

Development of Electronic Circuits

Adel Ahmed Almubarak

ABSTRACT

There are various types of circuits in electronics engineering which are designed to perform certain tasks. Circuits are very useful in every stage of a machine designing. The work also requires a skilled professional who handles these tasks to produce an efficient output. The circuits involve various component which is brought together to produce a single gadget. They can either be mounted on motherboards or designed on a chip called integrated circuits.

Keyword: *discoveries, Electronics components, motherboards, Electronic circuits, working principles, application, circuits' protection, conclusion, and recommendation.*

I. INTRODUCTION

Development of electronics circuit has changed dramatically since its invention. Much has been achieved, and more is still invented. The development of electronic circuits has been the process of advancement of electronics design since the invention of electronic circuits until the current generation. This application of electronic circuits is a symbolic method of demonstrating how the components connect jointly in a simpler version that is much easier to understand. Our eagerness to know how this component is connected is essential since it helps us to understand about electronics circuits.

Electronic circuits may consist of complex structures, even though they are governed by the very same laws of electronics engineering. As a result of the following research concepts, it gives elaborated ideas concerning the current technology which uses simple chip circuit to perform a big task on a given machine. The circuit has different components in which electric current flows through it. In other words, it is a complete system with input source and output source. Some have feedback, and such circuits are the best in designing amplifiers because an amplifier may have a distorted output. Therefore, it should be fed back to the input to produce a steady and good output. Wires are used as well in designing circuits such as jumpers which are essential in connecting parts which are far apart.

This essay will investigate and elaborate the construction and development of electronic circuits until the current world. It will also explain the application of electronic circuits in various fields of Information technology, automotive, medicine, defense, robotics, entertainment, and telecommunication. Most electronic gadgets nowadays use semiconductor components to carry out electron command. Components such as passive and active components will be studied in relation to how it is being used in various circuits in electronics

engineering. Invention of transistors and its impacts in circuit design

The 20th century is the period where solid-state electronics began, with the discovery of transistors in the year 1947 making the beginning in an exploration of various components in electronic. It was in 1956 when transistors were invented by Shockley William, who termed it as Shockley Semiconductor and he asserted that "the component could be used in most electronics circuits" (17). This led to the development of a business of silicon transistors. By then the use of transistors in regard to vacuum tubes was evident for many appliances; it was only essential to make transistors consistent and cheap, but Shockley changed his innovative objective, turning his focus to a further semiconductor component he had discovered while at Bell Labs which was a typically a four-layer diode perhaps useful in cellular phone controls but not much else. We have some companies which fabricated electronics components like the Fairchild Semiconductor, to keep on pursuing the silicon transistor. Luckily at Fairchild, there was a various demonstration of a complete circuit made up of semiconductor material. At this company, one could see the manufacturing of a complete circuit to a certain extent than just a single transistor. Bob invented the circuit manufacturer which has led to the current invention of computers chips.

The new integrated circuit components did not find a good market since they were expensive. Users were worried as well using the single transistors, capacitors, diodes, resistors, and other electronic circuit components because it could not be tested to ensure their consistency. Also, integrated circuits of those days were less, and they interrupted with the commercial business of home industry that usually belonged to the circuit designer at the client's company.

As a result, Noyce made a determining contribution that "silicon transistors were to be fabricated in large quantity for commercial purpose as

well as designing integrated circuits” (263). He produced a large variety of circuit and put the cost at a lower price than the way the customer could buy one component such as transistors, in this case, he introduced an IC. This enhanced the development of the commercial market of ICs in industries which further led to fewer expenses in manufacturing companies. Since then the expenses have decreased due to more experts who invents more discoveries regarding the improvement of circuits’ fabrication. Consequently, it has been realized that that the electronic gadgets with high performance in today’s world will be replaced with the one with much higher performance with low expense tomorrow.

Passive component

To begin with this research, it is important to know various components which are used in electronic. One of these components is passive components. The passive component is comprised of resistors, capacitors, and inductors. This component has been named as passive components since they are not capable of amplifying or processing an electrical circuit. On the other hand, this component is very important in any circuits since it assists in various functions of other circuits.

In analyzing these components, there is an important fact which one should know about its functions. The resistors are components which oppose the flow of current. The opposing forces are termed as a resistance of a material which is measured in Ohm. Most resistors are made up of carbon with the mixture of various semiconductor materials. The capacitors, on the other hand, are components which are used to store electrical charges and are released when needed. The SI unit is Farad. Farad is a person who invented the capacitor.

Capacitors behave like resistors, and they can be designed as fixed or variable capacitors. There is some various type of capacitors which include ceramic, mica paper, air gang and electrolytic. Ceramic, mica paper, and air gang are mainly used in designing radio frequency circuits while electrolytic capacitors are used in amplifiers and power supply units. An inductor is another passive component which produces inductance The SI unit for measuring inductance is henrys (H). It is also categorized as fixed and variable. It is mostly used in various circuits which include transmitters and radio receivers. An inductor is responsible for changing electric current to electromagnetic waves in transmitters and changing of an electromagnetic wave into electric current in radio receivers. Inductors are also used in designing power supply circuits, and it is majorly used in rectification of alternating current to direct current. It works with electrolytic capacitors to smoothen and remove alternating signals for the steady DC output voltage.

Active components

Active components are mostly used in electronic circuits. These components are classified into two types. And they include tube devices and semiconductor devices. Semiconductor devices have many advantages over tube device and are now widely used in various fields in electronics circuits. Such component includes diodes, transistors, thyristor triodes, and so forth. Most of this components are used to amplifier signals in this case transistor are used to amplifier audio and radio frequency signal. They are also used as switches, for example, a thyristor is one of the components which is used as a fast switching device in electronic circuits. Components like Zena diodes are used to regulate voltage in power supply circuits.

Analog circuits

Electronics circuits are composed of digital and analog circuits. An analog signal is a continuously inconsistent signal. It is different from a digital signal in that small difference in the signal change is meaningful. Analog signals are generally referred to as a continuous electrical signal with varying time. Conversely, mechanical, hydraulic, pneumatic and other arrangements may also use analog signals. The word analog entails an analogy linking the cause and effect of input energy and output energy, input current and output current, Input sound and output frequency.

Another way of transmitting analog signal is through modulation. In such state, some base signal, for example a sinusoidal carrier wave containing one of the components, is changed. The process of changing the amplitude of a sinusoidal voltage is called amplitude modulation, and this is mainly done by varying the input source for example frequency. In most cases, analog circuits in every aspect do not incorporate quantization of information into digital signals. The idea being deliberated over the circuit, whether sound, temperature, pressure, light, or beyond the limit, remains the same. Most analog electronic machines, such as radio receivers, are made from a few types of fundamental circuits.

Analog circuits use a constant range of voltage as compared to distinct intensity as in digital circuits. The number of dissimilar analog circuits so far work out is huge, since a circuit can be distinct as anything from a solitary component to various classification holding thousands of electronics components. Nowadays analog circuitry can use digital or even microchip system for better performance. This kind of circuit is generally called mixed signal to some extent, and it employs either digital or analog.

Digital circuits

Digital electronics has been described by Lazar as “signal having two numbers state, low and

high which use electronic logic gates” (96). The gates include OR gate NAND gate, X-OR, and flip-flops. In such circuits, the logical values are low and high which is represented by two dissimilar voltages, 0V for low and +5V for high. In the same way, numbers are generally represented in binary form using two dissimilar voltages to stand for zero and one.

Digital electronics has a difference from analog electronics which is characterized by continuously changeable quantities like sound pressure using continuously changeable voltages. Digital electronics has been employed mainly in designing the modern processors and digital communications systems. The massive composition of digital logic circuits with millions of logic gates are built in one integrated circuit as in the case of CPU chip, and these circuits can carry out millions of tasks per second. Digital skill is useful since it is easier to obtain an electronic device which acts as a switch in a numerous number of unknown states which continually produce a range of different values. Digital electronics is typically made from a large assembly of logic gates with a simple electronic knowledge depicted by a Boolean logic utility.

Construction of circuit using (PCB) and the components

A circuit with improved technology has a printed circuit board an electronic circuit is made up of definite electronic elements, which includes inductors transistors, diodes, capacitors, and resistors, linked by conductive wires which enable the current to pass through it. Usually, every electronic circuit is mounted on motherboards which have various conductive partway which jointly function to perform a specific function, for example, changing of electromagnetic wave to sound in radio receivers

Application of electronic circuits

Electronics circuits are used in different fields of engineering which includes Automotive, IT, telecommunication, medical, defense system, industrial application, entertainment, and robotics. It has assisted in improving this field and as a result, life has become simple.

Automotive engineering

To begin with automotive, it requires the “understanding of the electrical operation and electronic systems” Santini (216). Often heat radiating from automobile engine is seen after the vehicle has been driven for a particular distance. This is because of power train scheme of automotive electronics with a locomotive or internal ignition or motor as one of the sub-systems working with high heat more than 125 degrees Celsius. The application of power electronics with devices such as silicon-based power MOSFETs and IGBTs which are used as power electronic control switches in the power train system of locomotive electrical and electronic systems are essential to

decrease the overall size. In addition, managing thermal matter in which a high power of kilowatts ranges is being used is essential in improving fuel effectiveness.

Power electronics circuits’ applications are extended to different fields such as automotive utility systems electrical, commercial, telecommunication, residential, industrial aerospace, transportation, and so forth. In the case of automotive electronics circuits, the electrically generated structures are used in automobiles such as road motor vehicle like telemetric, in-car entertainment systems, carpenters, and so on. The requirements to control the engines of automobiles begin in automotive electronics for proper controlling of the machine.

Automotive electronics is categorized into different forms: locomotive electronics, communication electronics, chassis electronics, dynamic safety, and driver support passenger comfort and entertainment devices. For any control system such as DC/DC or DC/AC or AC/DC, the control electronic like regulators, gate drivers, converters and so on is necessary. Usually, based on the automobile or power supply units manufacturer insist on the analog or digital controllers which are selected such that the subsequent parameters including expenditure, integration, consistency and flexibility are taken into concern.

Application of control electronics circuits in the automotive power production system offer an automotive alternative with better efficiency and high power, alongside with high temperature holding up the capacity and high-power density with a range of research in constructing the alternators with switched mode power electronics circuits’ applications. The normally used alternator in motor vehicle applications is Claw-pole kinds of an alternator since it is suitable for the necessary needy performance. Field and armature characters of the alternator are improved by the use of control electronics circuits. These alternators are used in the vehicle to supply electricity to the batteries and electrical system as well as the energy run. A motor vehicle alternator needs a power electronic voltage regulator to produce a steady voltage at the battery terminals which modulates a small field of current.

Circuits are as well used in diverse DC to DC conversion which is accessible to be used based on the requirement. These circuits are classified as isolated and non-isolated circuits which are approved in control trains systems. The use of power electronics in switching has conveyed an idea of soft-switching where the controls are subjected to small stress using an LLC or resonant mode. The soft-switching, highly consistent and extended life converters are very helpful in the automotive electronics marketplace. The converters are bi-directional for example 400v to 12v

for electric motor cars and 48v to 12 for hybrid or combustion engine motor cars.

The onboard Charger (AC/DC) also employs the use of electronic circuits motor cars with automotive electronics which consist of battery cells needed to be charged. For the charging to take place, the AC supply should be converted to direct current. Generally, the power is stored in batteries in the form of direct current. The conversion of AC TO DC can be done by the use of power electronics using converters known as rectifiers. The use of power electronics circuits is increasing with the progress in technologies in automotive electrical and electronics systems which improve the overall system effectiveness with high working temperature, increasing flexibility, consistency as well as to decrease the overall size of the circuit fabrication.

Entertainment and communication

The availability of economical and rapid means of communication has paved the way for the development of various nations in the world. In the first few years of the 20th century, the electronics circuits were mainly used in the fields such as telephone and telegraph. Now with the invention of radio waves, messages can be transmitted from one point to another without the use of conductive wires. Radios and television broadcast uses radio waves to transmit signals through entertainment and also in communication. In this case, electronic gadgets are mostly used to receive and transmit such information and are aided by the use of electronic circuits.

Defense applications

Defense applications are fully controlled by electronic circuits. RADAR instruments which are radio detection systems which range in the various field of electronics engineering are the product formed from circuits. With the assistance of radar gadgets, it is possible to detect and find a different location where an enemy using an aircraft is located. Radar and anti-craft weapons are also linked by an automatic control device to produce a powerful, complete system.

Industrial application

Electronics circuits are mostly used in various sections in industries which include control of depth, quality, and heaviness and moisture substance of a material. Electronic amplifier circuits are also used to amplify signals, and for this reason operation of automatic door openers, power structure and safety devices are controlled. Electronically controlled devices are also used to heat and weld various metals in the industries. The most common use which is very important is for generating electricity in power station which produces thousands of megawatts power which are mostly controlled by a small gadget and circuit system.

Medical services

Doctor use electronics system in diagnosing and treating various diseases. The machine such as X-rays, ECG, in other words, Short wave diathermy component and oscillographs are among the instruments which are commonly used in the field of medical science. The application of this electronics circuits in various instruments in medical science has extremely increased, and it has become useful in saving the life of human beings from various ill which affects them.

Information technology

In information technology, electronics circuit has boosted a lot. Applications for integrated circuits in computers have been made with a varied imagination of every designer. Within limits, whatever that can be designed and constructed with discrete components can be put into a single IC. Logic, video processors, Audio amplifier, frequency encoders, switches, radio memory and decoders are just a few examples which use logic gates. The array of IC applications is immense and growing every day. Linear circuits constantly have variable output hypothetically able to achieve infinite figures of stages that depend on the signal input intensity. As the term entails, the output signal stage has a linear role of the input signal intensity. In an ideal operation, when the direct output is graphed alongside the direct input, the plot becomes visible as a straight line. Linear integrated circuits are used to make radio amplifiers as well as audio amplifiers.

Digital ICs functions in a distinctive levels or states, to some extent over a permanent array of amplitudes signal. These gadgets are used in processors, computer arrangement, modems, as well as frequency counters. The primary building stages of digital circuits are logic gates, which functions with binary information, that is, signals which have two dissimilar states, called low with logic zero and high with logic one. One of the main applications is the calculation. Computers which had thousands of transistors have been reduced to a handful of ICs. The initial computers that were big as the size of a building are now made smaller in nearly every way like laptops and even handheld computers since the use of IC has become common.

As the development of ICs continues, the design expenses and production expenses of equipment are dropping. It is consistent since large parts of the ending product are enclosed in single packages, reducing the assembling errors, connection problems and the size of circuit boards. Today it is rare to see any electronic apparatus that doesn't have at least one IC. Definitely, some have only one IC and need no other mechanism of any kind. The genuine answer to the issue is to look around. Wherever

electronics are used, there is perhaps an IC mounted inside.

Many integrated circuits can be established in almost all electronic devices. They work as temperature sensors timers, calculators, logic units, counters, amplifiers, and radio receivers. Integrated circuit System which is part of chip presents a memory blocks, logic and input and output devices around the peripheral, microchips with a visibility window on the integrated circuit placed inside. It should be noted that the fine silver-colored wires join the chip to the pins of the package. The window permits the memory data of the chip to be erased out, by a contact to high ultraviolet light in an eraser gadget

Robotics

Electronics circuits have been used in construction of robots called intelligent machine. And in this case, the term machine should be used to refer to artificial intelligence. The research plan commonly referred to as artificial intelligence has been outdated by cognitive science, device intelligence, and neurosciences as well. Artificial intelligence began in 19th century with the use of an electronic component in the circuit to store information as well as performing a command in computability person intelligence, (Turing Alan). Digital processors were seen as an intelligent gadget not just as a calculator but as a machine which is able to stand for the real world throughout a symbolic system in its internal circuitry. Repeated breakdown to design a software or hardware structural design using this information processing and physical representation system theory of the intelligence led to the final relocation of the field in control.

Cognitive science has no precise interest in the physical arrangement of the brain, but it is instead paying attention on how thought is processed and utilized. Machine intelligence inquiries about designing machines and the expression used refers to computers or other applicable hardware circuit components which demonstrate an intelligent behavior. All this machine assist human beings in performing a heavy task such as the construction of motor cars, industrial pieces of equipment and general machines which are used in many fields in our society. Protection of electronics devices

Electronics circuit must be protected to enhance its efficiency and its durability as well. Power guard is used in the gadgets to moderate the flow of current to work at a content level. Regulators are also used, and a good example is T7812 which regulates the amount of voltage fed to the circuit and protects the circuit from being damaged. There is a constant electrical movement which goes from the supply to the load in an electrical circuit. Most electronics gadgets are designed in a complex form, but the power protector is simple in construction.

The power guard is normally a superior circuit which uses simple components like regulator ICs to protect the gadget. An irreversible virtual circuit (PVC) is efficient circuits which present the best part by guaranteeing that the two points are connected without reversing it to the initial point. This criterion facilitates the whole system to share the same circuit protector, and as a result of this, all components are protected against the risks of getting damaged. The majority of these gadgets are well elaborated in circuits' diagrams, and the experiments are carried out in labs to prove it. Any electronics specialist must stick to safety measure of electronics components because any increase in electric current passing across such components will bring an immense damage to the whole system.

Electronics engineers also use other methods' to protect the gadgets. Fuses are used to cut the supply of electric current to the circuit in the case where the current goes up. Relays are used as well There are relays designed for 240v and those designed for 12 volts in a case of a power surge, the relay trips and cut off the supply to the circuit and this will assist in protecting the components in the circuit. It should be noted that any slight increase in the supply current to the electronics component will result to damage of such component thus the idea of protecting it should be the priority

II. RECOMMENDATIONS

In today's world, much should be done to improve the technology in manufacturing electronics gadgets with less cost and more efficient. This can be achieved by increasing more learning institutions to gather for a new generation as well as improving more lab test in various manufacturing industries. Children with certain talent should be educated from their childhood, and such children should be taken to a preferred institution so that they can put into practice their career course. The contribution of scientist has helped us invent much in Electronics circuits and engineering in general. Due to the use of electronics telecommunication gadgets have led construction of radio and television receivers. Information is passed from one point to another between the people, and this makes life better. The medium is faster and more reliable, but something should be done to reduce the rate of infrared rays which have long term effect on human beings. Electronics circuit devices have also boosted security in that terrorist can be captured using cameras their voice recorded and transmitted to the intelligent security department something should be done to improve the efficiency as well. The invention of the computer has led to the development of various fields such as the robotic machine which are used to replace of human tasks in the industrial manufacture of goods. It is a great deal, but our new experts should come up with the idea which helps in suppressing and

stopping developing virus since this is a major blow in IT sector. Automotive has been boosted as well since electronics circuits take some percentage in the development of the whole system, but it needs improvement as well. Generally, electronic circuits and electronics, in general, is importance aspect in our daily lives.

The use of a variety of circuits is as well known for its comprehensive and incorporated practice and support of leading-edge research and learning concerning next-generation machine technology as well as gadgets and system structural design in the technology. The division's program, which is based on higher academic research, should permit students to extend research abilities and increase a wide range of advanced awareness in the field of electronic circuits design. The subjects learned must cover all materials and development skill, electronic circuit technology, device technology, information processing and telecommunication technology. The process also should also provide full support to scholars studying masters and those who study doctoral dissertation as well. These wide-range and hard-working research and educational actions will assist students in visualizing flexible ideas and developing an excellent ability for success, thereby encouraging proposal in the generation of new invention technology and research industry in electronics circuits.

III. CONCLUSION

Electronic circuits are a major invention which has led to the development of other sectors of engineering. It has also paved the way for a number of benefits in the fields of IT, medicine, automotive, and robotics, among others. Although its initial release presented difficulties to the then existing systems, the changes done by its inventors created a new world for electronic engineering, which everyone benefitted up to today.

WORKS CITED

- [1] "Robert Noyce." Annual Obituary, 1990. (1991). Print.
- [2] Babbage, Charles, Martin Campbell-Kelly, and Peter M. Roget. *The Works of Charles Babbage*. London: William Pickering, 1989..
- [3] Lazar, Aurel A. 1998 Ieee Open Architectures and Network Programming: 3-4 April 1998, San Francisco, Ca, USA. Piscataway, NJ: IEEE, 2001..
- [4] Santini, Al. *Automotive Electricity and Electronics*. Clifton Park, NY: Delmar, Cengage Learning, 2013.
- [5] Shockley, William. *Imperfections in Nearly Perfect Crystals: Symposium Held at Pocono Manor, October 12-14, 1950*. New York: Wiley, 1972..