VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

ASSIGNMENT REPORT ON

INTERNET OF THINGS (18CS81)

Submitted as subject assignment work,

By

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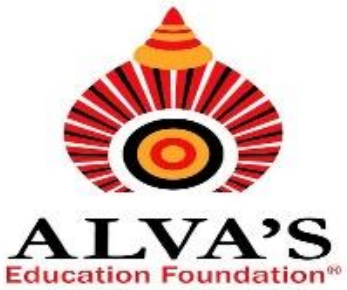

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

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CERTIFICATE

This is to certify that, assignment work for the subject **"Internet of Things (18CS81)"** has been successfully completed and report submitted by SHRADDHA ACHARYA 4AL18CS079 during the academic year 2021–2022. It is certified that all corrections/suggestions indicated presentation session have been incorporated in the report.

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CHAPTER 1

INTRODUCTION

In this project we will control a DC motor with a smartphone via Bluetooth. We will choose Arduino UNO for this purpose. Because it has open-source Integrated Development Environment. The Arduino IDE is a small computing device. It has limited memory, the limited capability of computing. It is a small on-chip computer with limited capability. It is a programmable device. It has RAM and ROM like a computer which is of very small size. We are using the Arduino IDE for the purpose of coding. It is very easy to learn, almost like English. It is very easy to master coding in Arduino IDE. We are using the Bluetooth HC 05 for Bluetooth connectivity. It has connectivity over an area of range 10 meters from it. It the option to both send and receive the information through its connectivity. It acts as an interface between the Arduino and mobile which is used to give commands. It facilitates the sending of a command and controlling the on and off process and speed varying of the fan. Our is the era of confluence of multiple engineering disciplines and is marked by integration of seemingly disparate technologies.

Following this paradigm, in this work, android technology has been integrated to establish secure channel over Bluetooth to provide visual control of speed of DC motor for example. Platforms and ideas developed here are general in nature and it can be used as a chassis to deploy multiple secure and digital hack-free control mechanisms for IoT (Internet of Things) and related networked devices. It is designed to improve the control and management of electrical machines through secure wireless technology. It has various signaling systems which are observed on the Bluetooth, and the micro-controller through the change in intensity of light and fluctuations of light when the change in speed is observed on the mobile app. It is designed in such a way that it can be integrated with robotics, drones, smart buildings etc. These DC Motors are normally used for industrial control, automation, and home electrical appliance. It spans everything from residential washing machines, fans, hand-held power tools, automotive window lift, traction control system, industrial drives and many more. Motor application is not completed without a control system. The inventions of microprocessor and microcontroller make the control system become easier. This control system is basically controlling the switch, speed, and direction of motor. Control signal is generated by a switch that is connected directly to the control circuit. To control and monitor the motor, user need to be at the place where the switch is located.

The major elements used in this system are Arduino UNO, Bluetooth module and DC motor. A 12v transformer powers the entire system. When an android device sends command, it is received by the Bluetooth module, which then sends the commands to microcontroller. Whenever the motor is turned on, it can run in both directions. An LCD is used to display the status and speed of dc motor. To control the signal speed and direction of dc motor, a signal from android device will be sent to microcontroller through Bluetooth module. This signal will be represented by a single direction that

denotes the speed and direction of the motor. Different letters will represent the three directions of rotation i.e., clockwise, anticlockwise and stopping of the motor. This letter will vary the speed of motor with reference to Arduino code. The duty cycle of PWM signal is varied in between 0-255 to change the speed of dc motor. Direction of DC motor is controlled by using H- bridge concept. This system is advantageous as it uses Bluetooth module that consumes less power as compared to other devices providing user-friendly environment. Technically more skilled persons are not required in this system. But the problem is that the usage of Bluetooth module makes the usage only within a short range and usage of android app in smart phone consumes battery.

CHAPTER 2

COMPONENTS USED AND CIRCUIT DIAGRAM

This Chapter contains the brief description about the components used in this project and their description.

2.1 Bluetooth Module

Fig 2.1 Bluetooth Module

Bluetooth serial communication module has two work modes: order-response work mode and automatic connection work mode. And there are three work roles at the automatic connection work mode. When the module is at the automatic connection work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order response work mode, user can send the AT command to the module to set the control parameters and sent control order. The work mode of this Module can be switched by controlling the module PIN (PIO11) input level. In this project Bluetooth module is used to send signals from the Arduino Uno. Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.402 GHz to 2.480 GHz, and building personal area networks.

2.2 Arduino UNO

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. Arduino can be used to communicate with a computer, another Arduino board, or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver

is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are two RX and TX LEDs on the Arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328P also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

2.3 Breadboard

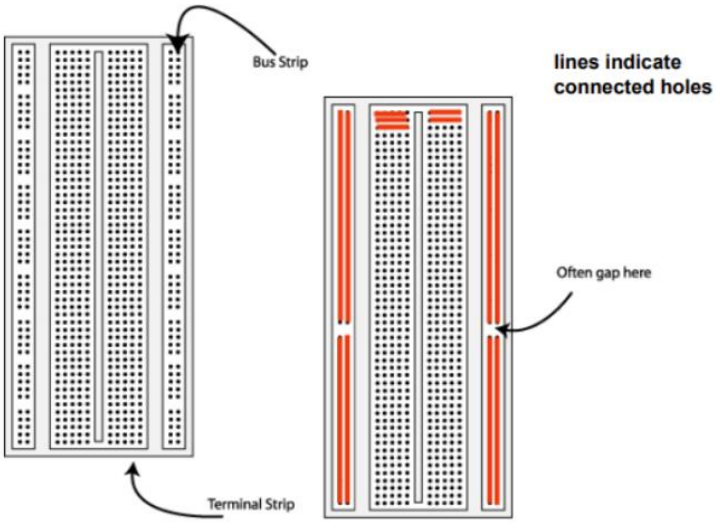

Fig 2.2 Breadboard

Breadboard is a way of constructing electronics without having to use a soldering iron. Components are pushed into the sockets on the breadboard and then extra 'jumper' wires are used to make connections. A breadboard is a solderless construction base used for developing an electronic circuit and wiring for projects with microcontroller boards like Arduino. As common as it seems, it may be daunting when first getting started with using one. The term “Breadboard” comes from a literal piece of wood used to cut bread, which back in the early days, people would build electronic circuits on it. A typical circuit is as seen in the picture above. A breadboard consists of two areas called strips, and are often separated from the middle portion. Bus strips are mainly used for power supply connections Terminal strips are mainly used for electrical components. Each strip consists of 5 pinholes, indicating that you only can connect up to 5 components in one particular section

2.4 Motor

A motor is an electrical device that converts electrical energy into mechanical. Motors are designed to produce rotary or linear motion when their electric current and magnetic field interact with each other which is commonly known as electromagnetic iRotor is the rotating part of the motor that is mainly responsible for delivering the mechanical motion to the shaft or subject attached to it. The rotor comes with conductors that interact with the stator magnetic field to produce the force for turning the shaft. Stator is the stationary part (body) of the motor that is mainly composed of permanent magnet or windings. Laminations made up of thin metal are used in stator core for minimizing the energy losses. Both rotor and stator, come under the influence of the magnetic field that interacts with an electric current. One magnetic field is generated by permanent magnetic and another is generated by the electromagnetic. Bearings are used to make the rotor turn on its axis and are supported by motor housing. Air gap is the distance between the stator and rotor which is made minimum to avoid magnetizing current and negative effects on the performance. Commutator is composed of slip rings that are insulated from each other and are used to toggle the input of the DC motors. Windings are nothing but wires wrapped around an iron magnetic core that are responsible for generating magnetic poles in the presence of electric current.

CHAPTER 3

RESULT

This Chapter contains the snapshots of the expected output

2.1 Bluetooth Module

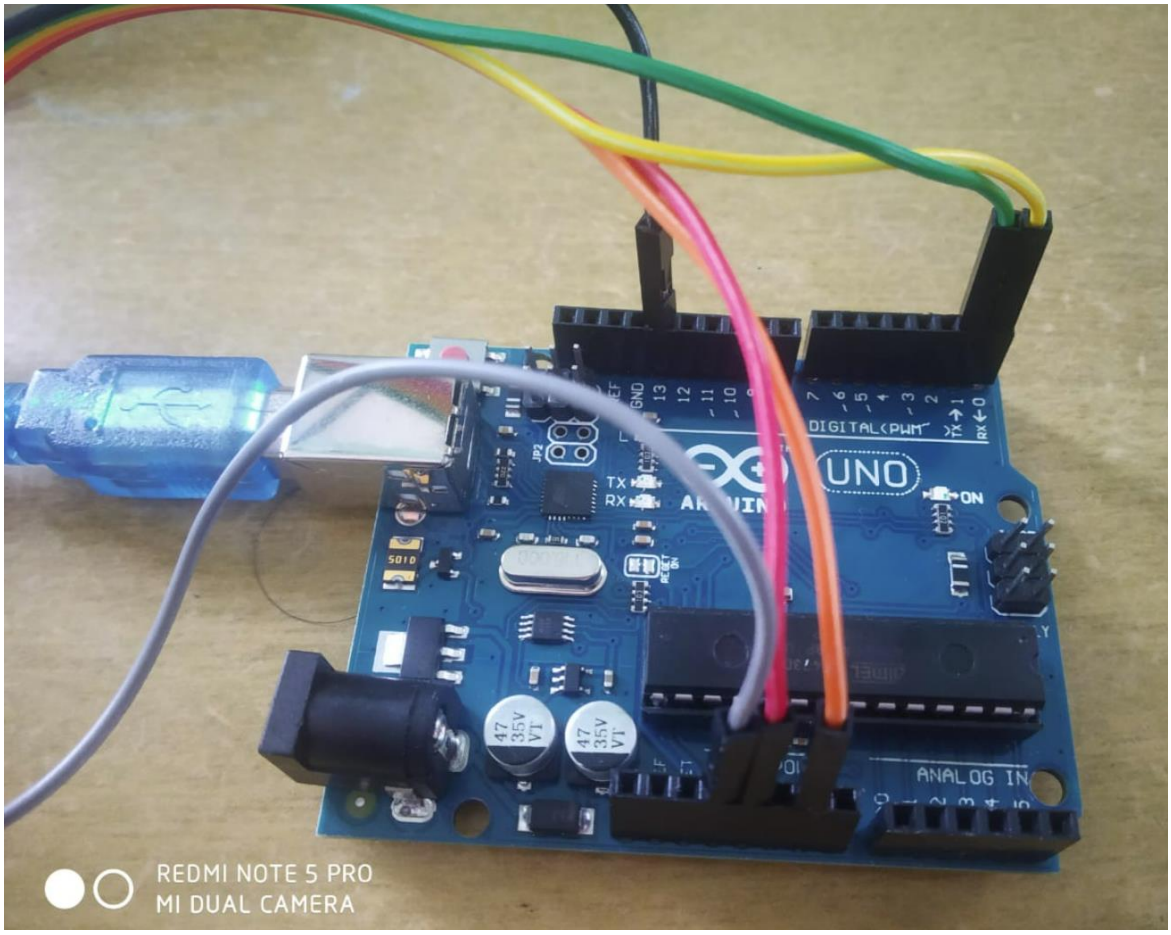

Fig 3.1 Power Supply to the Arduino board

Initially the power supply is given to the Arduino using the transfer cable. Then the Bluetooth module is connected to this Arduino board, the Bluetooth module used here is HC-05 it is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. It has 6 pins namely, key-It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode, VCC: Connect 5 V or 3.3 V to this Pin, GND: Ground Pin of module, TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin),RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module),,State: It tells whether module is connected or not.

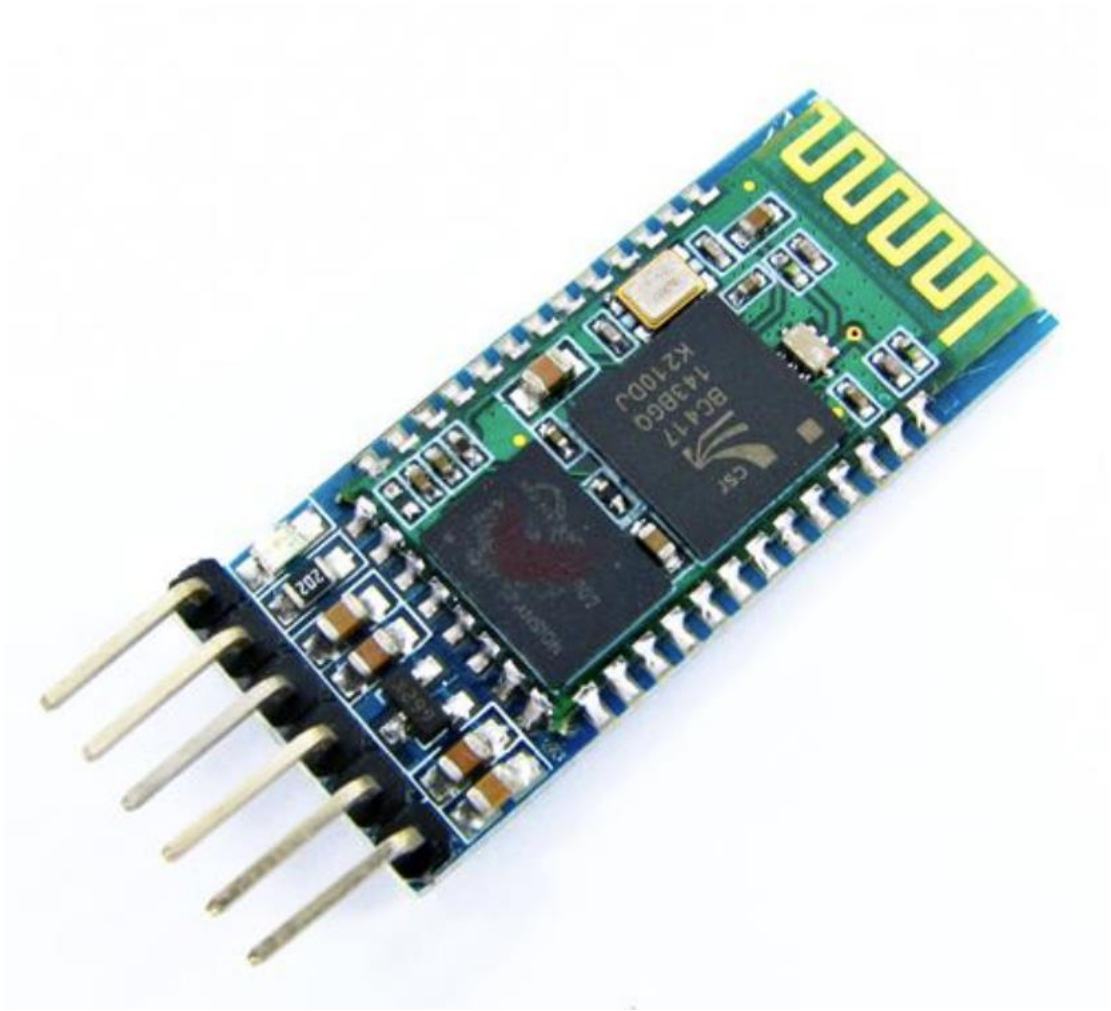

Fig 3.2 Bluetooth Module

The TXT of the Bluetooth module is connected to the RXT of the Arduino board and vice versa. Similarly, RXT of the Bluetooth module is connected to the TXT of the Arduino board. The GND of the Arduino board is grounded using the breadboard. VCC of the Bluetooth module to the 13V of the Arduino Board. HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds. This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module. The motor is connected to the breadboard as the output.

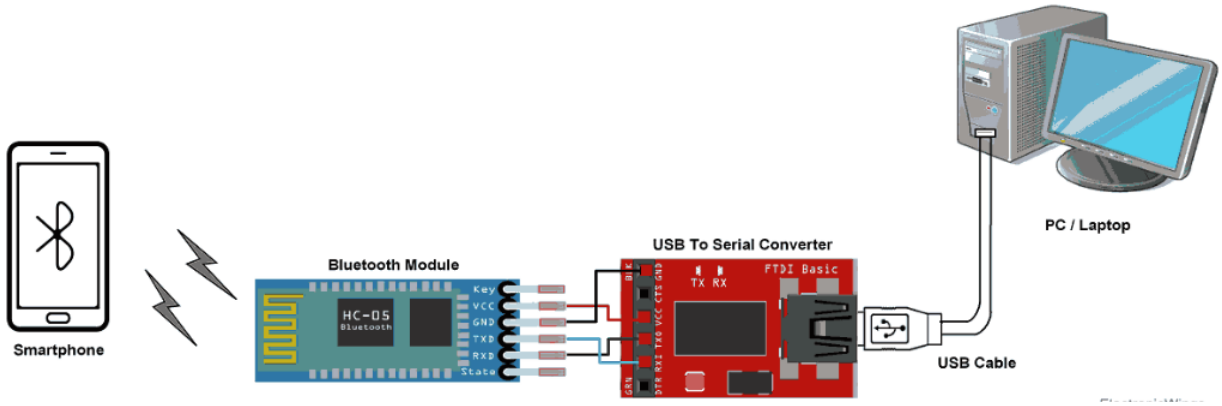

Fig 3.3 Working of the Bluetooth App

To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal application for transmitting and receiving data. You can find Bluetooth terminal applications for android and windows in respective app. store. So, when we want to communicate through smartphone with HC-05 Bluetooth module, connect this HC-05 module to the PC via serial to USB converter. Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication. Pair HC-05 and smartphone: Search for new Bluetooth device from your phone and find Bluetooth device with "HC-05" name. Click on connect/pair device option; default pin for HC-05 is 1234 or 0000. After pairing two Bluetooth devices, open terminal software in PC, and select the port where we have connected USB to serial module. Also select default baud rate of 9600 bps. In smart phone, open Bluetooth terminal application and connect to paired device HC-05. It is simple to communicate, we just have to type in the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05. HC-05 will automatically transmit it serially to the PC, which will appear on terminal. Same way we can send data from PC to smartphone.

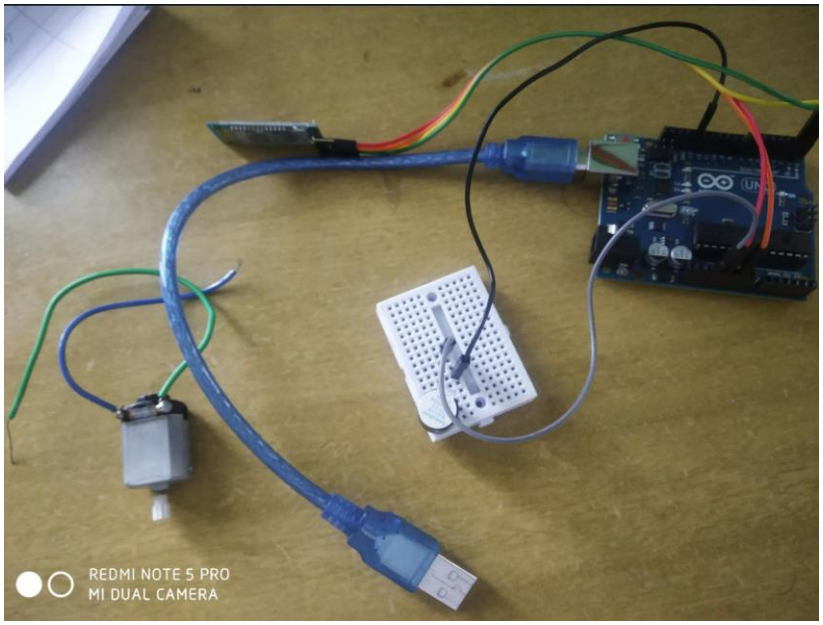

Fig 3.4 Final Circuit

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SEMINAR

Optimizing IP For IOT

Internet of Things will largely be built on the Internet Protocol suite. In coping with the integration of non-IP devices, may need to deal with the limits at the device and network levels that IoT often imposes. Therefore, optimizations are needed at various layers of the IP stack to handle the restrictions that are present in IoT networks. The following concepts take a detailed look at why optimization is necessary for IP.

- Constrained Nodes
- Constrained Networks
- IP Versions

Constrained Nodes

IoT having different classes of devices coexist. Depending on its functions in a network, a "thing" architecture may or may not offer similar characteristics compared to a generic PC or server in an IT environment. Another limit is that this network protocol stack on an IoT node may be required to communicate through an unreliable path. Even if a full IP stack is available on the node, this causes problems such as limited or unpredictable throughput and low convergence when a topology change occurs. Power consumption is a key characteristic of constrained nodes. Battery Enabled with life span of Months to 10 years. Battery-powered nodes impact communication intervals. The Node one that is "always on" instead another option is "always off," which means communications are enabled only when needed to send data. In constrained nodes, the costs of computing power, memory, storage resources, and power consumption are generally decreasing. At the same time, networking technologies continue to improve and offer more bandwidth and reliability.

Constrained Networks

Low-speed connections (like low-speed modems) demonstrated that IP could run over low-bandwidth networks. High-speed connections are not usable by some IoT devices in the last mile.The reasons include the implementation of technologies with low bandwidth, limited distance and bandwidth due to regulated transmit power, and lack of or limited network services. A constrained network can have high latency and a high potential for packet loss. Constrained networks are often referred to as low-power and lossy networks (LLNs). Constrained networks operate between a few kbps and a few hundred kbps and may utilize a star, mesh, or combined network topologies, ensuring proper operations. In constrained network, it is not unusual for the packet delivery rate (PDR) to oscillate between low and high percentages. Large bursts of unpredictable errors and even loss of connectivity at times may occur, where packet delivery variation may fluctuate greatly during the course of a day. Latency and control plane reactivity: One of the golden rules in a constrained network is to "underreact to failure.",Due to the low

bandwidth, a constrained network that overreacts can lead to a network collapse which makes the existing problem worse, Control plane traffic must also be kept at a minimum; otherwise, it consumes the bandwidth that is needed by the data traffic, The power consumption in battery-powered nodes, any failure or verbose control plane protocol may reduce the lifetime of the Batteries, This led to work on optimizing protocols for IoT.

IP Versions

IETF has been working on transitioning the Internet from IP version 4 to IP version 6. The main driving force has been the lack of address space in IPv4 as the Internet has grown. IPv6 has a much larger range of addresses that should not be exhausted for the foreseeable future. Today, both versions of IP run over the Internet, but most traffic is still IPv4 based. Internet of Things has the Internet itself and support both IPv4 and IPv6 versions concurrently. Techniques such as tunneling and translation need to be employed in IoT solutions to ensure interoperability between IPv4 and IPv6.The following are some of the main factors applicable to IPv4 and IPv6 support in an IoT solution:

- Application Protocol
- Cellular Provider and Technology
- Serial Communications
- IPv6 Adaptation Layer

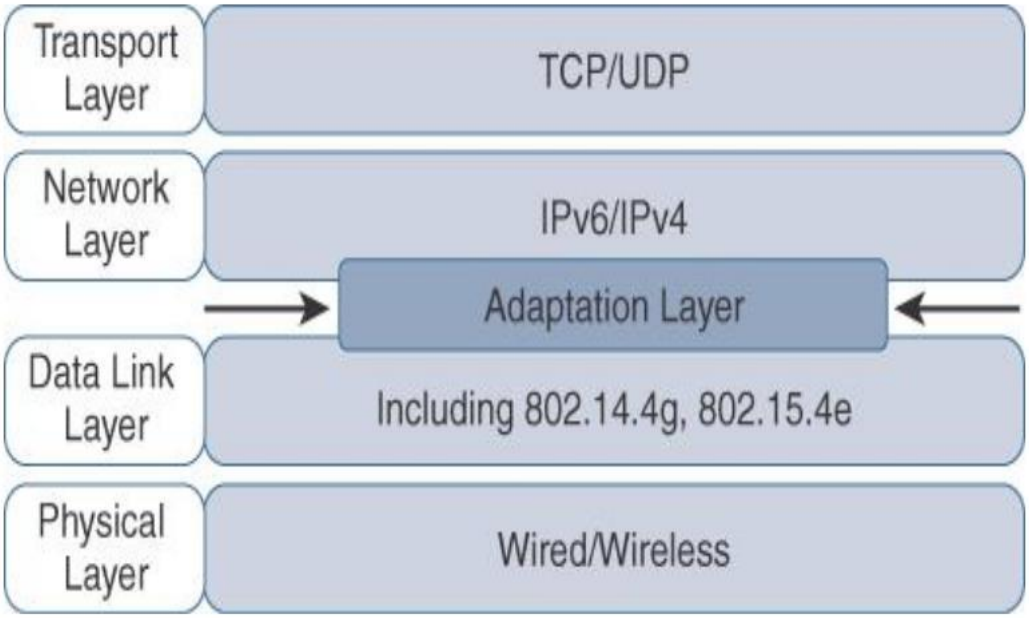
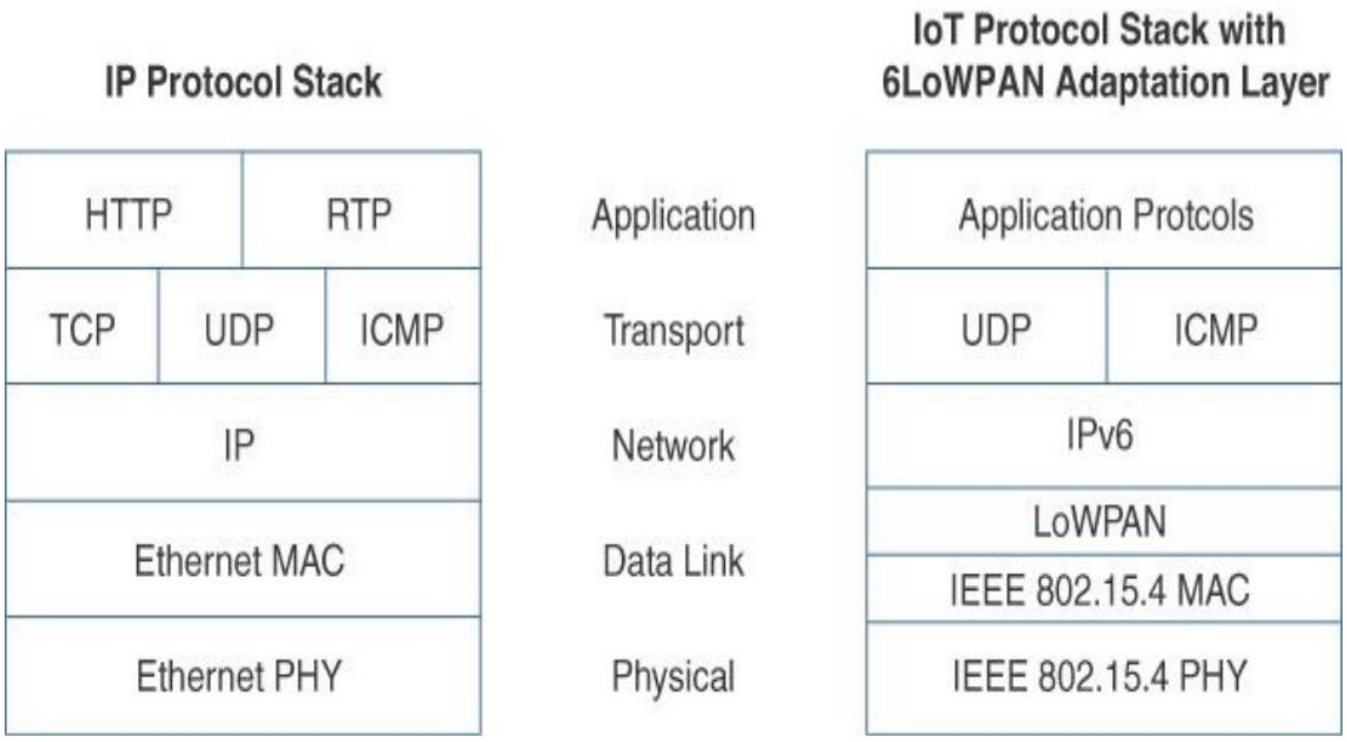


Fig 4.1 TCP/IP Layers

From 6LoWPAN to 6LO

In the IP architecture, the transport of IP packets over any given Layer 1 (PHY) and Layer 2 (MAC) protocol must be defined and documented. The model for packaging IP into lower-layer protocols is often referred to as an adaptation layer. Unless the technology is proprietary, IP adaptation layers are typically defined by an IETF working group and released as a Request for Comments (RFC). An RFC is a publication from the IETF that officially documents Internet standards, specifications, protocols, procedures, and events. For example, RFC 864 describes how an IPv4 packet gets encapsulated over an Ethernet frame, and RFC 2464 describes how the same function is performed for an IPv6 packet IoT-related protocols follow a similar process. The main difference is that an adaptation layer designed for IoT may include some optimizations to deal with constrained nodes and networks. The main examples of adaptation layers optimized for constrained nodes or ―things‖ are the ones under the 6LoWPAN working group and its successor, the 6Lo working group. The initial focus of the 6LoWPAN working group was to optimize the transmission of IPv6 packets over constrained networks such as IEEE 802.15.4



The 6LoWPAN working group published several RFCs, but RFC 4994 is foundational because it defines frame headers for the capabilities of header compression, fragmentation, and mesh addressing