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A BRIEF STUDY BETWEEN VARIOUS SPECIAL PURPOSE COMPUTERS WITH GENERAL PURPOSE COMPUTERS WITH ITS DETAILED DESCRIPTIONS

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ABSTRACT

From this paper, the investigation taken place on the two types of computer categories, which are the general-purpose computers and the special-purpose computers. Along with that, a brief explanation on the history of computers and its remarkable evolution to current day smart computers. Suitable examples and illustrations are provided to touch the minds of readers. Comparisons between the two computer categories are also covered in an attempt to enlighten readers on computers they may encounter in their daily lives. Hence 3 general purpose computers and 7 special purpose computers were investigated for the future study.

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Keywords: Computer Architecture, General Purpose Computer, Special Purpose Computer

I. INTRODUCTION

1.1 Epigraph

When Charles Darwin came up with the theory of evolution, he proposed that humans, both males and females evolved from a species of apes. In his book *'The Origin of Species'* he wrote about the nature of this evolution and how life has its own way of making modifications to its creatures. He wrote and I quote, "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved" by Darwin in 1859. Fast forward to the present day, many has labelled his writing as absurd and are still skeptical towards his theories despite being the fastest growing generation in terms of technological advancements. Like it or not, the fact that there are new models of smartphones released each year shows how far humans have evolved. Our capacity to think and innovate on present technological commodities shows we are capable of correcting and improving the basic form of past inventions and come up with new and better devices.

1.2 First Generation Computers

Most people are unaware of the essentials computers play to our daily lifestyle. From the complexity of NASA's Pleiades Supercomputer to the simplicity of our television remote controls, now everything is just a click away by NASA. But operating computers was never always this easy. The first ever electronic computer built, which was the Electronic Numerical Integrator and Computer (ENIAC), took around two years to manufacture between the years 1943 and 1945. It weighed up to 30 tons, as heavy as 20 Toyota Corollas and it was almost 1800 ft^2 in size. First generation computers, such as the ENIAC, were built based from vacuum tubes as its circuitry and magnetic drums as its memory, whilst not having any operating systems.

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1.3 Subsequent Generations

But like any other success stories, the ENIAC had its ups and downs. Manufactured with an estimated 18,000 vacuum tubes, the ENIAC now has 18,000 chances of failure. Along comes the Second Generation of Computers, one that uses transistors instead of vacuum tubes and the very firsts to have memory technology (RAM). Over the course of the next year or two, computer advancements were rapidly being carried out and improved. During the 1950's, devices such as the CSIRAC, EDSAC and Mark I, was introduced as stored-programmed computers and are also sold commercially. The next generation of computers, the third generation, introduces us to the invention of integrated circuits (IC). Jack St. Clair Kilby, an engineer at Texas Instruments, was patented for the invention of integrated circuits in 1958. Kilby's integrated circuit features a single transistor and a support based made out of a semiconductor, germanium. The introduction of semiconductors has resulted in a massive improvement in computer speed and efficiency. It has also allowed for a smaller built size and are capable of running multiple programs at a time. The third generation of computers were a landmark phase in computer technology.

II. Classification of Computers

Modern day computers are so complex and advanced that it is applicable to almost every appliance that we are a custom of on the daily basis. In this paper, we will discuss the main differences of computers in which it is divided into two categories, general-purpose computers and special-purpose computers. Computers such as our desktops, notebooks, smartphones and tablets fall under the bracket of the general-purpose computers. They are the ones that executes the most common computing tasks and its functions are broad. Whereas, machines such as our X-ray machines, ultrasound machines, cars and automated teller machines (ATM) fall under the bracket of the special-purpose computers. These types of computers are more specific and less broad. They only perform the required tasks needed for that machine. Also, being discussed in this paper, are the functions and working principles of each machine and its computers. For the likes of the general-purpose computers, the function and working principles are similar. Whereas, for the special-purpose computers, the function and working principles varies for every machine. Therefore, different computer systems are being applied.

2.1 GENERAL-PURPOSE COMPUTERS

When talking about computers, the first thing that comes to mind is our laptops and desktops. Little do we know that computers are actually more than that. Computers can be found in almost every single machine that we use on a daily basis, classified into two groups, general-purpose and special-purpose computes. The common misconception towards computers is that many regards us of using general-purpose computers more than special-purpose computers. But, in truth, we are using as many special-purpose computers daily, if not more, compared to general-purpose computers. In this section, we will be discussing the different types of general-purpose computers together with its working principles, construction and applications on a daily basis.

2.1.1 THE WORKING PRINCIPLE

There are a few computers that fall under this category, of which are very familiar to us. Personal computers, which includes laptops, desktops, smartphones and tablets are all examples of general-purpose computers. Computers that are classified as general-purposes are usually those that are capable of performing a variety of

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tasks simply with the aid of specific softwares, programs and applications. But most importantly, a computer will not be able to perform its task without the aid of an operating system. All computer based machines, may it be general-purpose or special-purpose, require an operating system to function. Without it, the machines have no way to communicate with the computers softwares and programs. An example of an operating system would be Microsoft's Windows 7 operating system which is majorly used in desktops and laptops.

2.2 SPECIAL-PURPOSE COMPUTERS

Special-purpose computers usually go under the radar, compared to its general-purpose counterpart. This is because, majority of people these days are not aware of the different categories of computer systems. And even if they are made aware of this, they would still consider the special-purpose computers to be rarely used on a daily basis. Little do they know that these special-purpose computers are in abundance in their everyday lifestyle. In fact, it is likely that we own more special-purpose computers in our house compared to general-purpose computers. Washing machines, calculators, televisions, electric ovens and automatic gates are just a few examples of a special-purpose computers that we can find within a household.

2.2.1 AUTOMATED-TELLER MACHINES (ATM)

As the world has already come to know of it, the Automated-Teller Machine (ATM) is used to withdraw cash instantly and at our convenience. Not only that, we are also able to check bank balance, perform transfers between other accounts and many more. Basically, all the task that were once done in bank offices, can now be done at a particular machine. There are two types of ATM's being used today; The Leased-line ATM and the Dial-up ATM machines.

2.2.1.1 THE WORKING PRINCIPLES

One may ask, "How does a machine, situated some distance away from the nearest bank offices, contain our bank account information and allows for easy transaction?" this has never been the case though. The first ATM machines were place on the bank premises to allow for easy record keeping and surveillance. But ATM's now a day uses the services of a host processor. The McGraw-Hill Dictionary defines a host processor as "The central computer in a hierarchical distributed processing system, which is typically located at some central site where it serves as a focal point for the collection of data, and often for the provision of services which cannot economically be distributed" [1]. With the aid of the host processors, ATM machines are now able to connect and communicate with those using the services. And together with the host processor comes the Internet Service Provider (ISP) which basically functions to supply internet connection to the teller machines shown in "Fig.1".

Figure.1 ATM machines of various bank companies are now widely used and can be found almost everywhere [2]

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2.2.2 GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System or better known as the GPS is a satellite-oriented navigation instrument that comprises of 24 satellites specifically placed to orbit the planet by the US government. Its uses vary from weather forecasting to vehicle navigation devices. Although it was first launched by the US for military purposes only, they soon made it available to civilians around the globe mainly for navigational purposes. Little do people know, the GPS is also considered a special-purpose computer as it fulfils the criteria of one, being specific and direct in operation.

2.2.2.1 THE WORKING PRINCIPLES

The basic working principle of a GPS is that one of the many satellites orbiting the planet will be able to track down our position and the "Fig.2" shown it. At least 3 satellites will be orbiting over a specific radius of the planet with each one transmitting information about its position at the current time. Signals travelling at the speed of light will be intercepted by the GPS receivers of each satellite to determine the distance between the object and the satellite and the time took for it to be intercepted. With the three-other satellite undergoing the same process, the GPS receiver can now pinpoint the location with precise accuracy. The more satellites there are over that specific radius, the better the accuracy.

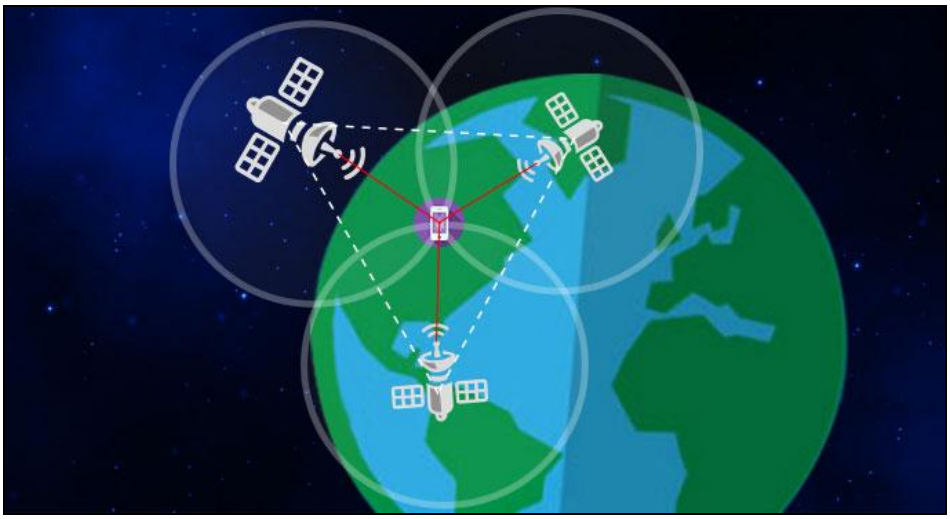

Figure.2 Satellites orbiting Earth acts as GPS [3]

2.2.3 CAR ALIGNMENT SYSTEM

When speaking of cars, one would assume that the engine is the most important part of the car. Some would even go on to say that they feel hypnotized by the motion of beating pistons, the purring engine and the speed of the car itself. Little do they know, that the tyre is the most important part of the car. Without tyres, our cars are not able to travel smoothly. With every rotation on the gravel, the whole car shacks and jumps. Not only that, a faulty tyre is at risk of endangering the lives of people on board the car. A broken axel and a deflated tyre could cause the driver to lose control of the car, thus resulting in an accident. Therefore, the car alignment system is very important in ensuring the tyres are properly aligned and free from any faults to ensure a safer and more comfortable journey. In this modern day, there are countless companies that specialize in tyre alignment machines and many other models of machines, as to focus on just one, which is the Hawk Eye Elite Alignment Premium System by Hunter Engineering Company [4].

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2.2.3.1 THE WORKING PRINCIPLES

The Hawk Eye Alignment Machine uses four precision cameras as to measure the current position and orientation of the tyres. These cameras detect target pieces mounted on the tyres by spring-loaded arms that acts as the grip. Once the cameras detect any no uniformity, the mechanic will then make required adjustments to the wheel specifically at the various suspension angles.

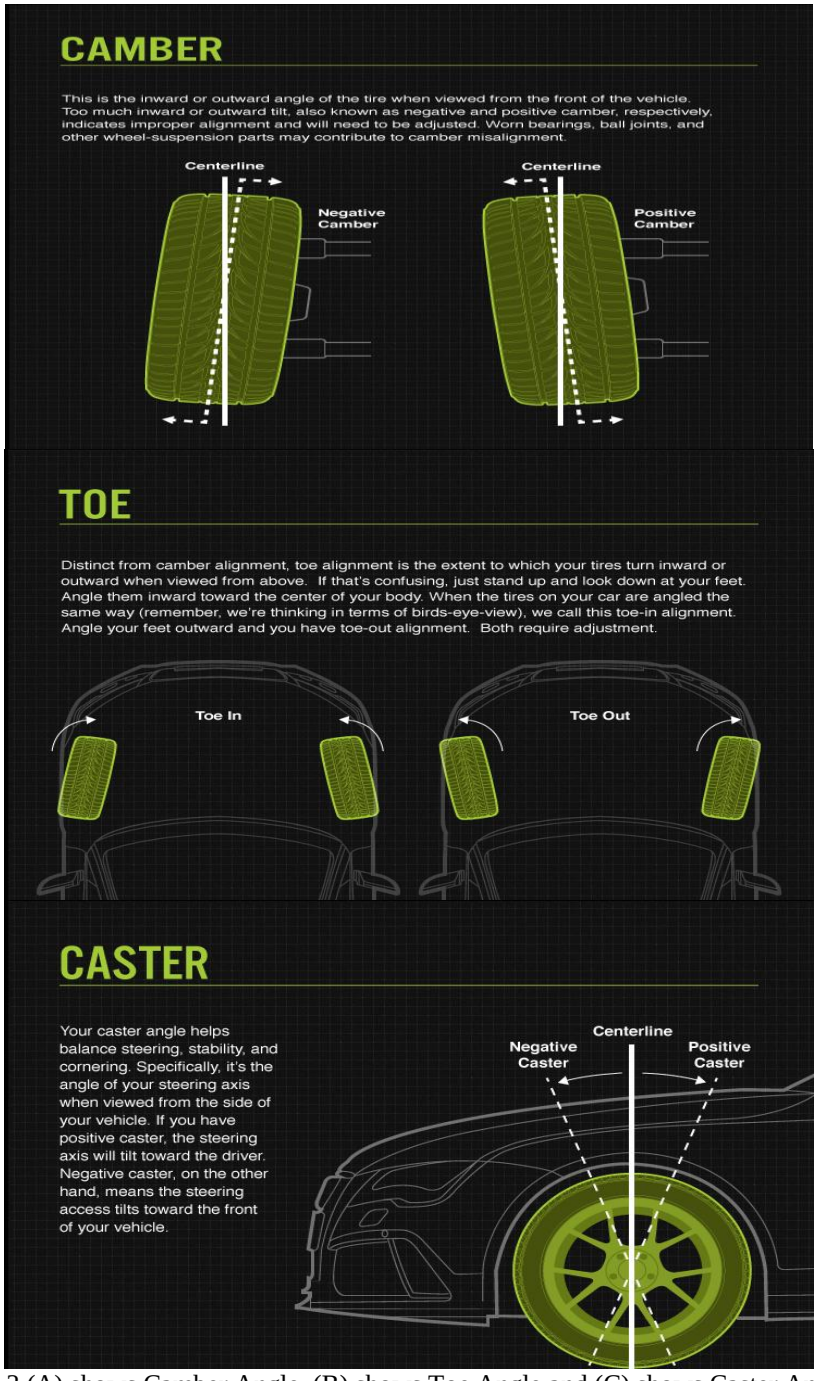

Figure.3 (A) shows Camber Angle, (B) shows Toe Angle and (C) shows Caster Angle [5]

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2.2.4 X-RAY MACHINES (GAMMA RAYS)

The healthcare industry has benefitted a lot from the field of engineering. Although some may consider the healthcare industry better than any other field in the world, the truth is that this industry will suffer dearly if it not for the marvels of engineering. As children of our beloved planet, we must learn to respect and coexist with one another in order to make the world a better place. One of the main contribution of engineering towards the healthcare field is the introduction of X-ray machines. With the introduction of this contraption, health officers are now able to identify the extent of certain injury without having to assume and thus being able to avoid any misdiagnosis. Not only that, X-rays are also being used in other fields such as security and food production. In this section, we will only focus on the contribution the X-ray machines have on the healthcare industry.

2.2.4.1 THE WORKING PRINCIPLES

Just like the light that we are exposed to on a daily basis, X-rays are also a type of light ray. But unlike the light that we are used to, which are visible light, X-rays are a type of invisible light. Just to get the picture, other invisible lights include, infrared of TV remotes and microwaves of the ever-reliable microwave oven. And just like visible light, invisible light too travel through space and makes its way into earth's atmosphere. Similar to how the flashlight emits visible light from an electricity source, the challenge now is to create or generate X-rays to be used and manipulated in the healthcare field shown in the following "Fig.4".

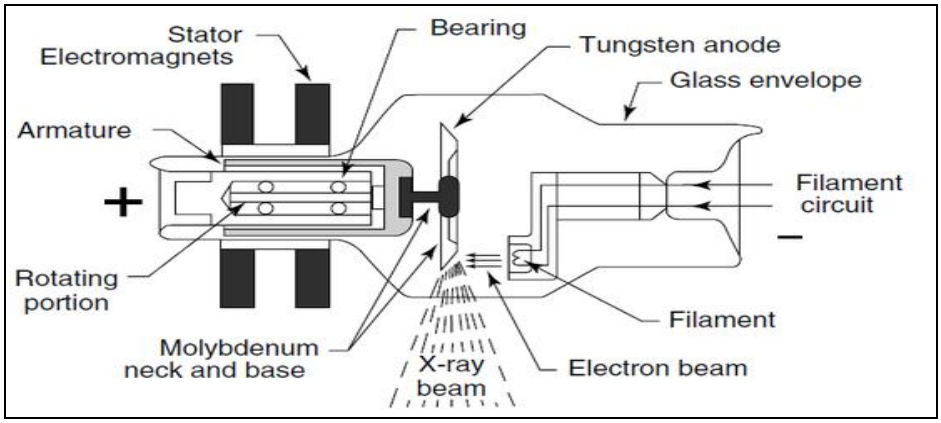

Figure.4 Working Principles of an X-ray [6]

2.2.5 VENDING MACHINES

Vending machines, a child's favorite piece of technology. Invented in the 1880's as a postcard dispenser, vending machines now dispense more than just letters with scenic backgrounds for our long-distance flings. It dispenses items such as soft drinks, chocolate bars, sweets among many other long lasting food products. These machines are popular amongst people from any age group but it is particularly even more popular amongst the young ones. The fact that they are easy and fast to operate, draws children to easily get their favorite snacks from these machines. The sort of snacks that their mother will not usually let them have. Of course, they are pros and cons that comes along with the invention of the vending machines but which invention does not. The "Fig.5" shown a sample vending machine.

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2.2.5.1 THE WORKING PRINCIPLES

I believe that everyone is aware of the ways to operate a vending machine. How hard can it be if a young child could operate it? Truth be told, it is actually much more complex than what your average neighborhood 9-year-old makes it look. Most vending machines will guide you through the process of purchasing any of their products by consolidating us that '3 simple steps' is all it takes. Now let's break down those '3 simple steps' and really study what happens behind the scenes.

Figure.5 An Old Coil Vending Machine and when emptied revealing the coils [7]

2.2.6 SMART HOME

'Home Is Where The Heart Is', at least that is how the expression goes. One may be accustom to items such as smartphones and smart TV's, so what exactly is a smart home? Similar to its sister devices, a smart home is also control by a central processing unit. To shed some light to the topic, a smart home is a residential house which electrical appliances are control by a central control unit. Devices such as lights, thermostats, TV's, entertainment systems, even doors and windows are able to communicate with one another through this central control unit. All these devices are also capable of being controlled from a remote location via remote controls. The idea of the smart home has provided families with better comfort, security and convenience at all times. If one wishes to have a smart home, they are required to install them independently as there are no homes that come built with this system installed onto it. Therefore, there are various companies that offers various systems of smart homes and thus each system is different.

2.2.6.1 THE WORKING PRINCIPLES

The control system of a smart home functions via three different methods which are, wired, internet or Wi-Fi controlled and computer based shown in the following "Fig.6". The wired method is mostly limited to only

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lightings and thermostats as companies are unable to install too many wires into an already built house. The internet or Wi-Fi controlled are able to control the entire system of the house wirelessly and are also remotely controlled. While the computer based control required a computer to operate and control it and whenever the user wishes to control it remotely, they are required to plug it into a power outlet. Table 10 below shows the methods of control and its differences.

Figure.6 (Clock-wise from left) Thermostat Unit, Smart Hubs, Lighting, Security Cameras[6]

2.2.7 TRAFFIC LIGHTS

Traffic lights were first invented in 1868 at London's House of Commons at the intersection of George and Bridge Street, one of the busiest streets in London. Prior to that, cars were not even invented. Even if there were cars, it was not many enough on the streets to cause a congestion. Although the first traffic lights were not electrically powered and controlled, modern day traffic lights are fully controlled by computers and powered by electricity. The famous three colours of traffic lights were not always as so. the early traffic lights only have two colours which are red and blue. The colour of lights are the same globally to create a uniformity and thus enables us to recognize it anywhere we go.

2.2.7.1 THE WORKING PRINCIPLES

One may wonder how a traffic light changes its lights regularly and sequentially. This is due to part of the traffic light that is made out of counter IC's. What the IC does is it counts the number of sequence in a series. Moving to the specifics, one IC will be in charge of controlling the period and sequence of the traffic lights, may it be red, yellow or green, shown in the following "Fig.7". A timer acts as a pulse generator which gives an input to the IC. This timer will give time of a specific light shown. It is this timer that controls whether the red light is on for say 30 seconds or the green for 60 seconds. It controls the time period of one light being shown at the time.

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The amount of time given for each light colour can be control by the user with the potentiometer. By playing around with the potentiometer, one can vary the amount of time for each light.

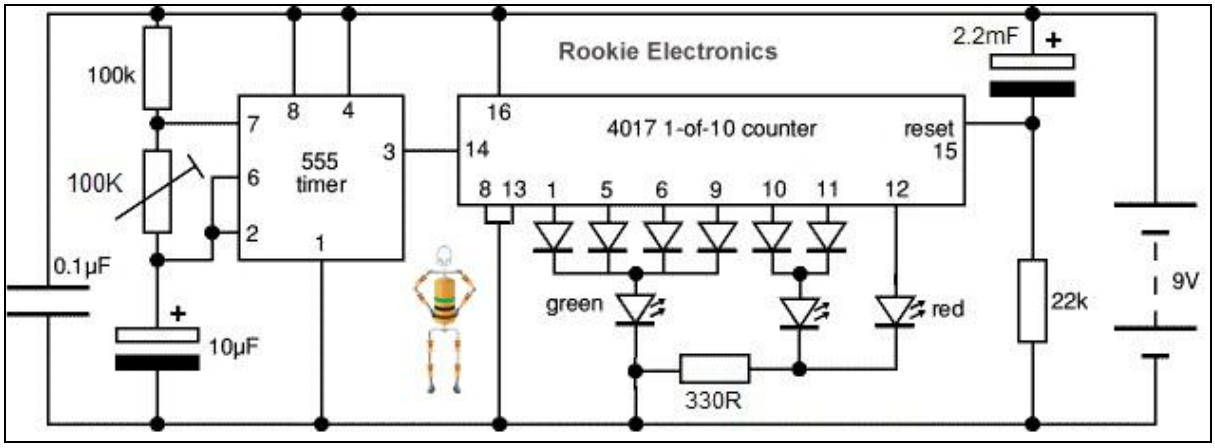

Figure.7 Schematic for the Electrical Design of a Traffic Light

III. COMPARISONS

Computers are growing at an immense pace that keeping up to date to current devices are impossible. Take the Apple iPhones for example, they release an updated version each year and to be realistic, one is not required a change of phones every year. Computers have become such an essential tool in our daily lifestyles, even adolescents feel that they are due one. For the young ones, owning such devices are tolerable, but one must also be able to distinguish and made aware of that computers are much more than just smartphones where they can socialize. "Table.1" below explains the differences between special purpose and general purpose computers.

ASPECTS	GENERAL PURPOSE	SPECIAL PUPROSE
Functionality	• Able to perform multiple task. • Flexible in everyday use.	• Specific functionality. • Able to perform one or two task only.
Availability	• Easy to get. • Available in all major retailers.	• Pre-order required. • Available only through specific order or requests.
Insurance	• No insurance or licence required.	• Some may require insurance and licences.
Cost	• Relatively cheap. • Instant purchase.	• Expensive. • Paid in instalments.
Production	• Produced in bulk. • Similar built	• Produced in small amounts. • Each computer may vary according to client's requests.

Table.1 Comparison between General purpose and Special purpose computer

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IV. CONCLUSION

The human brain ceases to amaze us, the capability of one to invent and innovate and nailing the physics behind it, the evolution of computers throughout time is just as impressive as Darwin's Theory of Evolution. Although Darwin's proposition is on God's will, and God is Almighty, the very fact that one managed to invent computers just by the connections of a few billion neurons in our brains is mind boggling. History aside, the growth of modern day technologies has enabled us to expand our knowledge and understanding of the world we live in. Everywhere we go, everything we see, are supported by computers. Smartphones, desktops, even our electric bullet trains all involves computers. With the classification of computers into these two categories, our everyday technological enhancements are able to function faster and more efficient. With general computers, one is only getting the fundamentals of a computer. It is able to perform multiple tasks and orders at an instance. This may come in handy for someone that wishes to perform multiple tasks on a computer, people such as students and teachers. But for those who wishes to perform only one task on a computer, special purpose computers are what they need. An electrical engineer working in the commuting industry, may require a computer that only powers the train and nothing else. Using a general-purpose computer may not be as fast and efficient as using a special purpose computer and therefore, special purpose computers come into play. With a special purpose computer, the engineer may now program the computer to instruct it to only control the train coaches and nothing else. As a closure, computers have helped us in so many ways imaginable. From saving lives in hospital, to sending man into outer space, we have a lot to be grateful for. Computers are not only prime evidence of the brilliance of the human brain, but its constant evolution shows what we, the human race, is really capable of handling tasks.

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REFERENCES

[1] Hendee, W.R. and Ritenour, E.R. (2002) Medical Imaging Physics, 4th Edition, John Wiley & Sons, New York.

[2] Steitz, B. (2006) Brief History of Computer. [Online]. Available at: http://people.bu.edu/baws/brief%20computer%20history.html [Accessed: 20 December 2016].

[3] T han, K. (2015) Live Science. [Online]. Available at: http://www.livescience.com/474-controversy-evolution-works.html [Accessed: 20 December 2016].

[4] Dunbar, J. (2016) Pleiades Supercomputer. [Online] Available at: https://www.nas.nasa.gov/hecc/resources/pleiades.html [Accessed: 20 December 2016].

[5] Agnihotri, N. (2014) Engineers Garage. [Online] Available at: http://www.engineersgarage.com/articles/global-positioning-system-gps [Accessed: 20 December 2016].

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[6] Operations, B.A.T. (2016) Tire alignment: What you need to know | Bridgestone tires. [Online]Available at: http://www.bridgestonetire.com/tread-and-trend/drivers-ed/tire-alignment [Accessed: 20 December 2016].

[7] Museum, C.H. (2015) Bell Laboratories. [Online]. Available at: http://www.computerhistory.org/timeline/computers/ [Accessed: 20 December 2016].