Algorithm of infrared sensor

Initialize: Set up your microcontroller or hardware platform and establish the necessary connections between the sensor and the microcontroller.

Configuration: Configure the sensor by setting its operating parameters, such as measurement range, resolution, and communication protocol (e.g., I2C or analog voltage output).

Read Data: Depending on the sensor's type, you can use one of the following methods to read distance data:

a. Analog Voltage Output:

Read the analog voltage output from the sensor using an analog-to-digital converter (ADC) on your microcontroller.
Convert the analog value to distance using a calibration equation specific to your sensor model.
b. Digital Sensor (I2C or SPI):

Send a command to the sensor to initiate a distance measurement.
Wait for the sensor to complete the measurement.
Read the measured distance data from the sensor's registers or memory.
Data Processing (Optional): You can perform additional data processing, such as filtering or averaging, to improve the accuracy of the distance measurement.

Output: Display or use the distance data as needed for your application, such as showing it on an LCD screen, sending it via communication protocols, or triggering actions based on distance thresholds.

CODE FOR INFRARED DISTANCE SENSOR

```
import com.pi4j.io.gpio.*;
import com.pi4j.io.gpio.event.GpioPinDigitalStateChangeEvent;
import com.pi4j.io.gpio.event.GpioPinListenerDigital;

public class InfraredDistanceSensor {

    public static void main(String[] args) throws InterruptedException {
        // Create a GPIO controller instance
        GpioController gpio = GpioFactory.getInstance();

        // Define the GPIO pin for sensor input (change this to the appropriate pin)
        Pin sensorPin = RaspiPin.GPIO_04;

        // Initialize the sensor pin as an input pin
        GpioPinDigitalInput sensor = gpio.provisionDigitalInputPin(sensorPin,
PinPullResistance.PULL_DOWN);
```

```
        // Add a listener to detect sensor state changes
        sensor.addListener(new GpioPinListenerDigital() {
            @Override
            public void handleGpioPinDigitalStateChangeEvent(GpioPinDigitalStateChangeEvent
event) {
                if (event.getState() == PinState.HIGH) {
                    // Object detected
                    System.out.println("Object detected!");
                } else {
                    // No object detected
                    System.out.println("No object detected.");
                }
            }
        });

        System.out.println("Press Ctrl+C to exit.");

        // Keep the program running
        try {
            while (true) {
                Thread.sleep(1000); // Sleep for 1 second
            }
        } catch (InterruptedException e) {
            e.printStackTrace();
        }

        // Clean up GPIO resources on program exit
        gpio.shutdown();
    }
}
```

RFERENCE

RFID

Radio Frequency Identification, or RFID, is a rapidly-emerging identification and logging technology. Whether or not you have come across RFID systems in your work, you have probably encountered RFID in your daily life, perhaps without even being aware of it. At their simplest, RFID systems use tiny chips, called "tags," to contain and transmit some piece of identifying information to an RFID reader, a device that in turn can interface with computers.
To begin understanding RFID, think of a conventional Point-of-Sale barcode reader scanning grocery barcodes. In its simplest form, an RFID system is much the same: it also can identify a package. However, unlike barcodes, RFID tags don't need a direct line of sight: within limits, we can now scan an unpacked skid of boxes. Next, think of RFID tags as mini databases, or as barcodes that can be written to, and that can accumulate information as they travel. At this point, RFID diverges qualitatively from bar coding, giving it great new potential.
In an RFID system, RFID tags are "interrogated" by an RFID reader. The tag reader generates a

radio frequency "interrogation" signal that communicates with the tags. The reader also has a receiver that captures a reply signal from the tags, and decodes that signal. The reply signal from the tags reflects, both literally and figuratively, the tag's data content. The reply signal is created as passive "backscatter" (to use the radio term).

2.1 Passive Tags

RFID has a couple of basic types of tag. Passive tags have no power source of their own, while active tags are self-powered, usually by some type of battery. Passive tags generally operate at a maximum distance of 3 meters or less, and have power only when in communication with an RFID reader. The simplest of these tags is capable of holding something in the range of 64 bits of factory-written unique data; these are called "Class 0" tags.

Fig 2.1: RFID Tag

2.2 Active Tags

Active tags, with their own power source, can actively and intensively transmit and processing data, and over considerable physical distances. Active tags can communicate with readers 100 meters or more away. Active tags need much less signal from the RFID reader than passive tags require, and so can contain sensors and data loggers, for instance, as they are continually powered. Active tags are also suited as data loggers because they can support a clock (for time-stamping data) and can contain significant amounts of memory. Also, active tags are much better suited than passive tags when a collection of tags needs to be simultaneously read: they do not all need to be in range of the reader at the same time.

The terms "passive" and "active" are however potentially confusing: in all cases of communication with a passive tag, the reader "talks" first; the RFID tag is essentially a server. But, in the case of active tags, communications can be initiated by either the tag or the reader. Also potentially confusing is the term "reader," for a reader can also write information to an RFID tag.

Both tagging technologies–active and passive–are needed for RFID to realize its full potential. The cost savings afforded by passive tags makes RFID tagging possible at a much lower price point than would be possible with active tags alone; on the other hand, active tags add functionality not possible with passive tags at this time.

2.3 How RFID Works

A Radio-Frequency IDentification system has three parts:

A scanning antenna

A transceiver with a decoder to interpret the data

A transponder - the RFID tag - that has been programmed with information.

The scanning antenna puts out radio-frequency signals in a relatively short range. The RF radiation does two things:

It provides a means of communicating with the transponder (the RFID tag) AND

It provides the RFID tag with the energy to communicate (in the case of passive RFID tags).

This is an absolutely key part of the technology; RFID tags do not need to contain batteries, and can therefore remain usable for very long periods of time (maybe decades).

The scanning antennas can be permanently affixed to a surface; handheld antennas are also available. They can take whatever shape you need; for example, you could build them into a door frame to accept data from persons or objects passing through.

When an RFID tag passes through the field of the scanning antenna, it detects the activation signal from the antenna. That "wakes up" the RFID chip, and it transmits the information on its microchip to be picked up by the scanning antenna.

In addition, the RFID tag may be of one of two types. Active RFID tags have their own power source; the advantage of these tags is that the reader can be much farther away and still get the signal. Even though some of these devices are built to have up to a 10 year life span, they have limited life spans. Passive RFID tags, however, do not require batteries, and can be much smaller and have a virtually unlimited life span.

RFID tags can be read in a wide variety of circumstances, where barcodes or other optically read technologies are useless.

The tag need not be on the surface of the object (and is therefore not subject to wear)

The read time is typically less than 100 milliseconds

Large numbers of tags can be read at once rather than item by item.