

# Porting Android 8.0 onto iMX6 Processor based Platform with driving an LVDS Display

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**Abstract** - Nowadays for the embedded devices use of android operating system has become current emerging trend in the market. The most widely used embedded device in industries which built with android OS is mobile phone. The advantage of using android OS compared to other OS is that, it is an open source and responds quickly to functional changes. It is becoming default OS for devices which requires the multimedia support. Porting of android onto ARM processor based platform is very necessary in order to bring the effectiveness of ARM and capability of android onto a product. The proposed work is to port android 8.0(oreo) onto iMX6 processor based Media Accelerated Graphics Innovation Kit (MAGIK-II).

**Key Words:** MAGIK-II, Qseven, iMX6 Processor, Carrier board, MFG tool, Booting, Flashing.

## 1. INTRODUCTION

Android operating system is based on linux platform which is developed by Google. The embedded systems are framed using particular real time operating system by specific vendors. These days android operating system is widely used for mobile phones, tablets etc. android is so popular because of its open source nature allowing user to build application using it And also modify the kernel as per the requirement. Further Google has developed android wrist watches, android TVs and more devices each with a specific user interface. ARM processor is the family of CPUs which is based on Reduced Instruction Set Architecture. It is used in many electronic devices such as tablets and smart phones. They require small sized integrated circuit due to their compressed instructions such as SOC which reduce the memory management and power management constraint by inbuilt support. It has greater performance in terms of speed, cost and accuracy hence it is used in many different embedded applications. An OS is required to establish communication between processor, peripherals and memory to perform a task. In order to improve speed and performance Google updated different android versions and the latest version is 8.0 (oreo). The enormous growth of android OS made developers, to think of porting it onto other embedded platform which has powerful peripherals support and power management. To make use of portability of android , user started porting android OS onto ARM baesd module. Since android user interface is optimized for the touch display and it can be perfectly developed for the next

generation smart devices. Hence the current work of porting android 8.0 onto a costum board has significant importance in building application in the area of automotives, multimedia and medical applications.

## 2. ANDROID ARCHITECTURE

Android is stack of software that consists OS, middleware and key applications, which runs on linux based kernel. It is a bundle of packages consisting of linux kernel, HAL framework, application framework, applications. Hardware used is target MAGIK-II module . Linux kernel includes necessary drivers like display, audio etc. The necessary display drivers is added at kernel level of architecture. LVDS is the display module used for target board with LDB driver which drives the display of resolution 1280 x 800. Between lower level and higher level HAL acts as intermediate. HAL interface has two components such as module and device. Module has package of library which defines version name and device defines particular hardware implemented. Libraries include set of C/C++ code for particular components. Developers can develop android application in application framework layer. In android architecture the top layer which includes all the basic applications is application layer.

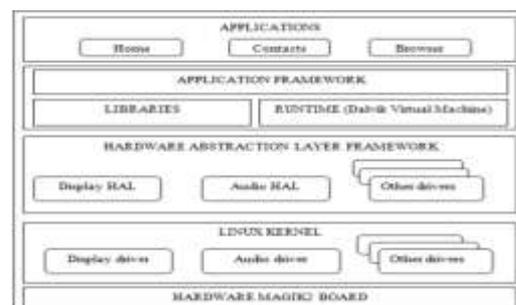


Fig-1 : Block diagram of android architecture

## 3. HARDWARE PLATFORM

### 3.1 Qseven Module

The target system on module used is Qseven which is a small integrated circuit board. It has many functional units. It also has many advantages as it reduces the cost of building base board and all its functional units. The specific advantage is

that the board can be reused for other embedded applications. The board consists of SOC processor, EMMC memory unit SD card and many peripheral interfaces. Fig 2 shows the photograph of MAGIK-II Qseven module. It has 70mm x 70mm dimension and it uses one 230 pin MXM edge connector to connect all power and signal lanes to the carrier board. The frequency of the processor is 1.2GHz, EMMC 4GB to 64 GB.



Fig2: Photograph of Qseven system on module

### 3.2 iMX6 Processor (SOC)

iMX6 is a system on chip which is mounted on the Qseven module. The SOC is a small integrated circuit which has CPU and functional units onto the single chip. iMX6 processor is based on ARM cortex A9 family. SOC includes specific number of cores, separate unit for multimedia and image processing, display and camera interface, internal memory, power management, controller and all the peripheral connectivity which are inbuilt such as EMMC, USB, Ethernet, UART, I2C, GPIO etc. LVDS also supported by SOC processor.



Fig -3: Photograph of iMX6 processor

### 3.3 Carrier Board

Carrier board is a base board on which SOM module is fixed with the help of 230 pin MXM edge connector. Carrier board helps in developing end application device. Carrier board is as shown in fig 4 which also includes other features such as CODEC, controller etc. This modular approach allows high scalability, upgradability and fast time to market.



Fig- 4: Photograph of carrier board

### 3.4 LVDS Display

LVDS display stands for low voltage differential signaling which is one of the peripheral unable to carrier board. It is a device which has low power and high speed for many video and graphics applications. It transmits informations the difference of two voltage on its two wires to the receiver. Proposed work is driving LVDS display of high resolution 1280 x 800.



Fig- 5: Photograph of LVDS display

### 3.5 Hardware Setup

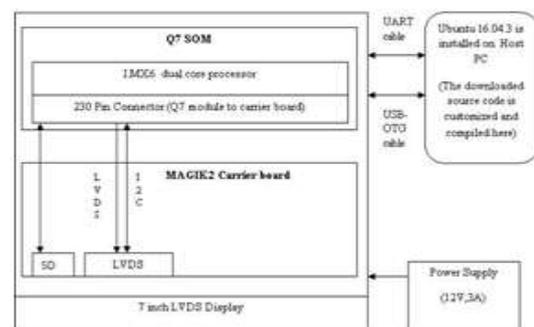


Fig 6: Hardware Setup for porting android

## 4. SOFTWARE IMPLEMENTATION

Android can be ported mainly in three phases

- i. Uboot Porting (2017.03)
- ii. Linux kernel Porting (4.9.17)
- iii. Android file system Porting (8.0)

Above phases intern includes steps such as downloading the source code for each phase, extracting tool chain. Relevant changes to be done in bootloader, after the customization as per the requirement bootloader is compiled and then the images generated is flashed to the target board.

### 4.1 Bootloader Porting

Since SABRESD is the reference board the following files are copied to the target board MAGIK-II and moified with following steps. The basic header file is added for magik2q7 from reference SABRESD board is copied to the magik2q7

board.

include/configs/magik2q7.h

#### 4.2 Compilation of source code

The steps involved for compilation of source code as follows.

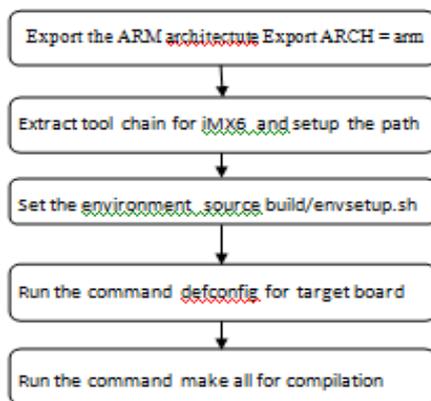


Fig- 7: flowchart of compilation of source code

#### 4.3 LVDS Interface

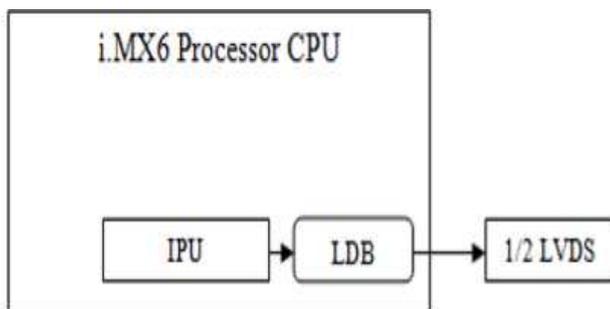


Fig- 7: LVDS Display

```

mxcfb1: fb@0 {
    compatible = "fsl,mxc_sdc_fb";
    disp_dev = "ldb";
    interface_pix_fmt = "RGB24";
    mode_str = "TIANMA-MIN-WXGA";
    default_bpp = <32>;
    int_clk = <0>;
    late_init = <0>;
    status = "disabled";
}
  
```

};

#### 4.4 Flashing the Images

After the compilation of the source code the binary images generated are boot.imx, partion.img, recovery.img, system.img created are copied to MFG tool. OTG cable is connected between computer and target module and 12V supply is given to the board. As soon as power flows the host system displays amessageHID device is detected, only when target board is detected as shown in fig 8. All the images are flashed.

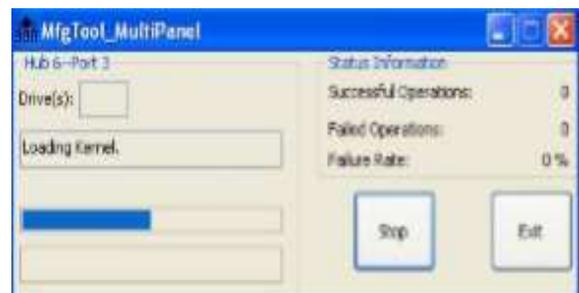


Fig- 8: MFG tool terminal panel

### 6. RESULTS

Display test is performed by using different resolution images and video. Fig 9 shows image displayed with resolution 1280 x 800. Image of resolution less than actual resolution will not be seen clear. Video files of mp4 format are also played. Video with 4k resolution failed to play on LVDS display.

Table- 1: Test procedure and Results

Test	Image resolution	Expected result	Actual result	Pass/Fail	Remarks
1	USB pen drive is connected to board which contain image of resolution 320 x 600 jpeg file in it.	The proper image should be displayed.	The image displayed is not clear.	Fail	The test is failed as the image size is less than the LVDS resolution.
2	USB pen drive is connected to board which contain image of resolution 1280 x 800 jpeg file in it.	The proper image should be displayed.	The clear image is displayed on the screen.	Pass	The test is passed, as the image size and LVDS resolution is same.
3	USB pen drive is connected to board which contain image of resolution 1800 x 900 jpeg file in it.	The proper image should be displayed	The image is clipped off.	Fail	The test is failed as the image size is greater than the LVDS resolution

### 7. CONCLUSION

Android has evolved greatly with mobile devices because of its features like open source nature and rich user interface. Android is being integrated and ported to various embedded devices. The main advantage of using android framework beyond mobile device is that functionality of the android devices. To take advantage of Android, speed and accuracy of

the ARM based processor in the current work Android 8.0 is ported onto MAGIK2 ARM based i.MX6 processor. Android is ported onto the target board by three steps as u-boot 2017.03, kernel 4.9.17 and Android 8.0 file system. MAGIK-II is ported with Android OS to drive a LVDS display with different resolution images and video.

## 8. REFERENCES

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