Welcome students.

Our module is on sensors and actuators.

Which come under IoT of T Y BSc

Computer Science for 6th semester.

In this module we are

going to define sensors,

study the features of the sensors and.

Types of the sensors. At the end of this

module one should be able to explain the

sensors and the types of the sensors.

Let's begin. Let us see what

are the building blocks of IoT.

Very essential component of IOT.

One is Sensor. another one is actuator sensor.

Basically sense the physical

phenomena that are occurring around

them based on sensory information,

actuators, actuator or perform some

actions on physical environment.

So they take some actions

based on what has been.

Against so we have sensors.

They sense different parameters

depending on sensors being used,

example, temperature, pressure, humidity.

Lighting so on.

This sensed information is going to

be sent over a connected system.

That is over a network.

It can involve cloud as well.

Finally,

based on the sensed information

and based on the requirements.

Some physical action is going

to be taken by an actuator.

Example of all may be turned

on if certain condition in the

agricultural field has happened.

Maybe water level in the field is reduced.

Then valve of the water pump in the

well that is used for irrigation

automatically turns on so that field gets.

Irrigated. .

So this can be done by actuation,

so we have sensing network and actuation.

Sensor is a device which

detects or measures of physical

property and records indicates

or otherwise responds to it.

Sensor detects the changes in

the ambient conditions or in the

state of another device or a system

and forwards or processes this

information in a certain manner.

They perform some input functions

by sensing or feeling the physical

changes in characteristics of a

system in response to a stimuli.

For example,

heat is converted to electrical

signals in a temperature sensor or

atmospheric pressure is converted to

electrical signals in a Barrow meter.

Like that we have P IR sensors.

Which is passive infrared sensor.

This is optical based obstacle detector.

We have ultrasonic sensor.

This detects how far that obstacle is.

It sends ultrasound waves,

they get returned back.

We know the velocity.

Then using the elapsed time from the

sound wave was sent and the reflection

is received distance is calculated.

We have cameras in so we have smoke

detection sensor which detects smoke.

Different sensors have different

functionality's that is fabricated

to measure certain physical property.

Temperature sensor cannot detect smoke.

That means they are application specific.

And they are available in different

shapes and different sizes.

Transducers convert, or transduce,

the energy of one kind into another.

For example,

in a sound system,

a microphone converts the sound

waves into electrical signals,

and a loudspeaker converts these

electrical signals back into sound waves.

The transducer is the collective term that

is used for both sensors and the actuators.

The features of the sensors.

First one,

it is only sensitive to the measured

property.

It is insensitive to any

other property likely to be

encountered in its application.

And the third one, it does not

influence the measured property.

Since the resolution is the

smallest change it can detect in the

quantity that is being measured,

the resolution of a sensor with

the digital output is the.

Smallest resolution of the digital

output that is capable of processing.

The more is the resolution of a sensor,

more accurate, its precision sensors.

Accuracy does not depend upon its resolution.

The sensors are classified into

two categories based on the

output and based on the data type.

Based on the output,

they are classified into an allow

digital and based on the data

type they are classified into.

Scalar and vector.

Analog sensors give continuous analog

output example temperature sensor

continuously measures the change in

the temperature and output is analog.

Digital sensors give

digital output on or off.

Discrete digital values are given as

the output by these digital sensors.

Scalar sensors measure the scalar variables,

which can measure only changes in the

magnitude, whereas vector sensors.

Since not only magnitude but

also direction, so scalar sensor.

Example, say temperature sensor.

Irrespective of its orientation or

in which direction you are taking it,

it gives the magnitude value only.

On the other hand,

vector sensor say camera sensor,

accelerometer sensor.

The value depends upon orientation or

the direction in which sensor is put.

Analog sensors produce a continuous

output signal, or the voltage,

which is generally proportional

to the quantity being measured.

Physical quantities, such as temperature,

speed, pressure, displacement, strain,

etc are all analog quantities as

they tend to be continuous in nature.

For example, temperature of a liquid can be

measured using thermometer or Thermo couple.

Thermocouple is used in the geezers.

We have two metallic strips.

They bend based on the amount

of bending they measure.

The change in the temperature.

If we calibrate the thermocouple,

we will know how much temperature has

changed and we can understand how much

liquid has heated up or cooled down.

Digital sensors produce discrete

digital output signals,

or the voltages that are a

digital representation of the

quantity being measured, so the.

Digital sensors produce a binary output

signal in the form of logic one or logic 0.

They produce discrete values which

can be 1 bit or it can be combination

of the bits that is a byte.

Scalar sensors produce output

signal or the voltage,

which is generally proportional to the

magnitude of the quantity being measured.

Physical quantities such as temperature,

color, pressure, strain,

etc are all scalar quantities,

as only their magnitude is

sufficient to convey an information.

For example,

the temperature of a room can be measured

using a thermometer or thermocouple,

which are responds to the temperature

changes irrespective of the orientation

of the sensor or its direction.

Vector sensors produce the

output signal or old age,

which is generally proportional to

the magnitude direction as well as

orientation of the quantity being measured.

Physical quantities such as

sound image velocity,

XD aration are all vector quantities as

only their magnitude is not sufficient

to convey the complete information.

For example,

accelaration of our body can be

measured using an accidental meter

which gives the components of the

acceleration of the body with respect

to the XYN zed coordinate axes.

Sensor types.

For measuring the light we have light

independent register photodiode,

temperature thermocouple, and thermistor.

The force can be measured by its train

Gorge pressure switch position can be

measured by the potential meter encoders,

optocouplers, speed,

reflective or optocoupler.

An Doppler effect sensor.

The sound can be measured by the carbon

microphone piezo electric crystal chemical.

Sensors are liquid chemical sensors

and gaseous chemical sensors.

Sensor deviations.

Sensors do not give the accurate data,

they come with the specifications Max and me.

The full scale range of a sensor

defines the maximum and minimum

values of the measure property.

The sensitivity of a sensor under

real conditions may differ from

the values specified and this

is called sensitivity error.

If the output signal differs from

the correct value by a constant,

the sensor has an offset error.

Sensitivity error can change overtime,

but offset error is constant.

Overtime. Non linearity.

Most sensors have linear behavior ideally,

but practically they exhibit non linearity.

If the output signal slowly changes

independent of the measure property,

this is defined as drift long term drift

over the months for the ears is caused

by physical changes in the sensor.

A particular sensor at one point

gives certain value and overtime.

If we use the same sensor for

measuring the same condition,

it gives different sense.

The value and that is because of drift.

The noise is a random deviation

of the signal that varies in time.

His deal is better now.

This is caused by the sensor output

value because it depends on.

Not only the previous,

not only the present value,

it depends upon previous input values.

Sensors output is different depending upon

whether the specific input value has reached

by increasing or decreasing the input.

Then the sensor has a hysteresis error.

The present reading depends

on the past input values.

When we. Heat the metal strips.

The strip bends.

If bent once it will take some time

to come back to its original position.

If a heated once we get one value.

If he did, once again,

we get some other value because

it depends on previous value.

The other errors are quantization error.

If the sensor has a digital output,

the output is essentially the

approximation of the measure property.

And other errors are aliasing errors.

The signal is monitored digitally and

that depends upon sampling frequency.

The sensor made to some extent be

sensitive to the properties other

than the property being measured

that also induces error.

The references are shown.

Thank you.