ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Device Driver Development of External Human Interaction Device for the Android

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ABSTRACT:
Smart phones become popular. They have various sensors and connection modules. They employ a mobile operating system for the control of sensors and modules. In this situation, a large amount of data comes to the operating system from sensors and modules. While such data is important for effective operations of smart phones, it is not well known that how it affects the operating system performance. In this paper, we prepare an experiment environment that mimics a smart phone. We selected the Android as an operating system and the Pandaboard-ES as a target board. The Pandaboard-ES equips a I2C controller module. We select Accelerometer sensor to operate the Android via I2C. We implement programs to use Accelerometer as the input device of the Android, and improve this program. We make change profiling software for the Linux and are enable to use it on the Android.

Index-terms: ***ARM Cortex A9 controller, keyboard, Panda board, Accelerometer.***

I. INTRODUCTION:

Recently, smart phones spread all over the world. In 2008, almost all cellular phones are Feature phones while now 70% of cell phones are smart phones. Furthermore, the adoption rate is expected to reach 80% by the end of 2016. The difference of feature phones and smart phones is that the smart phones employ a mobile operating system (OS), such as iOS or Android. Another feather of smart phones is that it is equipped with in number of sensor modules that include GPS, Bluetooth, acceleration sensor, direction sensor and luminance sensor and so on. Because it has many modules and it also can connect kinds of external devices, a large amount of data comes from modules and/or external devices to the smart phones, so smart phones must process these data. These data are too large, so if we don't process these data effectively, the application goes down at worst. There is no study how we can process data from the external device effectively and how external devices can be connected with Android.

The objective of this study is to examine how the data from the external device affect the Android and how time the input event complete. For our objective, we connect the external device with the Android and handle the Android by the external device. We implement a driver to get the data from Accelerometer sensor and use this data to make input event to the Android. We get the processing time of the input event by using this program.

II.RELATED WORK:

2.1 Scope of the project:

- Study of Input subsystem in Linux.
- Study of ARM Cortex A9 controller.
- Study of i2c controller in OMAP4460 processor.
- Linux Porting on OMAP4460 controller.
- Implementing Accelerometer Sensor driver program at kernel level.
- Implementing a get event application programs at user level to communicate accelerometer sensor.
- Testing the Interaction between kernel to user level using application and kernel program.

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2.2 Execution Environment:

We set up the following environment to get data from the external device and handle these data.

OS:

We choose Android as an embedded operating system on smartphone because Android is an open source software, and it is Linux based operating system so we can use some software for Linux. The version we selected is 4.0.4(Ice Cream Sandwich).

Board:

We choose Pandaboard-ES[12] for the target board. Pandaboard-ES is a single-board computer based on the OMAP4460 developed by Texas Instruments. The features Pandaboard-ES are a dual-core 1.2GHzCPU and 384MHz GPU, 1GB low power DDR2 RAM, onboard 10/100 Ethernet, 802.11 b/g/n, Bluetooth v2.1, general purpose expansion header, and so on. Some smart phones use the OMAP4460, so this board is similar to the smart phone. Figure1 is the appearance of Pandaboard-ES.

1. Supports multiple functions
2. ARM cortex A9 processor
3. On chip memory (SRAM-56K,ROM-48k)
4. External memory(DRAM-1GB)
5. GPMC interfacing for NAND and NOR
6. Supports 4 UART controllers and 4I2C
7. Audio Back End Systems, Display Sub System and Imaging Sub System

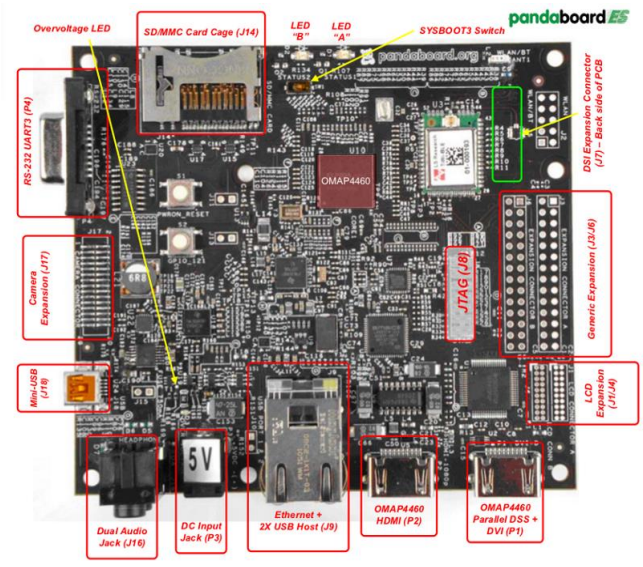

Figure-1: Panda board

2.3. Accelerometer sensor (ADXL345):

The ADXL345 is a complete 3axisaccelerationmeasurement system with a selectable measurement range of ±2 g, ±4 g, ±8 g, or ±16 g. The accelerometer is a built in electronic component that measures tilt and motion. It is also capable of detecting rotation and motion gestures such as swinging and shaking.

Basic interfacing diagram:

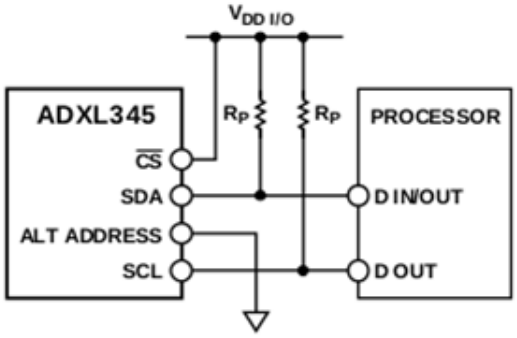

Figure-2: Accelerometer sensor interfacing

Accelerometer sensor interfacing with panda board:

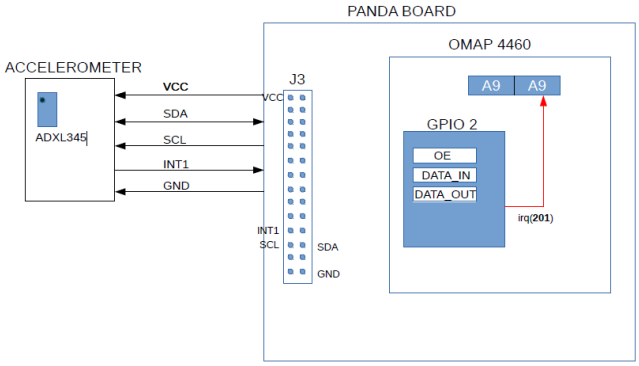

Figure-3: Sensor Interfacing with Panda Board

2.4 DEVICE DRIVER:

We implement device driver for Accelerometer. Our Android prepares insmod and rmmod commands so we can use kernel module on this Android. Device driver for ubuntu already exists, but we cannot use this driver on the Android. We Implement a get event application programs at user level to communicate accelerometer sensor and testing the Interaction between kernel to user level using application and kernel program.

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Proposed Block Diagram:

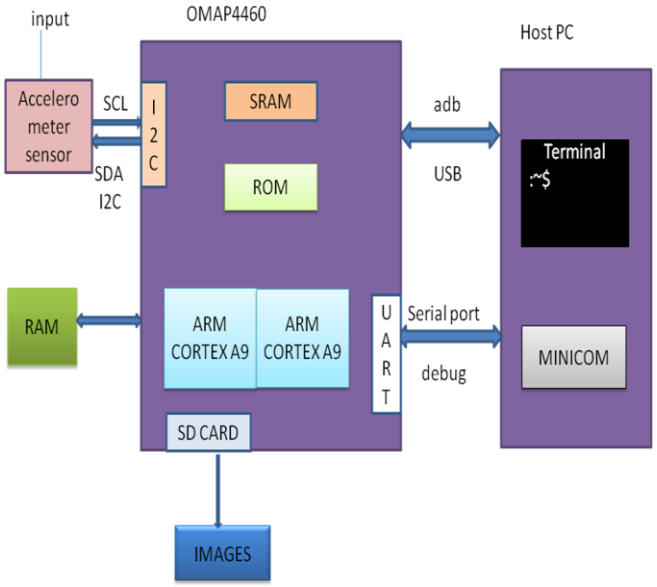
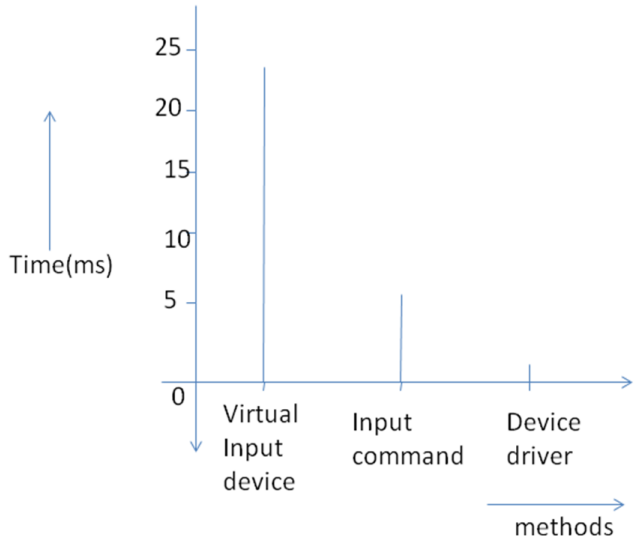


Figure-4: Block diagram

III. RESULTS:

3.1 Graph:

Compare Three Versions:



Input method	Virtual input device	Input command	Device driver
Time(ms)	24.13	6	0.43

Table-1: Command Result

3.2 LOGFILE:

127|root@android:/ # getevent -t
add device 1: /dev/input/event0
  name: "ft5x06_ts"
could not get driver version for /dev/input/mice, Not a typewriter
add device 2: /dev/input/event4
  name: "PandaES Headset Jack"
add device 3: /dev/input/event5
  name: "gpio-keys"
add device 4: /dev/input/event1
  name: "ads7846"
could not get driver version for /dev/input/mouse0, Not a typewriter
add device 5: /dev/input/event2
  name: "ADXL34x accelerometer"
could not get driver version for /dev/input/js0, Invalid argument
add device 6: /dev/input/event3
  name: "twl6040:vibrator"
287-194183: /dev/input/event2: 0003 0000 000000e7
287-194213: /dev/input/event2: 0003 0001 ffffffed
287-194213: /dev/input/event2: 0003 0002 0000018d
287-194213: /dev/input/event2: 0000 0000 00000000
287-237274: /dev/input/event2: 0003 0000 000000f7
287-237335: /dev/input/event2: 0003 0001 fffffff8
287-237335: /dev/input/event2: 0003 0002 00000185
287-237335: /dev/input/event2: 0000 0000 00000000
287-280364: /dev/input/event2: 0003 0000 000000ed
287-280395: /dev/input/event2: 0003 0001 0000000e
287-280395: /dev/input/event2: 0000 0000 00000000
287-323516: /dev/input/event2: 0003 0000 000000ef
287-323547: /dev/input/event2: 0003 0001 0000000f
287-323547: /dev/input/event2: 0003 0002 00000183
287-323547: /dev/input/event2: 0000 0000 00000000
287-366516: /dev/input/event2: 0003 0001 0000001e
287-366577: /dev/input/event2: 0003 0002 00000185
287-366577: /dev/input/event2: 0000 0000 00000000
287-409729: /dev/input/event2: 0003 0001 0000000f
287-409729: /dev/input/event2: 0003 0002 00000186
287-409729: /dev/input/event2: 0000 0000 00000000
287-452819: /dev/input/event2: 0003 0000 0000010a
287-452850: /dev/input/event2: 0003 0001 0000002e
287-452850: /dev/input/event2: 0003 0002 0000018c
287-452850: /dev/input/event2: 0000 0000 00000000

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287-495880: /dev/input/event2: 0003 0000 000000f6
287-495941: /dev/input/event2: 0003 0001 00000026
287-495941: /dev/input/event2: 0003 0002 000001a3
287-495971: /dev/input/event2: 0000 0000 00000000
287-539062: /dev/input/event2: 0003 0000 000000ea
287-539154: /dev/input/event2: 0003 0001 00000025
287-539184: /dev/input/event2: 0003 0002 000001a4
287-539184: /dev/input/event2: 0000 0000 00000000
287-582122: /dev/input/event2: 0003 0000 000000e8
287-582183: /dev/input/event2: 0003 0001 0000001d
287-582183: /dev/input/event2: 0003 0002 000001aa
287-582183: /dev/input/event2: 0000 0000 00000000
287-625396: /dev/input/event2: 0003 0000 000000f5
287-625488: /dev/input/event2: 0003 0001 0000003c
287-625488: /dev/input/event2: 0003 0002 0000019e
287-625488: /dev/input/event2: 0000 0000 00000000
287-668395: /dev/input/event2: 0003 0000 000000e7
287-668487: /dev/input/event2: 0003 0002 0000019c
287-668487: /dev/input/event2: 0000 0000 00000000
287-711334: /dev/input/event2: 0003 0000 000000f7
287-711395: /dev/input/event2: 0003 0001 0000004c
287-711395: /dev/input/event2: 0003 0002 000001a5
287-711425: /dev/input/event2: 0000 0000 00000000
287-754821: /dev/input/event2: 0003 0000 000000ee
287-754821: /dev/input/event2: 0003 0001 0000004e
287-754852: /dev/input/event2: 0003 0002 00000191
287-754852: /dev/input/event2: 0000 0000 00000000
287-797760: /dev/input/event2: 0003 0000 000000ec
287-797760: /dev/input/event2: 0003 0002 0000018f
287-797790: /dev/input/event2: 0000 0000 00000000
287-841094: /dev/input/event2: 0003 0000 000000ea
287-841186: /dev/input/event2: 0003 0001 00000059
287-841186: /dev/input/event2: 0003 0002 0000018c
287-841217: /dev/input/event2: 0000 0000 00000000
287-884063: /dev/input/event2: 0003 0000 000000f5
287-884094: /dev/input/event2: 0000 0000 00000000
287-926849: /dev/input/event2: 0003 0000 000000fc
287-926910: /dev/input/event2: 0000 0000 00000000
287-970153: /dev/input/event2: 0003 0000 00000102
287-970214: /dev/input/event2: 0003 0001 00000065
287-970214: /dev/input/event2: 0003 0002 0000018e
287-970214: /dev/input/event2: 0000 0000 00000000
288-13122: /dev/input/event2: 0003 0000 0000010e
288-13122: /dev/input/event2: 0003 0001 00000070
288-13153: /dev/input/event2: 0003 0002 00000199
288-13153: /dev/input/event2: 0000 0000 00000000
288-56518: /dev/input/event2: 0003 0000 000000f7
288-56579: /dev/input/event2: 0003 0001 00000067
288-56579: /dev/input/event2: 0003 0002 00000198
288-56579: /dev/input/event2: 0000 0000 00000000
288-99334: /dev/input/event2: 0003 0000 000000c6

IV. CONCLUSION

In this paper, we describe that how the data from an external device is handled. To get the data from the external device, we connect the accelerometer to the Panda board. We implement the driver program for the input device. By using this method it takes short time to complete input event.

V. REFERENCES

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[2] Sugimoto Masaki et al., *Input Method of Japanese Sentence by Using Wiimote*, ITE Technical Report, 35(16), 59-62, 2011-03-08.

[3] keiji Sakata and Takao Takahashi, *Development of learning system using noncontact input device*, IPSJ SIG Technical Report.CE, 2011-CE-112(1), 1, 2011-12-10.

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