Role Of electronics and Communication Engineering (ECE) in Technological revolution

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Abstract

Electronic and communications engineering is the utilization of science and math applied to practical problems in the field of communications. Can we imagine our daily life without mobile phone, laptop (computer), television, tablets, digital watch, internet banking, ATM cards, Wi-Fi, internet connection, microwave Owen and many more gadgets and communication systems. No, we cannot. All these are possible due to **Electronics & Communication Engineering (ECE).** As we look into future, robots will also be part of our lives very soon and embedded electronics which is a sub branch of electronics play an important role in this. All of this makes ECE an interesting field to study and work.[1]

ECE: Electronics & Communication Engineering deals with the electronic devices, circuits, communication equipments like transmitter, receiver, integrated circuits (IC). It also deals with basic electronics, analog and digital transmission & reception of data, voice and video (Example AM, FM, DTH), microprocessors, satellite communication, microwave engineering, antennae and wave progression.[2]

KEYWORDS: *ECE (Electronic and Communications) , GPRS (General Packet Radio Service),Wi-Fi (Wireless Fidelity), GPS (Global Positioning System), LASER (LightAmplification by Stimulated Emission of Radiation)*

Intoduction:

I. Scope: The Scope is very wide open because the world is moving in the field of technology and developments.

1. It has scope in almost every industry like oil, energy, agriculture as every industry and so many other important sectors of economy deal with electronics and computers.
2. Defense, space and other organizations, which undertake research on a large scale basis, employ electronics engineers in developing and designing systems and devices for telecommunication and signal processing.
3. Scope of ECE in various Specializations like VLSI Design, Embedded System, Communication Engineering, Signals and System, Microwave Communications etc.,

II. ECE plays a vital role in Technology Revolution: ECEis one of the largest and fastest growing fields of engineering. **The present Global Technology revolution** is changing the world and is offering challenging opportunities to specifically Engineers. ECE is a subfield of core Electrical Engineering. graduate level.

III. The basic aim of ECE: The basic aim is to produce products that are smaller, smarter and multi-functional.The ability of electronic devices to act as switches makes digital information processing possible

It covers a wide range of applications which make our life easier and enjoyable such as Television, Radio, computers, telecommunication etc.When Alexander Graham Bell invented the telephone and Marconi developed the radio in 19th century, no one dreamt that these two distinct technologies together would create another wonderful product that is Cell Phone which is now part of everybody's life. In 1969, Ted Hoff conceived the commercial microprocessor at Intel and thus the development of the personal computer was made. [3]

Applicationsof ECE: Electronics has made tremendous advancement during last few decades and our day to day life involves the use of electronic devices.This can be proved with the following application of electronics:

A. Wireless Communication:

A **wireless network** refers to any type of network that establishes connections without cables. Wireless connections have many advantages, starting with the fact that you don't need to buy and install cables. Wireless communications use electromagnetic (EM) waves that travel through the air. Electromagnetic waves are analog, while the information in a computer system is digital. Wireless networks therefore need adapters and routers to translate between analog waves and digital signals.

Wireless communication systems can be broken down into three broad categories:

- Short-range wireless communication uses signals that travel very short distances, from a few centimeters to several meters. Examples include Bluetooth, infrared and Zigbee.
- Medium-range wireless communication uses signals that travel up to 100 meters or so. The most widely used type is Wireless Fidelity, or Wi-Fi.
- Wide area wireless communication uses signals that travel quite far, from several kilometers to several thousand kilometers. Examples include cellular and satellite communications.

There are many different devices that use one or more of these wireless communication systems.

a) Smart Phones : The primary wireless connection for a mobile phone is the cellular network that uses cell towers for the transmission between mobile phones and the network. A mobile phone is also referred to as a cellular phone, or simply cell phone. The earliest commercial mobile phones date back to the 1980s, but it was not until the 1990s that they became widely used. Most smartphones can also use the other wireless communication systems, such as Wi-Fi and Bluetooth. [4]

b)**Bluetooth:** Bluetooth technology facilitates the replacement of the cables used to connect one device to another, with one universal short-range radio link operating in the unlicensed 2.45 GHz ISM band. **The main objectives of Bluetooth technology are:**

- Cable replacement
- Small size
- Low cost
- Low power

Bluetooth can imitate a universal bridge to attach the existing data networks, and also as a mechanism for forming ad-hoc networks. Designed to operate in noisy frequency environments, the Bluetooth radio uses a fast acknowledgement and frequency hopping scheme to make the link robust. At the nominal operating range of 10 meters, Bluetooth creates a 10-meter radius bubble around the mobile phone that instantly connects the Bluetooth Personal Area Network (PAN) to an existing Wide Area Network (WAN) such as TDMA, CDMA, GPRS or GSM. Within the PAN sphere.[5]

c) General Packet Radio Service (GPRS): General Packet Radio Service (**GPRS**) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM).**GPRS is** a standard for wireless communications which runs at speeds up to 115 kilobitsper second, compared with current GSM (Global System for Mobile Communications) systems' 9.6 kilo bits per second. GPRS supports an efficient use of limited bandwidth and is particularly suited for sending and receiving small bursts of data, such as e-mail and Web browsing, [6]

d)**Wi-Fi** (Wireless Fidelity) : A wireless network usesradio waves, just like cell phones, televisions and radios do. In fact, communication across a wireless network is a lot like two-way radio communication. Here's what happens:

1. A computer's wireless adapter translates data into a radio signal and transmits it using an antenna.
2. A wireless router receives the signal and decodes it. The router sends the information to the Internet using a physical, wired Ethernet connection.

The process also works in reverse, with the router receiving information from the Internet, [7]

C, **Laser Communications**

LASER is a device that generates an intense beam of coherent monochromatic light (or other electromagnetic radiation) by stimulated emission of photons from excited atoms or molecules. The coherency, highmonochromaticity, and ability to reach extremely high powers are all properties which allow for these specialized applications.
Laser Defense systems established across the world can detect enemy ships and missiles while at the same time disabling them.
Laser communication systems on airport runways can send signals back to headquarters letting officers know when and what planes have landed.
NASA has also developed Satellite-to-Satellite communications using laser communications.

Lasers are used in drilling and cutting, alignment and guidance, and in surgery.[8]

GPS Satellites

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 NAVSTARS placed into orbit by the U.S by Department of Defence. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS. There are wide ranges of applications of GPS on land, at sea, and in the air .

Travellers, sailors and explorers used to find their way using a compass, and by measuring the positions of the Sun, Moon and Stars. Today, all we need is a GPS and when it is switched on it can tell us where we are any where in the world .It will give us a map reference .It also shows our height above sea level, and if we are moving, how fast we are going and in which direction.

D .**Tsunami Warning System**

What is Tsunami? : Tsunami is a Japanese word represented by two words, Tsu-harbor, Nami-wave means a destructive, Ocean riding, gigantic wave created by an under sea disturbance.Tsunami a powerful fast moving wave by an under sea disturbance.

In the early hours of 26'Th December 2004 the world witnessed one of the most devastating natural disasters in the recent times causing the death of nearly 80,000 people. If we had sufficient warning system to give indications ,then we certainly could avoid this much of destruction. With the present technology, even a slight undersea disturbance can be detected by special electronic detectors placed on the sea floor. These signals are picked by the surface buoy, which sends data to satellite for further distribution to ground stations. [9]

E .Embedded Systems

An embedded system is some combination of computer hardware and software that is specifically designed for a particular function. Industrial machines, automobiles, medical equipment, cameras, household appliances, airplanes, vending machines and toys (as well as the more obvious cellular phone areexamples of an embedded system also known as Real Time Computing systems based on RTOS.

In contrast, a general-purpose computer can do many different jobs, and can be changed at any time with new programs for new jobs.An embedded system usually does not have a keyboard or monitor or mouse.For example, a controller is embedded in an elevator and tells the motor to move the elevator to different floors based on buttons that are pushed. [10]

Introduction of Embedded System in Automobiles

Right from to anti lock braking systems (ABS) to automatic traction control to air bags and fuel/air mixture controls, there may be upto 30-50 embedded systems within a present-day car. Embedded systems can also make driverless vehicle control a reality. Major automobile manufacturers are already engaged in work on these concepts. One such technology is Adaptive Cruise Control (ACC).ACC allows cars to keep safe distances from other vehicles on busy highways.

F. Intelligent Traffic Light Control Using Embedded Systems

Present Traffic Light Controllers (TLC) are based on microcontroller and microprocessor. These TLC have limitations because it uses the pre-defined hardware, which is functioning according to the program that does not have the flexibility of modification on real time basis. Due to the fixed time intervals of green, orange and red signals the waiting time is more and car uses more fuel. To make traffic light controlling more efficient, we explore the emergence of new technique called as "Intelligent traffic light controller". This makes the use of Sensor Networks along with Embedded Technology. The timings of Red, Green lights at each crossing of road will be intelligently decided based on the total traffic on all adjacent roads. Thus, optimization of traffic light switching increases road capacity and traffic flow, and can prevent traffic congestions. [11]

G. Barcodes

Bar coding was first used commercially in 1966, but to make the system acceptable to the industry as a whole ,a committee was formed in 1972 within the grocery industry to select a standard code that is today's UPC code (Uniform Product Code)

Bar Codes Basic: A bar code is an optical machine-readable representation of data. Bar codes provide a simple and inexpensive method of encoding text information that is easily read by inexpensive electronic readers. A bar code consists of a series of parallel, adjacent bars and spaces. Predefined bar and space patterns are used to encode small strings of character data into a printed symbol.

A bar code reader decodes a bar code by scanning a light source across the bar code and measuring the intensity of light reflected back by the white spaces. The pattern of reflected light is detected with a photodiode which produces an electronic signal that exactly matches the printed bar code pattern. This signal is then decoded back to the original data by inexpensive electronic circuits.

Electronic Toll Collection

Electronic Toll Collection is a generally mature technology that allows for electronic payment of highway tolls. It takes advantage of vehicle-to-roadside communication technologies to perform an electronic monetary transaction between a vehicle passing through a toll station and the toll

agency. This project is implemented using the innovative technology of Radio Frequency Identification (RFID).RFID is a wireless link to uniquely identify tagsEach vehicle will be provided with an RFID tag. This transponder (tag) stores the unique ID of the vehicle and related information. When interrogated by a reader, it responds with that data over a radio frequency link. The readers are fixed in the toll gates. So when the vehicle comes near the reader, the data from the tags can be easily read by the readers. This data is passed to the computer and thus the cash can be deducted from the user's account. [12]

Defence Applications: Defence applications are completely controlled by electronic circuits. RADAR that is Radio Detection and Ranging is the most important development in electronics field. With the help of radar it is possible to detect the exact location of enemy aircraft. Radar and anti craft guns can be linked by an automatic control system to make a complete unit. Other applications include Communication satellites, missiles, electronic surveillance for cross borders, detectors, drones etc.

Issues:

E-Waste:E-waste includes computers, entertainment electronics, mobile phones and other items that have been discarded by their original users

• E-waste is the most rapidly growing waste problem in the world.
• It is a crisis of not quantity alone but also a crisis born from toxics ingredients, posing a threat to the occupational health as well as the environment.
• In 2012, 42 million computers were discarded.
• Over 2 million old PCs ready for disposal in India.

E-waste: It's implications :

• Electronic products often contain hazardous and toxic materials that pose environmental risks if they are land filled or incinerated e.gTelevisions, video and computer monitors use cathode ray tubes (CRTs), which have significant amounts of lead.
• In addition, many electronic products have batteries that often contain nickel, cadmium, and other heavy metals . Relays and switches in electronics, especially older ones, may contain mercury. You can reduce the environmental impact of your E-Waste by making changes in your buying habits, looking for ways to reuse including donating or recycling. [13]

Future prospectus of Electronics & Communication Engineering

Electronics and Communication engineering opens up great career prospects for the students. The students after completion of the degree can easily avail job opportunities in manufacturing industries and service organizations such as broadcasting, consulting, data communication, entertainment, research and development; and system support.

The opportunities are galore for electronics and communication engineers as they are employed in variety of sectors such as Indian Telephone Industries, Civil Aviation, Development Centers in various States, Defense, NPL, A.I.R, Posts and Telegraph Department, Railways, Bharat Electronics , D.R.D.O, Telecommunication, Software Engineering/IT, Power sectorlike

NTPC,NHPC, Hardware Manufacturing, Home Appliance and VLSI design, Television Industry and Research & Development.[14]

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