Practical-2

AIM: -Demonstrate the communication modules like BLE, WIFI, XBEE.

BLUETOOTH LOW ENERGY (BLE) :

BLE is a type of wireless communication structured particularly for short-range communication. BLE is intended for circumstances where battery life is favored over high data transfer speeds. There are other factors to consider when designing a BLE IoT device. The user interface (UI) for the device, for instance, can involve built-in buttons and displays as with traditional embedded systems. Alternatively, designs can depend on an app running on a smartphone for its UI. Similarly, a device can use either a mobile phone or a fixed gateway device as its link to the Internet. A BLE module is a fully- contained BLE transceiver with controller and built-in antenna that is preprogrammed to handle all a design's radio interactions. Some modules are available that serve purely as an IO device for a host controller, making the BLE connection the logical equivalent of a serial port for design purposes. Other modules are able to operate in a stand-alone (hostless) manner and make available their processor and other IO resources to developers to run application code, as well. Both module types come pre certified with both the Bluetooth SIG (for interoperability) and various regulatory agencies.

Figure: BLE Module

WIFI

Wi-Fi is the name of wireless technology IEEE 802.11 which is used to connect computers,smartphones and other devices to the internet. Wi-Fi is the radio signal sent from a wireless router to a device, which translates the signal into data. The device transmits a radio signal back to the router, which connects to the internet by wire or cable. A WiFi network is simply an internet connection that's shared with multipledevices in a home or business via a wireless router. The router is connect eddirectly to the internet modemand acts as a hub to broadcast the internet signal to all Wi-Fi enabled devices. There are several versions of WiFi including, 802.11a, 802.11b, 802.11g, 802.11n, and802.11ac. WiFi has the advantage of addressing a very wide variety of profiles because of the proliferation of its family of standards. Hence, it plays an important role in most IoT environments,alone or inter working with more specialized protocols, or with cellular. Some IoT applications, such asvehicular services, or video-based apps like connected security cameras, will need the bandwidth of the wireless broadband network, implemented to enable other requirements like low latency. WiFi is uniquely placed to support broadband and narrowband IoT applications from a common platform thatcan work at varying levels of power consumption and signal range.WiFi has a few notable differences from other wireless technologies. For example, WiFi transmits at frequencies of 2.4 GHz or 5 GHz.These frequencies are much higher than the frequencies used for cellular transmission. Higher frequency means that signals can carry more data.

The next release of 5G standards, Release 16, will prioritize IoT-focused capabilities such as latency below four milliseconds and very high availability, to support emerging cases in the URLLC (ultrareliable low latency communications) category.

Figure - WiFi

XBEE

The Xbee is wireless connectivity modules from Digi International. They do not have anyMicro controller or processor in themselves, so they cannot manage the received or sent data. They cansimply transfer the information they receive. But they can be interfaced with other micro controllers andprocessors like Arduino, Raspberry Pi or PC via serial Interface.Xbee modules are capable of two types of communication – wireless and serial. The wirelesscommunication takes place between Xbee devices so that the devices act as radio frequency (RF)devices. By serial communication, the Xbee modules can communicate with microcontrollers andprocessors. A micro controller, processor or PC can send data through the serial interface to the Xbeemodule (transmitter) and the Xbee module wirelessly transmits the data to another Xbee module (Receiver). The receiver Xbee module transmits the data through the serial interface to controller,processor or PC to which it is interfaced. XBee modules typically come with several antenna options including U.FL, on-board chip, RF pad and integrated PCB.The Xbee modules communicate with each other in two modes – Transparent mode and API(Application Peripheral Interface) mode.

- **Transparent mode:** In this mode, Xbee modules act as serial line replacement. When another Xbee module receives data into the Data IN (DIN) pin wirelessly, it sends that exactly as it receives through the serial interface and vice versa. Incoming packets can either be directly addressed toone target (point-to-point) or broadcast to multiple targets (star).
- **API mode:** Data is wrapped in a packet structure that allows for addressing, parameter setting and packet delivery feedback, including remote sensing and control of digital I/O and analog input pins.

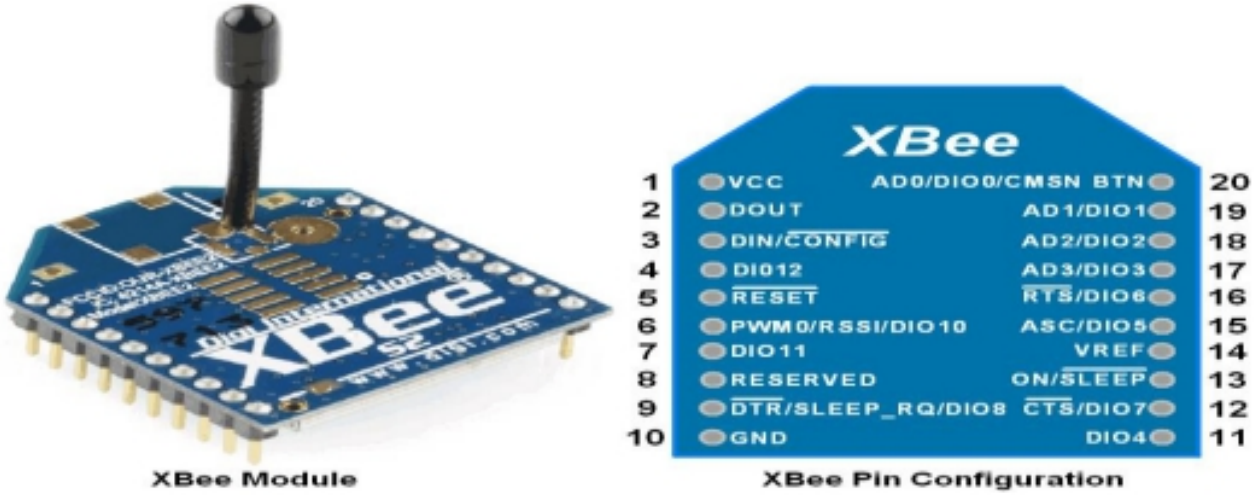

Figure: XBee Module

Practical-5

AIM: Interface Led/Buzzer with Arduino And Write A Program To Turn On/Off Led For Specific Duration.

HARDWARE REQUIREMENTS:Arduino board, Breadboard, LED – any color.
A bunch of male-to-male wires (if possible black, red, and other colors).

SOFTWARE REQUIREMENTS:Window/Mac Operating System and Arduino Software (IDE)

INTRODUCTION TO ARDUINO IDE ARDUINO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turnit into an output - activating a motor, turning on an LED, publishing something online. The board canbe programmed what to do by sending a set of instructions to the microcontroller on the board.

LED:

Light-emitting diode (LED) is a widely used standard source of light in electrical equipment. It has awide range of applications ranging from mobile phones to large advertising billboards. They mostly find applications in devices that show the time and display different types of data

STEP BY STEP INSTRUCTIONS TO BUILD THE CIRCUIT

STEP 1: First, make sure to power off the Arduino – remove any USB cable.
STEP 2: Plug a black wire between the blue line of the breadboard and a ground (GND) pin on the Arduino board.
STEP 3: Plug the LED. The LED has a leg shorter than the other. Plug this shorter leg to the ground(blue line here) of the circuit.
STEP 4: Connect the longer leg of the LED to a digital pin (here pin no 8,). Add a 220 Ohm resistor inbetween to limit the current going through the LED.
STEP 5: Connect one leg of the button to the ground, and put a 10k Ohm resistor in between. This resistor will act as a “pull down” resistor, which means that the default button’s state will be LOW.
STEP 6: Add a red wire between another leg of the button and VCC (5V).
STEP 7: Finally, connect a leg of the button (same side as the pull-down resistor) to a digital pin (here)

CIRCUIT

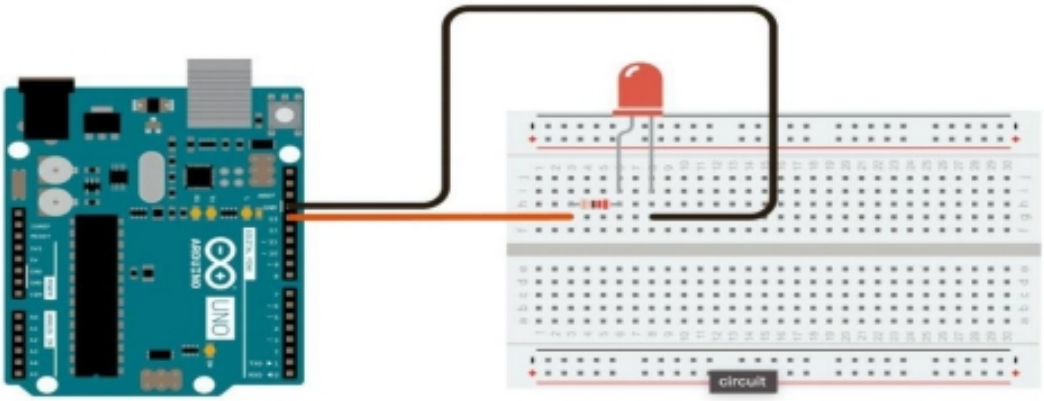

Figure-Circuit Diagram

COMPILER PROCESS

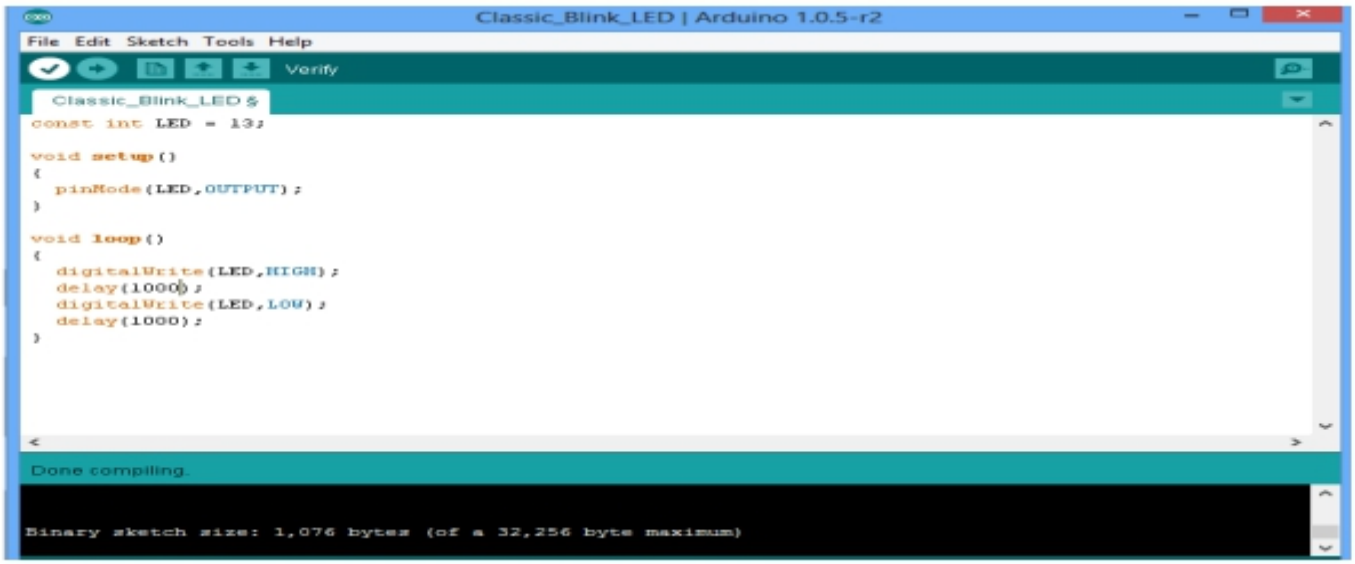

Figure: Compiling of Arduino Blink LED Code

OUTPUTS

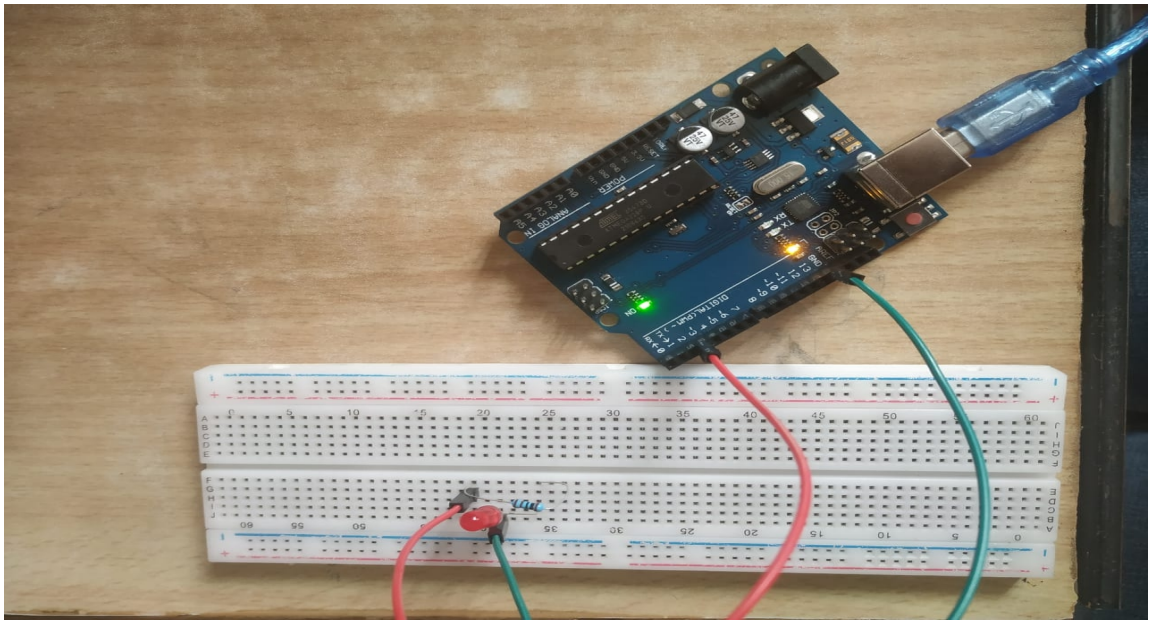

Figure:LED OF

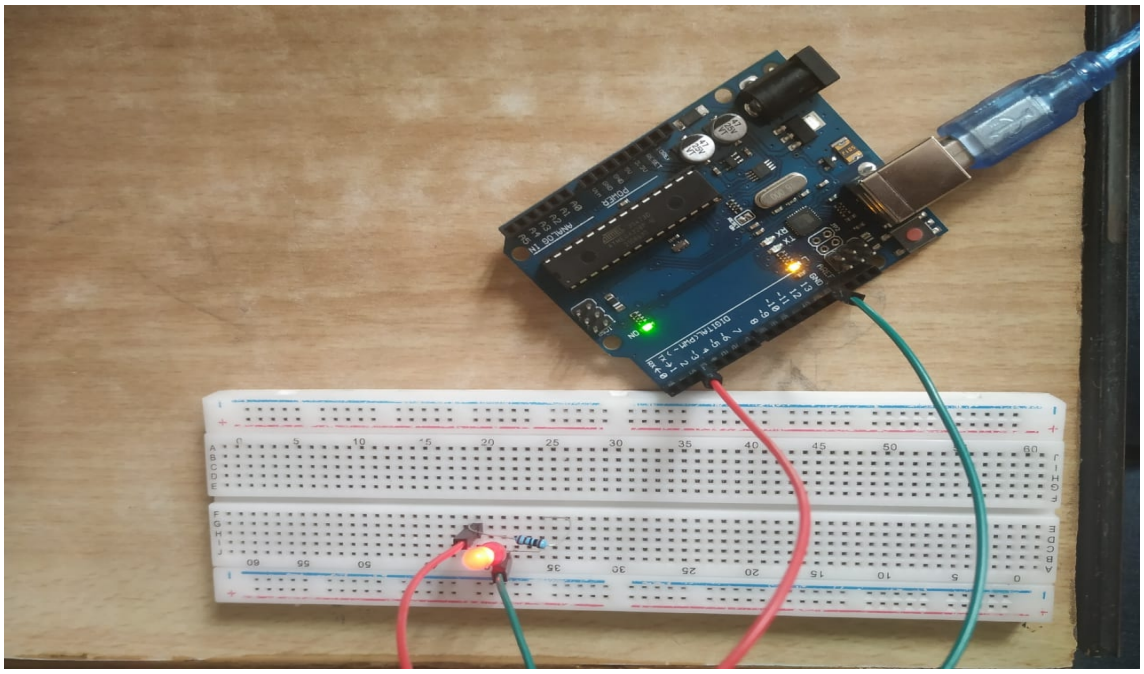

Figure:LED ON