/wisol/freescale-
imx6/work/Yocto/fsl-release-bsp/imx6q-yocto/tmp/work/cortexa9hf-vfp-neon-poky-linux-
gnueabi/evtest/1.25-r0/temp/log.do_fetch.13688
ERROR: Task 1785 (/home/treego/PROJECT/temp2/wisol/freescale-imx6/work/Yocto/fsl-release-
bsp/sources/meta-openembedded/meta-oe/recipes-support/evtest/evtest_1.25.bb, do_fetch) failed
with exit code '1'
NOTE: Tasks Summary: Attempted 2363 tasks of which 642 didn't need to be rerun and 1 failed.
Waiting for 0 running tasks to finish:
```

6) evtest 패키지가 해당 URL에서 받아오질 못해서 생기는 에러입니다. 아래 명령
으로 다른 위치에서 다운받아서 처리합니다.

```
$ wget http://dev.gateworks.com/sources/evtest-1.25.tar.bz2
$ cp evtest-1.25.tar.bz2 /home/treego/PROJECT/temp2/wisol/freescale-imx6/work/Yocto/fsl-release-
bsp/downloads/evtest-1.25.tar.bz2
$ touch /home/treego/PROJECT/temp2/wisol/freescale-imx6/work/Yocto/fsl-release-
bsp/downloads/evtest-1.25.tar.bz2.done
```

7) 다시 컴파일을 진행 합니다.

```
$ bitbake fsl-image-fb

Loading cache: 100%
|#######################################################################
##| ETA:   00:00:00
Loaded 2005 entries from dependency cache.
Parsing recipes: 100%
|#######################################################################|
Time: 00:00:00
Parsing of 1605 .bb files complete (1604 cached, 1 parsed). 2004 targets, 160 skipped, 0 masked, 0
errors.
NOTE: Resolving any missing task queue dependencies
NOTE: multiple providers are available for runtime libgl-mesa-dev (mesa, mesa-gl)
NOTE: consider defining a PREFERRED_PROVIDER entry to match libgl-mesa-dev
NOTE: multiple providers are available for jpeg (jpeg, libjpeg-turbo)
NOTE: consider defining a PREFERRED_PROVIDER entry to match jpeg


Build Configuration:
BB_VERSION         = "1.20.0"
BUILD_SYS          = "x86_64-linux"
NATIVELSBSTRING    = "Ubuntu-12.04"
TARGET_SYS          = "arm-poky-linux-gnueabi"
MACHINE             = "imx6qsabresd"
DISTRO             = "poky"
DISTRO_VERSION      = "1.5.1"
TUNE_FEATURES       = "armv7a vfp neon callconvention-hard cortexa9"
TARGET_FPU          = "vfp-neon"
meta
meta-yocto         = "(nobranch):bee7e3756adf70edaeabe9d43166707aab84f581"
meta-oe             = "(nobranch):eb4563b83be0a57ede4269ab19688af6baa62cd2"
meta-fsl-arm        = "(nobranch):af392c22bf6b563525ede4a81b6755ff1dd2c1c6"
meta-fsl-arm-extra = "(nobranch):07ad83db0fb67c5023bd627a61efb7f474c52622"
meta-fsl-demos      = "(nobranch):5a12677ad000a926d23c444266722a778ea228a7"
meta-fsl-arm
meta-fsl-demos      = "(nobranch):16c911d80ade96702e3c42ce97f1d69069576bdc"
meta-browser        = "(nobranch):fc3969f63bda343c38c40a23f746c560c4735f3e"
```

```
meta-gnome
meta-networking     = "(nobranch):eb4563b83be0a57ede4269ab19688af6baa62cd2"

NOTE: Preparing runqueue
NOTE: Executing SetScene Tasks
NOTE: Executing RunQueue Tasks
WARNING: lttng-modules: no modules were created; this may be due to CONFIG_TRACEPOINTS not
being enabled in your kernel.
WARNING: Failed to fetch URL
http://ftp.de.debian.org/debian/pool/main/m/mklibs/mklibs_0.1.38.tar.gz, attempting MIRRORS if
available
WARNING: nbench-byte: No generic license file exists for: freely in any provider
WARNING: nbench-byte: No generic license file exists for: distributable in any provider
NOTE: Tasks Summary: Attempted 4040 tasks of which 2452 didn't need to be rerun and all
succeeded.

Summary: There were 4 WARNING messages shown.
```

컴파일한 이미지는 **"./imx6q-yocto/tmp/deploy/images/imx6qsabresd/"** 위치에 존재 합니다.

2. 툴 체 인 설 치 방 법

1) 이전에 받은 Yocto 소스 위치에서 " bitbake meta-toolchain" 으로 Toolchain을 다운 받습
니다.

```
$ bitbake meta-toolchain
Loading cache: 100%
|###########################################################################
##| ETA:  00:00:00
Loaded 2005 entries from dependency cache.
NOTE: Resolving any missing task queue dependencies

Build Configuration:
BB_VERSION          = "1.20.0"
BUILD_SYS           = "x86_64-linux"
```

```
NATIVELSBSTRING     = "Ubuntu-12.04"
TARGET_SYS          = "arm-poky-linux-gnueabi"
MACHINE             = "imx6qsabresd"
DISTRO              = "poky"
DISTRO_VERSION      = "1.5.1"
TUNE_FEATURES       = "armv7a vfp neon callconvention-hard cortexa9"
TARGET_FPU          = "vfp-neon"
meta
meta-yocto          = "(nobranch):bee7e3756adf70edaeabe9d43166707aab84f581"
meta-oe             = "(nobranch):eb4563b83be0a57ede4269ab19688af6baa62cd2"
meta-fsl-arm        = "(nobranch):af392c22bf6b563525ede4a81b6755ff1dd2c1c6"
meta-fsl-arm-extra  = "(nobranch):07ad83db0fb67c5023bd627a61efb7f474c52622"
meta-fsl-demos      = "(nobranch):5a12677ad000a926d23c444266722a778ea228a7"
meta-fsl-arm
meta-fsl-demos      = "(nobranch):16c911d80ade96702e3c42ce97f1d69069576bdc"
meta-browser        = "(nobranch):fc3969f63bda343c38c40a23f746c560c4735f3e"
meta-gnome
meta-networking     = "(nobranch):eb4563b83be0a57ede4269ab19688af6baa62cd2"

NOTE: Preparing runqueue
NOTE: Executing SetScene Tasks
NOTE: Executing RunQueue Tasks
WARNING: QA Issue: gcc-cross-canadian-arm: found library in wrong location:
/opt/poky/1.5.1/sysroots/x86_64-pokysdk-linux/usr/libexec/arm-poky-linux-gnueabi/gcc/arm-poky-
linux-gnueabi/4.8.1/liblto_plugin.so.0.0.0
gcc-cross-canadian-arm: found library in wrong location: /opt/poky/1.5.1/sysroots/x86_64-pokysdk-
linux/usr/libexec/arm-poky-linux-gnueabi/gcc/arm-poky-linux-gnueabi/4.8.1/liblto_plugin.so.0
gcc-cross-canadian-arm: found library in wrong location: /opt/poky/1.5.1/sysroots/x86_64-pokysdk-
linux/usr/libexec/arm-poky-linux-gnueabi/gcc/arm-poky-linux-gnueabi/4.8.1/liblto_plugin.so
NOTE: Tasks Summary: Attempted 1827 tasks of which 1059 didn't need to be rerun and all
succeeded.

Summary: There was 1 WARNING message shown.
```

2) 완료가 되면, " tmp/deploy/sdk/" 폴더가 생성이 되고, "tmp/deploy/sdk/" 폴더위치에 하나의 스
크립트 파일이 존재합니다.

```
poky-eglibc-x86_64-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.1.sh
```

3) 스크립트 파일을 실행합니다.

$ ./poky-eglibc-x86_64-meta-toolchain-cortexa9hf-vfp-neon-toolchain-1.5.1.sh
Enter target directory for SDK (default: /opt/poky/1.5.1):
You are about to install the SDK to "/opt/poky/1.5.1". Proceed[Y/n]?
[sudo] password for treego:
Extracting SDK...done
Setting it up...done
SDK has been successfully set up and is ready to be used.

4) 완료가 되면, "/opt/poky/1.5.1/" 에 SDK 및 toolchain이 설치가 됩니다.

" /opt/poky/1.5.1/sysroots/x86_64-pokysdk-linux/usr/bin/arm-poky-linux-gnueabi" 위치에 arm용 툴체인이 설치가 됩니다.

```
treego@treego-C2SBA:/opt/poky/1.5.1/sysroots/x86_64-pokysdk-linux/usr/bin/arm-poky-linux-gnueabi$ ls
arm-poky-linux-gnueabi-addr2line    arm-poky-linux-gnueabi-gcc-ar      arm-poky-linux-gnueabi-nm
arm-poky-linux-gnueabi-ar           arm-poky-linux-gnueabi-gcc-nm      arm-poky-linux-gnueabi-objcopy
arm-poky-linux-gnueabi-as           arm-poky-linux-gnueabi-gcc-ranlib  arm-poky-linux-gnueabi-objdump
arm-poky-linux-gnueabi-c++filt      arm-poky-linux-gnueabi-gcov        arm-poky-linux-gnueabi-ranlib
arm-poky-linux-gnueabi-cpp          arm-poky-linux-gnueabi-gdb         arm-poky-linux-gnueabi-readelf
arm-poky-linux-gnueabi-elfedit      arm-poky-linux-gnueabi-gprof       arm-poky-linux-gnueabi-size
arm-poky-linux-gnueabi-g++          arm-poky-linux-gnueabi-ld          arm-poky-linux-gnueabi-strings
arm-poky-linux-gnueabi-gcc          arm-poky-linux-gnueabi-ld.bfd      arm-poky-linux-gnueabi-strip
```

3. Kernel, uboot 소스 추출 및 컴파일 방법

3.1. U-boot

1) uboot소스 위치는 아래에 있습니다. 소스 파일을 원하는 위치에 복사를 합니다.

Uboot 소스 위치 **"imx6q-yocto/tmp/work/imx6qsabresd-poky-linux-gnueabi/u-boot-imx/2013.04-r0/git "**

2 복사한 u-boot 소스 위치에서, "build_uboot" 스크립트 파일을 생성 합니다.

$ vi build_uboot

```sh
#!/bin/sh

export ARCH=arm
export CROSS_COMPILE=arm-poky-linux-gnueabi-
export PATH=/opt/poky/1.5.1/sysroots/x86_64-pokysdk-linux/usr/bin/arm-poky-linux-gnueabi/:$PATH

KERNEL_IMAGE=uImage

# Default kernel configurations
KERNEL_CONFIG=$2

INSTALL_BINDIR=../image
export LOADADDR=0x10008000
DTB_FILENAME=imx6q-sabresd.dtb

#{
CPU_JOB_NUM=$(grep processor /proc/cpuinfo | awk '{field=$NF};END{print field+2}')
START_TIME=`date +%s`
#sudo apt-get install libncurses5-dev
case "$1" in
clean)
    echo make -j$CPU_JOB_NUM mrproper
    cp .config arch/arm/configs/$KERNEL_CONFIG
    cp .config config.sav
    make -j$CPU_JOB_NUM mrproper
    ;;
config)
    sudo apt-get install libncurses5-dev
    echo make -j$CPU_JOB_NUM menuconfig
    make -j$CPU_JOB_NUM menuconfig
    ;;
defconfig)
    if [ "$2" ] ; then
        KERNEL_CONFIG=$2
    fi
    echo make -j$CPU_JOB_NUM $KERNEL_CONFIG
    make -j$CPU_JOB_NUM $KERNEL_CONFIG
    ;;
```

```
all|*)
    echo make -j$CPU_JOB_NUM uImage
    make -j$CPU_JOB_NUM uImage
    make $DTB_FILENAME
    if [ $? != 0 ] ; then
        exit 1
    fi
    if [ "$2" ] ; then
        INSTALL_BINDIR=$2
    fi
    if [ $INSTALL_BINDIR ] ; then
        echo cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR/$KERNEL_IMAGE
        cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR/$KERNEL_IMAGE
        echo cp -a arch/arm/boot/dts/$DTB_FILENAME $INSTALL_BINDIR/$KERNEL_IMAGE
        cp -a arch/arm/boot/dts/$DTB_FILENAME $INSTALL_BINDIR/$KERNEL_IMAGE
    fi
    if [ $INSTALL_BINDIR2 ] ; then
        echo cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR2/$KERNEL_IMAGE
        cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR2/$KERNEL_IMAGE
    fi
    ;;
esac

END_TIME=`date +%s`
echo "Total compile time is $((($END_TIME-$START_TIME)/60)) minutes $((($END_TIME-
$START_TIME)%60)) seconds"
#} 2>&1 |tee b.out
```

3 만든 스크립트를 이용해서, 컴파일을 합니다.

```
$ ./build_uboot config
```
```
$ ./build_uboot
```

3.2. Kernel

1) kernel소스 위치는 아래에 있습니다. 소스 파일을 원하는 위치에 복사를 합니다.

Kernel 소스 위치 **"imx6q-yocto/tmp/work/imx6qsabresd-poky-linux-gnueabi/linux-imx/3.10.17-**

2) 복사한 Kernel 위치에서, "build_kernel" 스크립트 파일을 생성 합니다.

```sh
$ vi build_kernel

#!/bin/sh

export ARCH=arm
export CROSS_COMPILE=arm-poky-linux-gnueabi-
export PATH=/opt/poky/1.5.1/sysroots/x86_64-pokysdk-linux/usr/bin/arm-poky-linux-gnueabi/:$PATH

KERNEL_IMAGE=uImage

# Default kernel configurations
KERNEL_CONFIG=$2

INSTALL_BINDIR=../image

#{
CPU_JOB_NUM=$(grep processor /proc/cpuinfo | awk '{field=$NF};END{print field+2}')
START_TIME=`date +%s`
#sudo apt-get install libncurses5-dev
case "$1" in
clean)
    echo make -j$CPU_JOB_NUM mrproper
    cp .config arch/arm/configs/$KERNEL_CONFIG
    cp .config config.sav
    make -j$CPU_JOB_NUM mrproper
    ;;
config)
    sudo apt-get install libncurses5-dev
    echo make -j$CPU_JOB_NUM menuconfig
    make -j$CPU_JOB_NUM menuconfig
    ;;
defconfig)
    if [ "$2" ] ; then
        KERNEL_CONFIG=$2
    fi
    echo make -j$CPU_JOB_NUM $KERNEL_CONFIG
```

```
    make -j$CPU_JOB_NUM $KERNEL_CONFIG
    ;;
all|*)
    echo make -j$CPU_JOB_NUM uImage
    make -j$CPU_JOB_NUM uImage
    if [ $? != 0 ] ; then
        exit 1
    fi
    if [ "$2" ] ; then
        INSTALL_BINDIR=$2
    fi
    if [ $INSTALL_BINDIR ] ; then
        echo cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR/$KERNEL_IMAGE
        cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR/$KERNEL_IMAGE
    fi
    if [ $INSTALL_BINDIR2 ] ; then
        echo cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR2/$KERNEL_IMAGE
        cp -a arch/arm/boot/$KERNEL_IMAGE $INSTALL_BINDIR2/$KERNEL_IMAGE
    fi


    ;;
esac

END_TIME=`date +%s`
echo "Total compile time is $((($END_TIME-$START_TIME)/60)) minutes $((($END_TIME-$START_TIME)%60)) seconds"
```

3) 컴파일을 하면, 에러가 발생이 됩니다.

```
$ ./build_kernel defconfig imx_v7_defconfig
$ ./build_kernel
  CHK     include/generated/uapi/linux/version.h
  CHK     include/generated/utsrelease.h
make[1]: `include/generated/mach-types.h'는 이미 갱신되었습니다.
  CC      scripts/mod/devicetable-offsets.s
  CALL    scripts/checksyscalls.sh
  GEN     scripts/mod/devicetable-offsets.h
  HOSTCC  scripts/mod/file2alias.o
```

```
  HOSTLD   scripts/mod/modpost
  CHK        include/generated/compile.h
  CHK        kernel/config_data.h
  Kernel: arch/arm/boot/Image is ready
  LZO        arch/arm/boot/compressed/piggy.lzo
  AS         arch/arm/boot/compressed/piggy.lzo.o
  LD         arch/arm/boot/compressed/vmlinux
  OBJCOPY arch/arm/boot/zImage
  Kernel: arch/arm/boot/zImage is ready
multiple (or no) load addresses:
This is incompatible with uImages
Specify LOADADDR on the commandline to build an uImage
make[1]: *** [arch/arm/boot/uImage] 오류 1
make: *** [uImage] 오류 2
```

4) uImage는 zImage와 다르게, 커널 로딩 주소를 갖는데, 정의가 되지 않아서 생기는 에러입니다. 아래 파일 하나를 생성 하면 됩니다.

```
$ vi arch/arm/mach-imx/Makefile.boot
zreladdr-$(CONFIG_SOC_IMX6Q) := 0x10008000
params_phys-$(CONFIG_SOC_IMX6Q) := 0x10000100
initrd_phys-$(CONFIG_SOC_IMX6Q) := 0x10800000
```

4. Image Write 방법

1) Micro SD를 삽입하고, 장치 이름을 확인 합니다.

```
[ 7456.857578] sd 4:0:0:0: [sdc] 15644672 512-byte logical blocks: (8.01 GB/7.45 GiB)
[ 7456.859072] sd 4:0:0:0: [sdc] No Caching mode page present
[ 7456.859076] sd 4:0:0:0: [sdc] Assuming drive cache: write through
[ 7456.861822] sd 4:0:0:0: [sdc] No Caching mode page present
[ 7456.861825] sd 4:0:0:0: [sdc] Assuming drive cache: write through
[ 7456.863091]   sdc:
```

2) 아래 명령으로 SD에 이미지 파일을 write할 수 있습니다.

```
sudo dd if=u-boot.imx of=/dev/sdc bs=512 seek=2; sync
```

```
sudo dd if=uImage of=/dev/sdc bs=512 seek=2048 conv=fsync
```
```
sudo dd if=imx6q-sabresd.dtb of=/dev/sdc bs=512 seek=20480 conv=fsync
```

Rootfs 만드는 소스를 찾지 못해서, Yocto 프로젝트 컴파일시에 나온 rootfs 이미지 파일을 복사해서, write를 진행 했습니다.

3) sd에 파티션을 설정합니다.

Command (m for help): p

Disk /dev/sdc: 7948 MB, 7948206080 bytes

245 heads, 62 sectors/track, 1021 cylinders, total 15523840 sectors

Units = sectors of 1 * 512 = 512 bytes

Sector size (logical/physical): 512 bytes / 512 bytes

I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk identifier: 0xd29dc410

   Device Boot   Start   End   Blocks   Id System

Command (m for help): n

Partition type:

    p   primary (0 primary, 0 extended, 4 free)

    e   extended

Select (default p): p

Partition number (1-4, default 1): 1

First sector (2048-15523839, default 2048): 40000

Last sector, +sectors or +size{K,M,G} (40000-15523839, default 15523839):

Using default value 15523839

Command (m for help): p

Disk /dev/sdc: 7948 MB, 7948206080 bytes

245 heads, 62 sectors/track, 1021 cylinders, total 15523840 sectors

Units = sectors of 1 * 512 = 512 bytes

Sector size (logical/physical): 512 bytes / 512 bytes

I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk identifier: 0xd29dc410

```
   Device Boot       Start         End         Blocks    Id   System
/dev/sdc1           40000      15523839      7741920    83   Linux


Command (m for help): w
The partition table has been altered!


Calling ioctl() to re-read partition table.
Syncing disks.
```

4) 설정한 파티션을 포멧 합니다.

```
$ sudo mkfs.ext4 /dev/sdc1

mke2fs 1.42 (29-Nov-2011)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
484800 inodes, 1935480 blocks
96774 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1983905792
60 block groups
32768 blocks per group, 32768 fragments per group
8080 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632


Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

```

5) 복사한 rootfs 이미지 파일을 write를 합니다.

```
$ mkdir temp
```
```
$ sudo mount /dev/sdc1 temp
```

$ sudo tar xf fsl-image-fb-imx6qsabresd-20140925044842.rootfs.tar.bz2 -C temp/
$ sync
$ sudo umount /dev/sdc1

6) SD로 부팅 후, uboot prompt 상에서 환경변수를 수정 합니다.

U-Boot > setenv loadaddr 0x12000000
U-Boot > setenv fdt_addr 0x18000000
U-Boot > setenv fdt_high 0xffffffff
U-Boot > setenv bootargs_base 'setenv bootargs console=ttymxc0,115200'
U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs} root=/dev/mmcblk0p1 init=/sbin/init rootwait rw video=mxcfb1:dev=ldb,LDB-XGA,if=RGB666 video=mxcfb0:dev=hdmi,1920x1080M@60,if=RGB24'
U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc dev 1;mmc read ${loadaddr} 0x800 0x8000;mmc read ${fdt_addr} 0x5000 0x800;bootm ${loadaddr} - ${fdt_addr}'
U-Boot > setenv bootcmd 'run bootcmd_mmc'
U-Boot > saveenv
U-Boot > run bootcmd