International Journal of Advanced Technology in Engineering and Science
Vol. No.4, Issue No. 12, December 2016
www.ijates.com
ijates
ISSN 2348 - 7550

A NEW STUDY OF SAMSUNG GEAR S2 MOBILE ARCHITECTURE, SPECIFICATION AND ITS FEATURES

Aaron Lai Tien Wei[1], Said Ali Akbar[2], Rajev Dylon A/L Vincent[3]

[1]Diploma in ICT (SE), Asia Pacific University, Kuala Lumpur, (Malaysia)

[2, 3]Diploma in ICT, Asia Pacific University, Kuala Lumpur, (Malaysia)

ABSTRACT

In this paper, researchers were asked to conduct a study on a specific model of mobile computing.A meeting was scheduled and executed to decide the most suitable model. Three determining factors were applied for the meeting which help determined the suitable model for study. One being popularity among the public which allowed for detailed findings and sufficient data required for analysis. Public perception to balance an advantages and disadvantages of the device. Newer and lack of mainstream technology was another factor to study further on understanding mobile computing concepts. These three determining factors lead to choosing the Samsung Gear S2 as it fulfilled these three criteria. The documentation will provide coverage for the Gear S2's computer architecture and implementations issues. The technology that led to its release and limitations of the Gear S2.

Keywords: Architecture, Data Dependency, Implementation Issues, Mobile Computing

I INTRODUCTION

Mobile computing is a term describing one's ability to use computing technology while roaming anywhere whilst he/she still maintains services and connectivity. For example, a person may use a smartphone to access online resources via Wi-Fi, instead of using their PC which isn't possible to do so outside his/her home or workplace. This means that mobile computing has changed people's daily lives, ranging from their interaction with daily tasks to gaining knowledge etc.

1.1 Technologies behind the Success of Mobile Computers

Mobile computers would not be possible without the technologies required for it to be able to function. What allow us users, of mobile computers, can freely roam around anywhere are the following things:

1.1.1 WIFI

IEEE 802.11x, also known as WIFI, is a network connection that uses radio waves to provide wireless high speed internet to its consumers. Without this technology, we wouldn't be able to retrieve online resources at any place and time shown in "Fig.1.1".

Figure 1.1: Wi-Fi Router [1]

1.1.2 Touch Screen

Touch screen is a monitor, with a sensitive panel directly on the screen, which registers the touch of a finger as an input [2]. It replaces devices such as mouse and keyboard. Instead of having a physical peripheral device to perform functions done in a computer, the touch screen has the ability to display a virtual keyboard and sense touch from our fingertips. This allows devices such as Laptop, TV and mobile phones to be much lighter shown in "Fig.1.2".

Figure 1.2: IPhone Touch Screen [3]

1.1.3 Bluetooth Headset

Bluetooth headset is another technology behind mobile computing success. It uses radio waves instead of wires to connect to the mobile devices or computer. It has an integrated microphone and small ear speaker into one device making it easier for the user to talk and listen to a call without the need to hold the mobile phone, giving its user flexibility in their daily tasks and also shown in "Fig 1.3".

Figure 1.3: Bluetooth headset [3]

1.1.4 Global Positioning System (GPS)

Global Position System, aka GPS, is a satellite-based navigation system that is made up of a network of satellites placed in the Earth's orbit. It is used to track someone or something anywhere in the world by transmitting a signal into person's device such as a mobile to detect that exact location of a certain person or object. The system has replaced the need for us to look into the map and check our current position and destination manually making it immobile for us also shown in "Fig.1.4".

Figure 1.4: Smartphone GPS navigation system

1.1.5 LI-ION Battery

Li-Ion battery or lithium ion battery has a high energy density and low discharge rate making it the current most efficient battery to date. The high energy density allows the battery to store excess charge granting higher power capacities. Low discharge rate is the rate of involuntary release of remaining power from the battery, decreasing its

current capacity. The rate of power drain depends on the computing processes of the device itself. Rapid computing processes results in a significant power drain of the Li-ion. However, its lithium ion element allows an estimated battery lifespan of 23 hours for active users and estimated 48 hours for less active users of the device. Lithium ion batteries experience less battery deterioration and are known to last longer before needing a replacement shown in "Fig.1.5".

Figure 1.5: Lithium ion Battery

II CPU SPECIFICATION, FEATURES AND GENERAL ARCHITECTURE

2.1 Central Processing Unit (CPU)

The central processing unit is the brain of the devices where most of the calculations take place. The computer's CPU can hold all the instructions that it receives from hardware and software which is running on the computer [1]. The Samsung Gear S2 watch is using the 4th generation CPU which is Integrated Circuits (IC) shown in "Fig 2.1". Graphics processing, system memory, and a few other functions are managed by a single integrated circuits (IC) inside the Samsung Watch. High resolution graphics shown on the display of this watch is due to very sophisticated and complex IC embedded into its CPU.

Figure 2.1 Samsung Gear S2 CPU

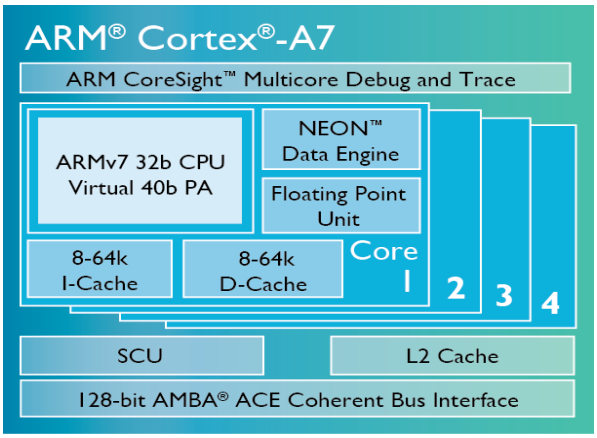
Figure 2.2: ARM Cortex – A7

The ARM Cortex-A7 is a 32-bit applications processor with 40-bit physical addressing and hardware virtualization support [4]. The features of integrated L2 cache that can be configured from 128KB to 1MB as shown above "Fig 2.2". The Cortex-A7 pipeline is based on eight stage that provides significant performance improvements compared to the Cortex-A5 processor. The other improvement is, integrated L2 cache subsystem that provides improved area efficiency and up to 43% improvements in memory streaming performance.

2.2 Features

2.2.1 S HEALTH

The Samsung Gear S2 watch have one of the best features which is "S Health". It can help to achieve the fitness goals and improve overall wellness with smarter health monitoring [5]. It will monitor daily activity levels including the number of steps we walk in a day, how many calories we burn due to our daily activities such as walking,



running, jumping etc. This smart watch also tracts and stores in its memory the distance we walked or run in a day. This Samsung watch can help us to control the caffeine intake and encourage us to drink more water. Samsung Gear S2 watch can also measure the wearers' pulse which is an important health indicator. It we want lose our weight in a short period, Samsung Gear S2 will help to monitor our daily activities such as running, walking, jogging, swimming, cycling etc shown in "Fig 2.3".

Figure 2.3: Types of S Health

2.2.2 Social Media

Samsung Gear S2 help us to check messages or emails without having to take out our smartphone especially when we are walking in a crowded place. The watch will provide an alert whenever there is a message or email received by the smartphone. It is dangerous to read a message from our phone while driving. But by looking at our smart watch we read the message and stop our car if it is urgent to reply to the message received. Samsung Gear S2 watch can also use voice command to type and send messages or emails. Some of voice command features of this watch, which is called S Voice, is a hands-free feature to check notifications, start the workout, to get the direction for GPS or to reply the message/email [6] also shown in "Fig.2.4".

Figure 2.4: Examples of social media

2.2.3 Samsung Gear S2 GPS

Samsung Gear S2 is very useful as a GPS (Global Positioning System). When we travel for vacation or recreation by bicycle and stuck somewhere in middle of the jungle, Samsung Gear S2 can help us to find the direction to get the way out of the jungle as shown "Fig 2.5". There is one app called "Uber" which is a cab service provider. Samsung Gear S2 will show the time when the Uber cab will arrive to pick us up and even it will also show the map where the current location of the Uber cab is.

Figure 2.5: Samsung Gear S2 GPS

2.2.4 Connected & Bluetooth Availability

Samsung Gear S2 can pair with the smartphone or any other devices except iPhone. It can connect only android smartphones. When Gear S2 watch connected with the android smartphone, we can talk with someone through the watch without having to take out our smartphone. Samsung Gear S2 comes with a loudspeaker and microphone. We can hear the messages or send message by voice command by using this microphone. Bluetooth + 3G/4G model has a built-in speaker for standalone phone calls [7]. It can make call, text, and email and receive notifications even when the phone isn't nearby. Samsung Gear S2 has sim-card which can call directly to the watch shown in "Fig.2.6".

Figure 2.6: Samsung Gear S2 Phone Call

III IMPLEMENTATION ISSUES

This section will explain the various implementation issues associated with the Gear S2 based on information on its computer architecture and from varied user reviews. It will focus mainly on but not limited to the issues faced with original Gear S2 variant compared to Gear S2 3G and Classic despite slight differences such as its Central Processing Unit (CPU) that affect overall functionality and performance. The Gear S2 also has a wider market reach compared with the Gear S2 3G or Classic that is available in selected markets, granting it added mainstream value. Potential causes are identified and recommendations to solve the Gear S2 issues are presented.

3.1Interoperability

Interoperability in defined as the ability of a system to operate with another system without any special effort by the user/consumer. In other interpretation, the user does not have to make any special configuration to allow the compatibility between two different systems. Each system has the ability to operate simultaneously to complete a specific task. The Gear S2 was designed specifically to interoperate with smart devices (mobile phones and tablets) running an Android OS. An example would be for the Gear S2 to notify users of incoming messages from the 'paired smartphone device. The Gear S2 had been capable to synchronise time with the Android smart device. The Gear S2 primarily pairs through using Bluetooth but can alternatively connect through Wi-Fi. Since Gear S2 is a mobile device that connects primarily wirelessly, the Connectivity issues is a primary issue with the Gear S2 among

the users. This can be particularly annoying to users pending to receive alerts from the Gear S2. Gear S2 connection stability be contingent to the user's smart device model. It's important to identify the connection issues that still prevail for compatible models. The Gear S2 does not support automatic connection to Wi-Fi Networks. Users must manually establish a connection by inputting the password for thedesired network through the T9 keyboard shown in "Fig.3.1".

Figure 3.1: Connect via Wi-Fi in the Gear S2

Due to its connectivity issues, the Gear S2 may intercept nearby foreign smartphone signals which could lead to connectivity issues.

Among the few are the following: -

HTC	**Huawei**	**Lenovo**	**LG**
One	Honor 4x	Vide Shot	G Flex
One (M8)	Honor 6	X2 Pro	Optimus G
826W	P8		Optimus G2
	Ascend Mate 7		G4
			G Vista
			Nexus 5

Table 1: Compatible Android devices

The list is limited to Samsung brand devices. Samsung based devices hold a different requirement to pair with Android 4.3 versions and above and 1.5 GB RAM and above to pair correctly with the Gear S2 shown in "Table 1".

Galaxy A5	Galaxy S7	Galaxy A8	Galaxy Alpha
Galaxy E5	Galaxy E7	Galaxy J3 2016	Galaxy J5
Galaxy Note 3	Galaxy Note 4	Galaxy Note 5	Galaxy Note Edge
Galaxy S4	Galaxy S4 Active	Galaxy S5	Galaxy S6

Table 2: Compatible Android devices

However, connection issues that still prevail for compatible models. Performance of the Gear S2 varies among compatible models. Cases of users who had to face long reconnection times of an estimated 15 minutes had to factory reset their Gear S2 to pair again. Instability of the connection had reduced the Gear S2's capability of streaming music remotely from a user's mobile phone to the Gear S2. The issue with the Gear S2 limited range of apps is because of Tizen OS lacking developer establishment. A second reason would be its circular watch face which would limit the display of the apps that the Gear S could run. The rotating bezel is gives added comfortability if for non-touchscreen savvy users shown in "Table.2".

3.2-Coprocessors

A system-on-a-chip (SoC) is a microchip with all the necessary electronic circuits and parts for a given system, such as a smartphone or wearable computer, on a single integrated circuit (IC) (Rouse, n.d.). Samsung's Gear S2 has a smooth display and an adequately responsive touch screen. Little lag is experienced by most users when scrolling through their favourite apps on the Gear S2. The Exynos 3250 its original Gear S2 variant is specifically designed for mobile use, sporting two ARM Cortex A7 Central Processing Unit (CPU) cores running at 1Ghz and a Mali-400MP2 Graphics Processing Unit (GPU) running at 133 Mhz. The Exynos 3250 is one of the many SoCs developed by Samsung and was integrated with a 302-pixel density display for the Gear S2. The quad core Qualcomm Snapdragon 400 MsM 8226 in the Gear S2 3G variant allows for better multitasking performance, to reduce lag and maintain smooth display.

3.3 Memory

Memory can be defined as an electric component that store data and instructions. Memory capacity can be defined as the extend of the device to store and process data, larger memory capacity contributes to faster processing power. Volatile memory which is the RAM and hard drive is extremely limited for the Gear S2 due to its body size. The Gear S2's hard drive capacity of 4GB can only store a limited number of mobile apps. This also indicates mobile apps developed are smaller in file size compared to its Android origin. High graphic quality for apps made for the Gear S2 are largely limited due to small file size quota. RAM capacity is limited on the Gear S2 which indicates a slower processing power due to its inability to store large amounts of information at a time. Shortage of RAM can lead to a slower processing power overall and also its ability to render high quality graphics for apps.

3.4 Battery

The Gear S2 sports a 48-hour battery life but decreases overtime with repetitive charging and battery consumption. Large processes can drain the Gear S2's battery life even if power saving mode is enabled.

3.5 Pipelining

Pipelining occurs when the second instruction is fetched by the control unit of a CPU before the first machine cycle is complete.

3.6 Peripherals

A peripheral is an electronic device that is connected to the system unit and controlled by the CPU. Peripherals can add to a device such as the Gear S2 and add functionality. The Gear S2 sports functionalities such as video display but does not have sound. There is no sound functionality for the Gear S2 and it relies primarily on vibration to alert users of incoming messages. The Gear S2 does encompass a ready built-in speaker due to accommodate its portability issue. Installation of a speaker would increase its size and weight and affect its lightweight characteristics. Alternatively, the Gear S2 vibrates when an incoming message or news is displayed for the user.

IV INPUT AND OUTPUT SPECIFICATION

4.1 Input

There are many types of inputs for the Samsung Gear S2 watches. Any data or instructions that enter a computer or devices can be considered as inputs.

4.1.1 Ambient Light Sensor

The ambient light sensor will automatically adjust the brightness of the watch displays according to the external environmental brightness as shown in “Fig 4.1”. Meanwhile, proximity sensor detects changes in distance between our eyes looking at the watch and the downward movement of hand to which the watch is worn. Example, it allows the screen of Gear S2 watch to timeout when moving the hand downwards after looking at the time. This input can help to save the battery of the Samsung Gear S2 watch.

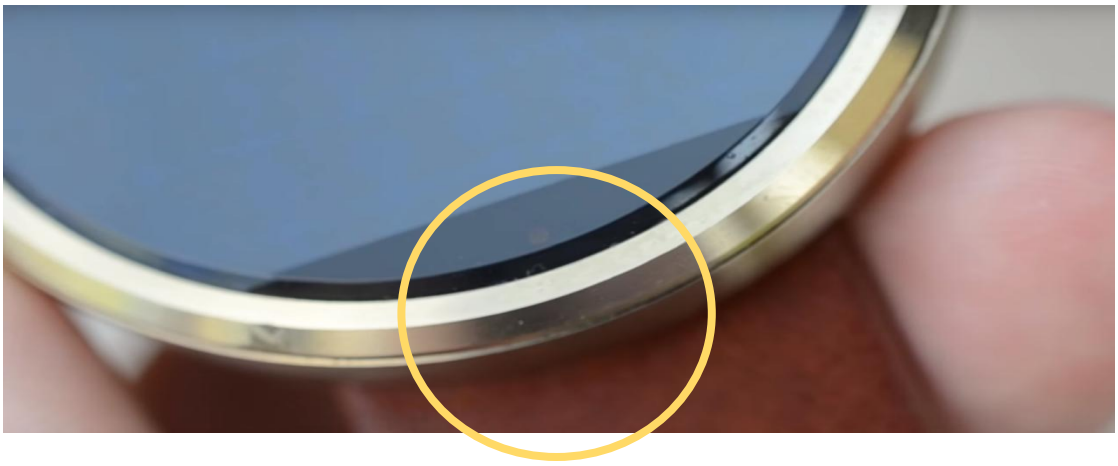


Figure 4.1 Ambient light sensor

4.1.2 Voice Command (VCD)

Voice Command is very useful for the Samsung Gear S2 watch. VCD is the device controlled by means of human voice. By removing the need to use the buttons, dials, and switches, consumers can easily operate appliances with their hands full or while doing other tasks just by speaking to the watch. Samsung Gear S2 watch has app for the voice command called S Voice. Example, while driving the car and someone is calling but couldn't answer because need to hold the steering. Voice command can help us to hear the caller's voice and we can answer the call through the watch. It is safer than picking up the phone while driving. Samsung Gear S2 voice command can be used to write messages, answer calls, calling a person, provide information on weather condition, show us time and etc shown in "Fig.4.2".

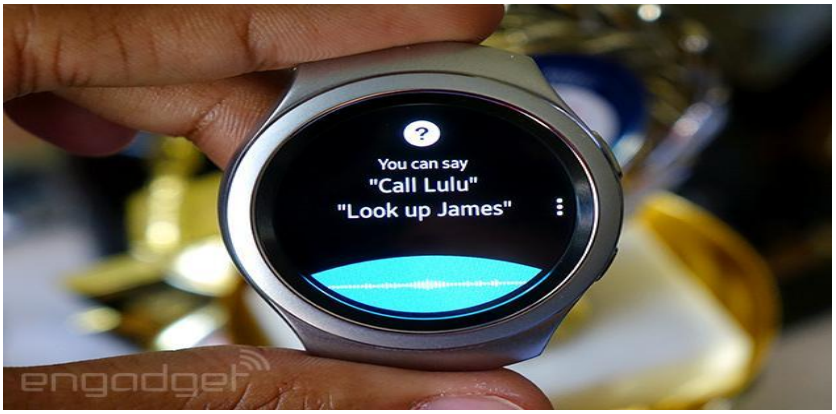


Figure 4.2 Voice Command (S Voice)

4.1.3 TOUCH SCREEN

A display device which allows the user to interact with a computer by touching areas on the screen. Samsung Gear S2 is the touch screen where can touch the screen to open any app or to check on some commands available on Gear S2 watch as shown below "Fig 4.3".

Figure 4.3 Touch Screen

4.2 Output

Output is the data that has been processed into information and visualized or communicated with the user externally. Generally, what can see or hear are the results of these output data.

4.2.1 Display the Screen

Samsung Gear S2 watch display that show us the information is an output device. Gear S2 watch displays time, date, monitor activity of fitness, calendar, messages, emails, call received and etc. Display output is a multi-chrome display with very colourful text and pictures. The brightness of this output can be adjusted according to our comfort. We can also play and watch video files on this display which is designed a very high output resolution. Samsung Gear S2 and Gears S2 Classic smartwatches feature a 1.2-inch circular Super AMOLED display with a screen resolution of 360x360 pixels and a pixel density of 302ppi shown in "Fig.4.4".

Figure 4.4 Display the information

V FUTURE OF MOBILE COMPUTING

From the term "mobile computing" we all know what is mobile. We then divert to mobile phones or small portable devices. But if you really talk a walk in the world of mobile computing, you will be amazed with the diversity in mobile computing. At one point of time, devices like computers, communication devices, and cameras were not so mobile. All these devices years ago were too big and heavy to be transported. For example, the First-Generation Computer called the ENIAC which was very heavy and huge, it used vacuum tubes and was somewhat rather unreliable. In today's world technology, has improved in every way from size, weight, reliability, to mobility. Today we have mobile compact computers known as laptops and compact mobile smartphones, digital cameras and so much more technology. All the information that we need is literally at our fingertips with all the technology we have today.

These are the kinds of technology we have in our era today. Everything became smaller and more complex. These are the mobile computing we have today. If we are talking about the future of mobile computing, there are still many more kinds of technology to be discovered and created. The limit of technology is unlimited. There is no stopping technology. Today mobile computing is used by everyone as a day to day necessity. Everything around you today is mobile computing, and mobile computing has a very bright future. If we look at what the future of mobile computing be, there is already studies being carried on the theory of cyborgs. Researches has predicted that by the year 2025 there will be 6 devices per human on the planet. This means everyone will be carrying 6 different kinds of devices with them. Many mobile computing companies have ideas on new products for the future. For example, Sony's 2020 Cell phone, or the Nokia Morph shown in "Fig 4.5".

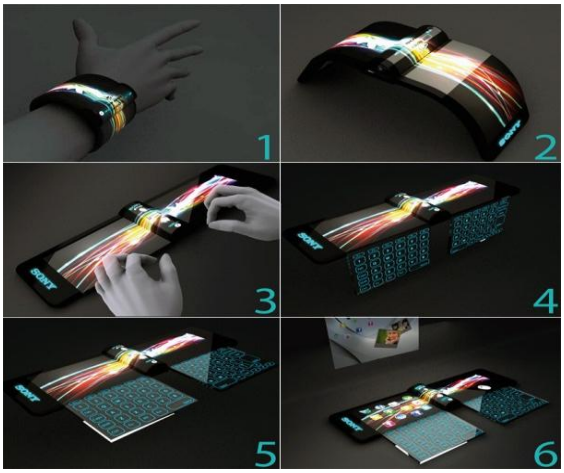


Figure 4.5: Sony's 2020 Cell Phone **Figure 4.6: Nokia Morph**

In all these new future technologies, we are looking at hologram technology, extremely durable devices, new futuristic software and interface and even futuristic looking devices. And the evolution of technology is moving at an incredible speed. Where else there are also the positive and negative impacts of mobile computing shown in "Fig.4.6".

VI LIMITATIONS OF MOBILE COMPUTING

Mobile computing may be able to change the future, although mobile computing does have some limitations. Some of the limitations that mobile computing comprises of is -:

- Insufficient bandwidth
- Security standards
- Power consumption
- Transmission interference
- Potential health hazards

All of the mentioned are the limitations of mobile computing.

6.1 Insufficient Bandwidth

Insufficient bandwidth is when the mobile internet is way slower than the direct cable connection. Nowadays mobile phones use technologies such as 2G, 3G, or 4G LTE to use the internet without the need to be near a wireless LAN network. But the mobile internet service tends to be more slow than the wireless LAN network. This can also be affected by the range of cell phone towers. If your phone is not in range with cell phone towers, your mobile internet service will not function. The wireless LAN network which is inexpensive, more reliable and much faster may seem like a better option, but its only limited and can be accessed only in the certain area.

6.2 Security Standards

Security standards also seem to be a limitation to mobile computing. No matter how advance security system may be, there will always be a loophole to breach it. When mobile computing advances, so does hackers. Hacker will continue learning about the new security systems and find ways to breach it. Security standards will always be a limitation to mobile computing. But researcher and software engineers are still trying to find way to improve the security systems for mobile computing. With the technology hacker have in today's world, they can easily know your personal details, your location, bank details, some can even control your device without you even knowing at all.

6.3 Power Consumption

All devices today need a source of power to function for example, a mobile phone runs on a rechargeable battery, and a computer runs on direct electricity from a power outlet. Everything needs a source of power, and this is a limitation of mobile computing. Power is not always available everywhere. When your mobile phone runs out of battery life, and there is no power outlets to charge it, you will be stuck with a dead phone until you find a source of power. To overcome this limitations, users can purchase back-up power banks. Power banks are portable batteries that can be used to charge phone or most mobile devices.

There are also other ways to overcome this problem, like purchasing a high quality battery that lasts for a very long time. Most of the ways to overcome this limitation is costly ways because you have to purchase 3rd party devices to help you solve your problem.

6.4 Transmission Interferences

Transmission is a very important part of mobile computing. Without signal transmission, you cannot connect with others or you can't even link yourself with the outside world. But there is always going to be an interference of transmission in mobile computing and this is a limitation which can't really be solved. Interference can be caused by something blocking the signal, or by another device or signal interfering with the signal. That's why the use of

mobile devices is not allowed in airplanes because the signal produced by the mobile phone can interfere with the plane's positioning system and can cause a lot of complications. This limitation is solved by having the airplane mode feature on mobile devices, so users can still use their mobile phones for entertainment with their mobile phones on airplane mode.

6.5 Potential Health Hazards

There are a lot of health hazards caused by mobile computing. This is quite a dangerous limitation of mobile computing. In the first place, a lot of people in today's world use cell phones on a daily basis. And this could end up badly when they use it while driving or walking on the street. Countless number of road accidents happen every day because people are distracted by their mobile phones while driving or crossing a street. It is against the law to drive while using a mobile phone. Other than accidents, mobile computing can also cause health problems to a person who is in front of screens too much. Being in front of a computer screen too much can cause eye problems and is the cause of people wearing glasses in today's world. Other than screens, it has also been proven that signals emitted from a mobile device can also cause health problems. It is even said that keeping a mobile phone in the front pocket of your shirt is a bad idea as it can cause damage to the heart. There are ways to overcome this limitation which is by controlling the usage of mobile devices in a day and making sure your eyes are not too close to any screen while using a mobile device.

VII CONCLUSION

To conclude everything, there are many factors to mobile computing and the future of mobile computing. Mobile computing may bring a lot of advantages and a lot of improvement to human life, but with all good things there is always a price to it. There are the disadvantages to mobile computing and limitations. But mobile computing will further continue to move on and evolve more. In the future, we are looking at the use of cyborgs and human like androids, cars that drive themselves, holographic technology on mobile devices and a new era of technology. With the evolvement of mobile computing, many future objectives can be achieved. And maybe in the future technology will be created to eliminate the limitations of mobile computing.

VIII ACKNOWLEDGMENT

The authors would like to share thanks to Mr Umapathy Eaganathan, Lecturer in Computing, Asia Pacific University, Malaysia for his constant support and motivation helped us to participate in this International Conference and also for journal publication.

REFERENCES

[1] Neil Willis, 1993. Computer Architecture and Communications (Computer Studies Series). 2 Sub Edition. Alfred Waller Ltd

[2] CCM. 2016. What is WiFi and How Does it Work?. [ONLINE] Available at: http://ccm.net/faq/298-what-is-wifi-and-how-does-it-work. [Accessed 06 December 216].

[3] zeenado. 2011. apple-iphone-touch.jpg. [ONLINE] Available at: http://zeendo.com/info/wp-content/uploads/2011/11/apple-iphone-touch.jpg. [Accessed 22 September 2016].

[4] Behind The Scenes Of Mobile Computing Success. 2016. Behind The Scenes Of Mobile Computing Success. [ONLINE] Available at: http://www.fieldtechnologiesonline.com/doc/the-scenes-of-mobile-computing-success-0001. [Accessed 14 September 2016].

[5] BGR. 2016. iPhone 7: AirPods Wireless Headphones | BGR. [ONLINE] Available at: http://bgr.com/2016/09/07/iphone-7-airpods-wireless-headphones/. [Accessed 14 September 2016].

[6] What is Mobile Computing | IGI Global . 2016. What is Mobile Computing | IGI Global . [ONLINE] Available at: http://www.igi-global.com/dictionary/mobile-computing/18821. [Accessed 12 September 2016].

[7] CCM. 2016. What is WiFi and How Does it Work?. [ONLINE] Available at: http://ccm.net/faq/298-what-is-wifi-and-how-does-it-work. [Accessed 06 December 2016].